FALTA PETROLEO!

Perspectives on the Emergence of a More Ecological Farming and Food System in Post-Crisis Cuba

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To my mother and father, and

to Cuba, for showing that it doesn't have to be this way

ABSTRACT

This research takes as its case for analysis the nationwide change to a more self-reliant agricultural production and food sector in Cuba at the end of the 1990s, almost a decade after the collapse of the Soviet Bloc of the USSR and Eastern Europe. Understanding the Cuban experience is essential for countries which are still unable to provide national security of food, as well as for all those industrialised countries whose agricultural systems are dependent on fossil fuels.

In the early 1990s, industrialised Cuba was faced with a critical situation: its foreign supplies of agricultural inputs and food imports were permanently cut off. There was no other option but to become more self sufficient and to turn to alternative agricultural systems. By the end of the decade, it appeared that Cuba had not only managed to feed all its population and increase production, but also to be operating its agriculture along more ecological lines. This research addresses the nature of this change from the perspectives of farmers and institutional actors. It looks at the type of agriculture emerging in Cuba and the interpretation of ecological agriculture, at the institutional processes which drove through and emerged from these changes, and the mechanisms implemented to ensure food security.

The primary data for this research was collected in Cuba during 1999-2001. Over 400 interviews and survey questionnaires were undertaken the provinces of Havana, Cienfuegos and Holguin. These interviews were made with farmers and farm co-operatives, with representatives of the Ministries of Agriculture, the Environment, Education and Health, and with researchers and extension and support staff, and with family households. This was supported by secondary literature, the majority of which was only obtainable from within Cuba.

Cuba has managed to turn around a serious and nation-threatening crisis through an innovative and pragmatic mix of measures in its agricultural and food sectors. This has been achieved through providing safety nets (through social food programmes), emphasising self-provisioning at farm, municipal, provincial and national levels, and localising distribution, storage and processing systems. Decentralisation of States land holdings, increased access to land, and emphasis on individual and community responsibility have all played a part in this, as has investment in more appropriate agricultural research, extension and training. Agricultural production doubled between 1994 and 1999, calorific availability increased by 25%, wages for agricultural workers tripled, yet at the same time subsidies to the agricultural sector were halved. By the end of the decade, the country was able to meet a far higher proportion of domestic food needs than at any time in its recent history and stimulate a far more innovative and forward looking agricultural sector.

The Cuban experience provides food for thought on the development of ecological agriculture: on the top-down promotion and legislation which shows to work to transform an industrialised production system to one of substitution by biological inputs; on the emergence of an agricultural system which embraces the enlightened use of agrochemicals; on the indication that ecological illiteracy rather than agribusiness is limiting the development of ecological agriculture; and on the degree of efficacy of organic development in the absence of a more entrepreneurial and autonomous grassroots organic movement.

The achievement of food security is less dependent on the agricultural husbandry approach than on political will and its comprehensive enactment. Ecological agriculture shows to be technically feasible as a mainstream component of a nation's food security policy, yet an enforced lack of external inputs is insufficient to ensure an ecological agriculture without the political will. Finally, without a more holistic framework for the food system, both human and environmental health-related production problems appear to persist.

Key words: ecological / organic / agriculture / transition / farming systems / co-operatives / Cuba / food security / food system / institutional learning / crisis / rural livelihoods / coping strategies / localisation

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Not more than a month into the PhD, it became very clear that completing this research would necessitate profound changes: training the mind to focus and pay attention for long periods, establishing a disciplined routine, and living moderately. Several years - and no changes - later, the simple epitaph of this tome reads 'it was not easy'.

CONTENTS

GLOSSARY AND ACRONYMS

Acronyms and names of Cuban institutions

ACAO *Asociación Cubana de Agricultura Organica*
Cuban Association of Organic Agriculture
ACPA *Asociación Cubana de Producción Animal*
Cuban Association of Animal Production
Acopio State food collection and distribution agency (National Union of)
ACTAF *Associacion Cubana de Tecnicos Agricolas y Forestales*
Cuban Association of Agricultural and Forestry Technicians
ANAP *Asociación Nacional de Agricultores Pequeños*
National Association of Small Farmers
BANDEC *Banco de Credito y Comercio*
Credit and Commerce Bank
CAI *Centro AgroIndustrial*
Agroindustrial Centre for Sugarcane
CCS *Cooperativa de Creditos y Servicios*
Credit and Service Co-operative
CEAS *Centro de Estudios de Agricultura Sostenible*
Centre for Sustainable Agriculture Studies
CIGB *Centro de Investigaciones Genetica y Biotechnologia*
Genetics and Biotechnology Research Centre
CIGEA *Centro de Informacion, Gestion y Educaciona Ambientales*
Centre for Environmental Information, Education and Management
CIPS *Centro de Investigaciones de Psicología y Sociología*
Psychology and Sociology Research Centre
CITMA *Ministerio de Ciencia, Tecnologia y del MedioAmbiente*
Ministry of Science, Technology and the Environment
Citricus Caribe State citrus marketing entity
CPA *Cooperativa de Producción Agricola*
Agricultural Production Co-operative
CPMOL *Centros Procesadores de Materia Organica y Lombricultura*
Provincial centres for organic matter and vermiculture
CREE *Centro por la Reproducción de Entomofagos y Entomopatogenos*
Centre for the Reproduction of Entomophages and Entomopathogens
DECAP Cuban Council of Churches
ETIAH *Estacion Territorial de Investigaciones Agricolas de Holguin*
Holguin Regional Agricultural Research Station
ETPP *Estaciones Territoriales de Protección de Plantas*
Regional Stations of Plant Protection
Frutas Selectas State food collection and distribution agency for tourist markets
FNH *Fundación de la Naturaleza y el Hombre 'Antonio N. Jimenez'*
Foundation for Nature and Humanity
ICA *Instituto de Ciencias Animales*
Institute for Animal Sciences
INCA *Instituto Nacional de Ciencias Agricolas*
National Institute of Agricultural Sciences
INHA *Instituto de Nutricion y Higiene Alimentaria*
Institute of Food Hygiene and Nutrition
IIHLD *Instituto de Investigaciones Horticolas 'Liliana Dimitrova'*
Horticultural Research Institute 'Liliana Dimitrova'
IIES *Instituto de Investigaciones de Ecologia y Sistematica*
Research Institute of Ecology and Systematics
IIRD *Instituto de Investigaciones de Riego y Drenaje*
Irrigation and Drainage Research Institute
IIMA *Instituto de Investigaciones de Mecanizacion Agricola*
Research Institute of Agricultural Mechanisation
INIFAT *Instituto Nacional de Investigaciones Fundamentales de Agricultura Tropical*

	National Research Institute for Tropical Agriculture
INISAV	*Instituto Nacional de Investigaciones de Sanidad Vegetal* National Research Institute of Plant Health
INIVIT	*Instituto Nacional de Investigaciones de Viandas Tropicals* National Research Institute for Tropical Roots and Tubers
IIPF	*Instituto de Investigaciones de Pastos y Forages* Pastures and Forages Research Institute
ISCAH	*Instituto Superior de Ciencias Agricolas de Havana* (renamed - see UNAH)
MINCIN	*Ministerio de Commercio Interior* Ministry of Domestic Trade
MINAG	*Ministerio de la Agricultura* (also known as MINAGRI) Ministry of Agriculture
ONE	*Oficina Nacional de Estadisticos* National Statistics Office
PPB project	*Proyecto de Fitomejoramiento Participativo* Participatory Plant Breeding project (at INCA)
Sanidad Vegetal	National Institute of Plant Protection
SISVAN	*Sistema Nacional de Vigilancia Alimentaria y de Nutricion* National Food and Nutrition Surveillance System
SINCITA	*Sistema Nacional de Ciencias Agricolas y Innovación Technologica* National System of Agricultural Science and Technological Innovation
UBPC	*Unidades Basicas de Produccion Cooperativa* Basic Units for Co-operative Production
UCLV	*Universidad Central de Las Villas* Central University of Las Villas
UNAH	*Universidad Nacional de Agricultura de Habana* National Agricultural University of Havana
UNH	*Universidad Nacional de Habana* National University of Havana

Non-Cuban acronyms

AKS	Agricultural Knowledge System
CGIAR	Consultative Group on International Agricultural Research
CLADE	Latin American Centre for Sustainable Development
CMEA	Council of Mutual Economic Assistance
ESTRELA	Europe-Latin America Research Network of the EU
EU	European Union
FAO	Food and Agriculture Organisation (of the UN)
FHIA	The Honduran Agricultural Research Foundation
IFOAM	International Federation of Organic Agricultural Movements
NGO	Non-governmental organisation
RAAKS	Rapid Rural Appraisal of Agricultural Knowledge Systems
RLF	Rural Livelihoods Framework
UNDP	United Nations Development Programme
USAID	United States Agency for Intenational Development
WHO	World Health Organisation (of the UN)

Glossary and translations

agro-ecology	the scientific basis of alternative agriculture, synonymous in some circles with collective social action on eco-management of the natural resource base. Common usage in Latin America.
cachaza	sugarcane waste
campesinos	traditional, peasant, small-scale, autonomous farmers
canasta basica	basic State ration

comercio minorista	retail trade network
ecological agriculture	production system based on the proactive intent to farm according to ecological principles and a corresponding knowledge base. Optional market orientation.
industrialised agriculture	production system based on concepts of industrialisation – high external inputs, high ouput, homogenised environment and people, tending to monocropping and large-scale systems.
latifundio	large landed estate
la bodega	food ration store
la libreta	food ration book
las placitas	capped-price municipal markets
minifundio	smallholding
organic agriculture	production system with principles synonymous with ecological agriculture, which promotes enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. Its market-orientation has led to connotations with industrialised procedures.
organoponico	raised-bed, intensive urban agricultural unit
tiro directo	direct marketing
en usufructo	in perpetuity

1 CUBA: ORGANIC EDEN OR ENIGMA?

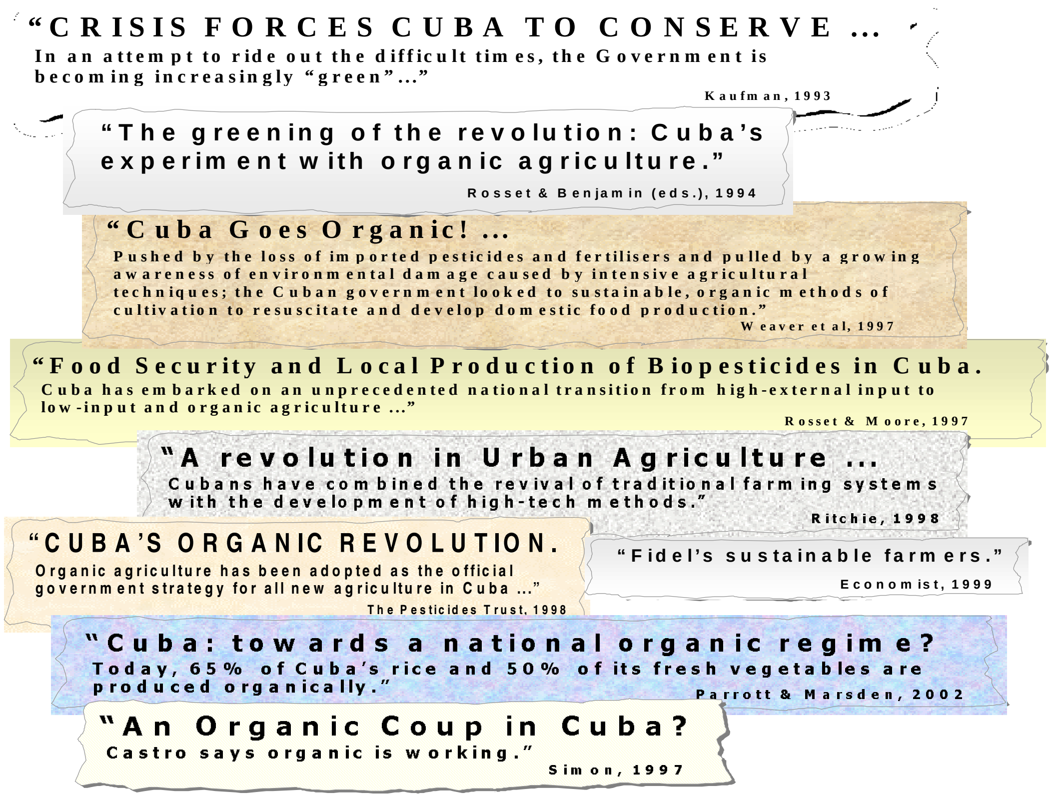
"Like a sunset effect, the glories of industrial capitalism may mask the fact that it is poised at a declining horizon of options and possibilities. Just as internal contradictions brought down the Marxist and socialist economies, so do a different set of social and biological forces signal our own possible demise."

Hawken, 1993

1.1 INTRODUCTION

Is Cuba the nearest thing to an organic garden of Eden, practising a successful and productive ecological[1] approach to agriculture, or is it an enigma, a completely different construction behind the media façade? With the exponential rise in more ecologically sustainable production over the last decade, there has been much international interest in Cuban affairs, and especially by organic interest groups who strive to provide examples of organic production over a large scale. Figure 1.1 lists the headlines of some reports emerging over the decade of the 1990s, all of which corroborate the view that not only was Cuba using an ecological approach, but also that this was supported by the State. If this were true, over a whole nation, then there may be lessons for learning, and systems for adapting by other nations similarly interested in developing a more sustainable agriculture.

Figure 1.1 International reporting on the transformation toward ecological agriculture in Cuba



[1] 'Ecological' in this thesis means a more ecologically-, agro-ecologically- or organically-oriented production approach, using regenerative husbandry techniques based on ecological principles, but without the market and standard connotations of organic agriculture or the unqualified knowledge and input levels of low-input agriculture. This concept will be further discussed in Chapter 3.

This chapter provides an overview of the evidence of the agricultural crisis that hit Cuba in the early 1990s as a result of the collapse of the Soviet Union, and the country's subsequent, apparent rise to success in terms of ecological agricultural production. The Cuban success in coping with this crisis and in mobilising an alternative to industrial agriculture, and one that has apparently been at least somewhat successful in ensuring food security for the country, may provide valuable lessons for other nations trying to develop their agricultural sectors and meet food needs in a more sustainable fashion. Explaining how Cuba was able to deal with the crisis and drawing the lessons from it is the rationale for the research presented in this thesis.

1.2 AN ECOLOGICAL RESPONSE TO CUBAN AGRICULTURE IN CRISIS?

1.2.1 The crisis in Cuban agriculture

Since the Revolution of 1959, Cuba has maintained restricted and selective contact and interaction with non-socialist countries. From an international perspective, this has meant a relative dearth of knowledge on all aspects of Cuban life. Reports that have emerged paint a picture of triumph over adversity.

As the story goes, the collapse of the Soviet Union in 1989 brought an abrupt end to its support for Cuba, and with this went the inputs that Cuba had relied upon to maintain its highly industrialised system of agriculture – petrol, machinery, synthetic fertilisers and pesticides. From the beginning of the Socialist Revolution of 1959, ideology in Cuba had led to this industrialisation, in order to emancipate the rural population (or proletariat) from the perceived drudgery of farm labour and tenancy, to provide an abundant supply of cheap food, and to do this through a triumphant conquering and domination of nature by man. Cuba and the other socialist countries in the Council of Mutual Economic Assistance (CMEA) had relied on each other for obtaining whatever goods and services they required, this partly induced by the trade sanctions by politically opposed countries. In this way, and in common with other lower-income countries, Cuba had followed a model of externally-assisted agricultural modernisation, although at a far more rapid rate and spread, and its industrial growth had remained dependent on imported inputs and capital goods (Pastor, 1992). Cuba, a country without significant petroleum reserves, was in receipt of subsidised imports of fuel, agrochemical inputs, technology, training, many basic foodstuffs and medicines. In return it sold its tropical produce – largely sugarcane but also tobacco and fruits (along with other resources such as nickel) - to those temperate socialist countries at more than double the world market price. This symbiotic trading relationship lasted for three decades, throughout the 1960s to 1980s,[2] so well that the materially abundant decade of the 1980s was subsequently referred to in Cuba as "the years of the fat cow."[3]

The abrupt changes of 1989 hit the Cuban agricultural sector particularly hard for four reasons. First, Cuba had a very highly industrialised agricultural system, one that was using more tractors and applying more nitrogen fertiliser per hectare (192kg/ha) than similar production systems in the USA (Hamilton, 2003). Mechanised irrigation systems covered over one quarter of crop land. Second, Cuba was importing not just a select few of the inputs and foodstuffs it required for survival but the large majority of them: in 1988, for example, 90% of fertilisers and pesticides, and 57% of calorific food intake were reportedly being imported (Rosset & Benjamin, 1993). Farms controlled by the Ministry of Agriculture were producing just 28% of nationally consumed calories. Third, not only did Cuba lose its trading partners who were paying preferential prices for its products – an average of 5.4 times the world market price for sugar, for example, but just as Cuba

[2] In fact Cuba's external dependency on agricultural inputs, food imports, and sales of its main crop - sugar cane - originated long before the Revolution of 1959, being fairly standard features of trade relations between the USA, Europe and much of the Caribbean basin region (and the developing world) since the beginning of the 20th century (Enríquez, 2000).

[3] During this time, farmers were paid on the basis of how much they produced, no matter what the production cost, and workers on the basis of number of days worked, no matter what their output (Sinclair & Thompson, 2001).

was forced to enter the global sugar market, international commodity prices plummeted.[4] Fourth, Cuba had developed very little in the way of diversified agricultural products or light industry over the previous 30 years, either for export or for domestic consumption (Pastor, 1992).

The years of the fat cow were over. The availability of pesticides and fertilisers fell by 80%. Fossil fuels dropped by 47% for diesel and 75% for petrol (PNAN, 1994). Agricultural production and food availability fell to critical levels (Rosset & Moore, 1997), with average calorific intake dropping by as much as 30% compared to levels in the 1980s (Rosset, 2000) and with food imports dropping by over 50%.

1.2.2 The reported response to the crisis

Evidence throughout the 1990s has given rise to a reputed success story of an alternative, ecological agricultural model on a national scale. Much of this evidence is qualitative or anecdotal and a large percentage stems from "Fact-finding missions" and study tours[5] of Cuban agriculture organised by organic interest groups from the United States and also from Europe (for example, Levins, 1990; Altieri, 1993; Carney, 1993; Rosset & Benjamin, 1994; Rosset & Cunningham, 1994; Wilson & Harris 1996; Rosset & Moore, 1997; Weaver, 1997; Ritchie, 1998; Murphy, 1999; Moskow, 1999; Bourque, 1999).

In 1990, the State declared the start of a 'Special Period in Peacetime', a self-imposed state of emergency which would entail sacrifices in living standards, including acceptance of insufficient food supplies, in order to enable the country to build up its levels of self-sufficiency, particularly in meeting basic food requirements[6] (Rosset & Moore, 1997). Within this framework, the agricultural sector was forced to find solutions to production problems using local resources. Given the priority placed on technology and science, this initiative was spearheaded by the scientific community.[7] Researchers who had previously been beavering away in isolation on alternative technologies were now mobilised and brought into the mainstream, and already-existing plans to produce biological pesticide and fertiliser products were put into operation and scaled-up in order to replace the shortfall of imported inputs. Over 220 small laboratories and production centres were constructed nationwide for the production of these biological inputs. In place of tractors, teams of oxen were reinstated, and the knowledge and skills of older farmers were sought for the handling of the livestock as well as for other issues. Recourse was made to traditional crop husbandry practices such as intercropping, green manuring, rotations and crop-livestock interactions in order to decrease the incidence of pest and disease and make best use of potential soil fertility sources. Box 1.1 provides Rosset's description of the change in agricultural technologies.

Box 1.1 The change to alternative technologies in Cuba

"*In response to the crisis, the Cuban government launched a national effort to convert the nation's agricultural sector from high input agriculture to low input, self-reliant farming practices on an unprecedented scale. Because of the drastically reduced availability of chemical inputs, the State hurried to replace them with locally produced, and in most cases biological, substitutes. This has meant biopesticides (microbial products) and natural enemies to combat insect pests, resistant plant varieties, crop rotations and microbial antagonists to combat plant pathogens, and better rotations, and cover cropping to suppress weeds. Synthetic fertilisers have been replaced by biofertilisers, earthworms, compost, other organic fertilisers, natural rock phosphate, animal and green manures, and the integration of grazing animals. In place of tractors, for which fuel, tyres and spare parts were largely unavailable, there has been a sweeping return to animal traction.*"

Source: Rosset, 2000 p. 206

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[4] This was exacerbated by the trade sanctions concurrently imposed on Cuba by the United States.

[5] The author herself participated in two such tours, in 1995 and 1999.

[6] In 2005 this Special Period is still in place.

[7] A much quoted figure from Rosset & Benjamin (1993) is that Cuba has only 2% of the population of Latin America, but 11% of its scientists.

Training courses on these issues were run at all levels – for farmers, technical staff and administrators - in all areas of the country, and long distance diploma and postgraduate courses on ecological agriculture were developed. Large State farms were broken down to smaller ones and placed under co-operative ownership and new forms of organisation, and this reorganisation and increased accountability extended to the agricultural support institutions – research and other State entities.

The area of development that seems to have gained the most international coverage and interest is that of urban agriculture (Murphy, 1999; Weaver 1997). As soon as the potential impact of the crisis was visible, the State decreed that all fallow and unused urban land could be cultivated in perpetuity (*en usufruct*) and untaxed. People from all professions took up this opportunity and, supported by the State, developed an intensive network of cultivated plots run explicitly along organic principles. The emphasis on organic was partly by default: the lack of agrochemicals, but also because of the concern that using chemicals in the urban environment would be harmful to human health. There was even a law prohibiting the use of chemicals. At 1998, Havana had more than 26,000 urban gardens, producing 540,000 tons of fresh fruits and vegetables (Moskow, 1999). By 1996-97, yields of the majority of basic food items were higher than the previous averages (Rosset, 1998), and especially of roots, tubers and fresh vegetables (Funes, 2002). The food crisis had apparently been overcome. As Rosset (1996, p.66) explains "*Although no figures are available, numerous interviews and personal observations indicate that by mid-1995 the vast majority of Cubans no longer faced drastic reductions of their basic food supply.*"

It was not only agricultural production that had apparently been transformed. According to reports, the Cuban government had succeeded in maintaining its socialist policy of feeding its people. As Rosset & Moore (1997) explain, Cuba had previously placed high priority on the social development of its population and social infrastructure through the development and provision of education, good communication channels, adequate housing and health care facilities, and it was this solid foundation which provided the bedrock for Cuba's survival during the critical years of the early 1990s. "*We can proudly say that despite the difficult circumstances, we were able to ensure equal access opportunities for the entire population to the available food, health and education*" (Fidel Castro, 1996). In the absence of information from Cuban-based organisations, or of any systematic, broad scale analysis during the mid to late 1990s,[8] it is these reports which formed the basis for the perception that Cuban agriculture was feeding its people with an ecological form of agriculture.[9]

1.3 THE RELEVANCE OF THE CUBAN EXPERIENCE

As well as the keen general interest in the Cuban agricultural experience by international organic interest groups, as described, the experience of conversion to widespread ecological production holds significance from other perspectives and especially in the tropical context.

1.3.1 Providing a model of support for widespread ecological production

Ninety percent of the world's farmers, who manage 75% of global agricultural lands and largely in lower-income countries, have little recourse to formal markets nor to agrochemical inputs (Conway, 1997). Although this low-market-low-input situation arises often through default, the group includes the 2.5 million farmers over 5 million ha who intentionally use agro-ecological principles (Altieri et al., 2000), as well as traditional farmers and pastoralists who eschew industrialised

[8] Mesa-Lago (1998), in an attempt to assess the economic and social performance of the Cuban transition in the 1990s, notes in relation to Cuban data that "*Statistical series vanished at the beginning of the transition, making a serious evaluation virtually impossible. In 1995-97, important data were released but their reliability is questionable*." More detailed reasons for concern over the validity of Cuban statistics is provided by Alvarez, 1994 p. 60-66.

[9] From more recent reports, this perception of Cuba in the 1990s has endured and perhaps even strengthened into the 21st century (for example, Oppenheim, 2001; Snyder, 2003; Hamilton, 2003; Handscombe & Handscombe, 2004).

approaches.[10] For such farmers who have dropped out of, or never entered, the Green Revolution, or for whom markets do not work, innovative, ecological production approaches are the norm for improving their livelihood options in terms of increasing production, resilience and food security. Such 'alternative' strategies are generally promoted at the grassroots level with less support at policy and industry levels (Pretty, 1995).

At the same time, markets for certified organic food products are growing, as is the potential for tropical countries to increase their market share. Global organic food sales reached US$ 26 billion in 2001, and in some European countries the share of organic foods was expected to reach 10% of total food sales by the year 2005. In terms of supply, 7 million ha were farmed to certified organic standards by the year 2000 (Bullard, 2000), and over one-third of organic produce is tropical or subtropical, with lower-income regions comprising at least half of the 130 organic producer countries (FAO/ITC/CTA, 2001). Almost half of the global organic cultivated area is in Oceania, and the largest growth in organic farmland is projected to be in lower-income countries where economies are highly reliant on agriculture and thus are turning to organic production to reap the export benefits (Organic Monitor, 2001[a]). Nevertheless, the conversion and production, as well as certification, inspection and export, of organic produce remains largely under the auspices of foreign bodies, usually in the importing countries and primarily in Europe and the United States. Lower-income countries with their own state-supported organic conversion and production strategies are scarce, only Thailand and China playing any visible lead by the end of the 1990s (Organic Monitor, 2001[b]; Parrott & Marsden, 2002).

For all these farmer groups, support is called for to advance innovative, ecological production approaches through more appropriate research, extension and policy (Röling & Jiggins, 1998). The organisational experiences that Cuba might have gone through to reach a nationwide, ecological production system, as well as the support system that enabled this, would certainly provide a learning model for others to draw from.

1.3.2 Providing a model for feeding the world

A major concern by the formal agricultural sector is that non-industrialised production strategies are unable to attain the yields required to feed the growing populations of lower-income countries. An estimated 200 million people are classified as undernourished in Africa alone (Benson, 2004). With forecasts predicting a shortfall in meeting the Millennium Development Goal of halving global food insecurity by 2015, pressure remains on the agricultural sector to increase yields. Policy makers are largely sceptical that ecological styles of agriculture can play a mainstream role in addressing this problem (FAO 1998; IAC, 2003) and frequently advocate pursuit of an industrialised, high-input model. Yet formal evidence continues to emerge that ecological and organic farming approaches can outperform industrialised and Green Revolution approaches in many circumstances (e.g. Parrott & Marsden, 2002; Pretty, 1998; Scialabba & Hattam, 2002; IFAD, 2003), and advocates argue the need to put into operation and support more appropriate agricultural practices through which these populations can feed themselves, and regenerate their natural resource base, in a more sustainable manner.

If tropical Cuba, which by all accounts was critically poor during the 1990s, has been able to increase productivity and feed its population through such an approach, this would provide large-scale evidence that non-industrial agricultural systems should be on the agenda for meeting national and global food security objectives.

[10] Such as in Tanzania, where a regional agricultural census showed that one-third of the 600,000 holdings which were not using any chemical fertiliser chose to do so because they felt that the inputs were destroying soil fertility (Landmark, 2000).

1.3.3 Providing an alternative to petroleum-based systems

The driving force of this third perspective is that of a potential economic downturn caused by chronic depletion of petroleum resources. Industrialised nations are over-consuming natural energy resources by two-thirds (Desai & Riddlestone, 2002), and demand is forecasted to outstrip supply by 2015 (Harrison, 2004). Contributing to this is industrialised agricultural production, heavily dependent on fossil fuels for its agrochemical inputs and its levels of mechanisation (Odum, 1994; Vandermeer et al., 1993). According to estimates, it takes 6 to 10 times more energy to produce a tonne of cereals or vegetables by industrialised agriculture than by using more sustainable methods (Niles et al., 2001). Already at the turn of the Millennium, nitrogen fertiliser prices increased, as several US fertiliser plants closed due to the quadrupling of petroleum prices since 2000.[11] The corresponding, industrialised food system is similarly dependent, relying on cheap fossil energy for the ever-increasing movement of raw and processed foodstuffs (Tansey & Worsley, 1995), whilst the wider impacts of this industrialised food system on the environment are not factored-in (Pretty et al., 2000). Yet although the energy sector has invested in research for alternatives, little has been put into operation whilst fossil fuel reserves continue to hold out, and the mainstream agricultural sector has not made a significant response to this threat.

Cuba, meanwhile, may have developed a nationwide agricultural production strategy which relies relatively little on petroleum, certainly for agrochemical inputs and also, perhaps, for mechanisation and even transport. In the event of a global energy crisis, the experiences of Cuba may serve as a useful model for industrialised countries, including for certain high-fuel consuming, organic food systems.

1.3.4 The shortage of national level examples of ecological agriculture

Given the above, there appears a need for more information and understanding on the large-scale organisation, and support for ecological production systems in both high- and low-income countries. This need is variously driven by existing ecological producers, by a growing consumer demand, by efforts to enable food security, and/or by prudent economic policy.

However, in most countries ecological production systems are spatially fragmented, and the studies which exist on their development mechanisms and support needs tend, as a result, to be localised (Reijntjes et al., 1992; Pretty, 1995; Pretty & Thompson, 1996). As Pretty (1995) points out, real sources of evidence of the impact of these alternative approaches, and on the factors necessary for their operation, come mainly from research stations, on-farm trials, and individual farmers. There are few from whole groups or communities, and none from whole regions or countries. By March 1998, when this research project was initiated, no single country had made a policy commitment to a nationwide ecological or organic agriculture except, according to reports, Cuba. Just after that date, the government of the Cook Islands declared a 3-year conversion of all agriculture to organic – yet had not achieved this target by 2004, and Switzerland has since put organic and sustainable agriculture at the centre of its agricultural development policies. Beside this, most EU countries offered some policy support for organic agriculture, in the form of action plans and subsidies for conversion to and/or maintenance of organic farms. Of these, Sweden had the most ambitious target: that 20% of farm land will be organic by the year 2005.[12] At 2001, only one lower-income country (Argentina) had more than 1% of its agricultural land under organic management (Parrott and Marsden, 2002) (although it has since then been joined by several other countries[13]). All these percentages are way below those that had been reported for Cuba.

Given the longstanding exhortations to develop more sustainable, environmentally friendly, and less chemically-dependent forms of agriculture (Soule & Piper, 1992; Goering et al., 1993;

[11] This does not take into account the pressures on the oil industry by the turbulence in Iraq in 2003-5.

[12] Since then, Liechtenstein has developed the highest percentage of organically farmed land at 26%, followed by Austria and Switzerland (11.6% and 10% respectively) (Willer & Yussefi, 2004).

[13] Notably Uruguay (4%), Costa Rica (3.1%), Chile (1.5%), Uganda 1.4%), Belize (91.3% and Bolivia (1%) (Willer and Yussefi, 2004)

Thompson, 1995; Pretty, 1998), and the concern that depletion of fossil fuel reserves within the next two decades may require both the strict regulation of petrol and petroleum-based products and the development of alternatives, there has been surprisingly little proactive interest in the Cuban experience by the formal agricultural research, development or policy community. By the late 1990s, there had been scant reference to Cuba as a demonstrative model, nor any major analytical or evaluative studies underway by the public sector.[14] As Rosset & Benjamin concluded in 1994, it is an experiment that the world should be watching.

1.4 RESEARCH QUESTIONS AND DESIGN

1.4.1 Overall research goal and objective

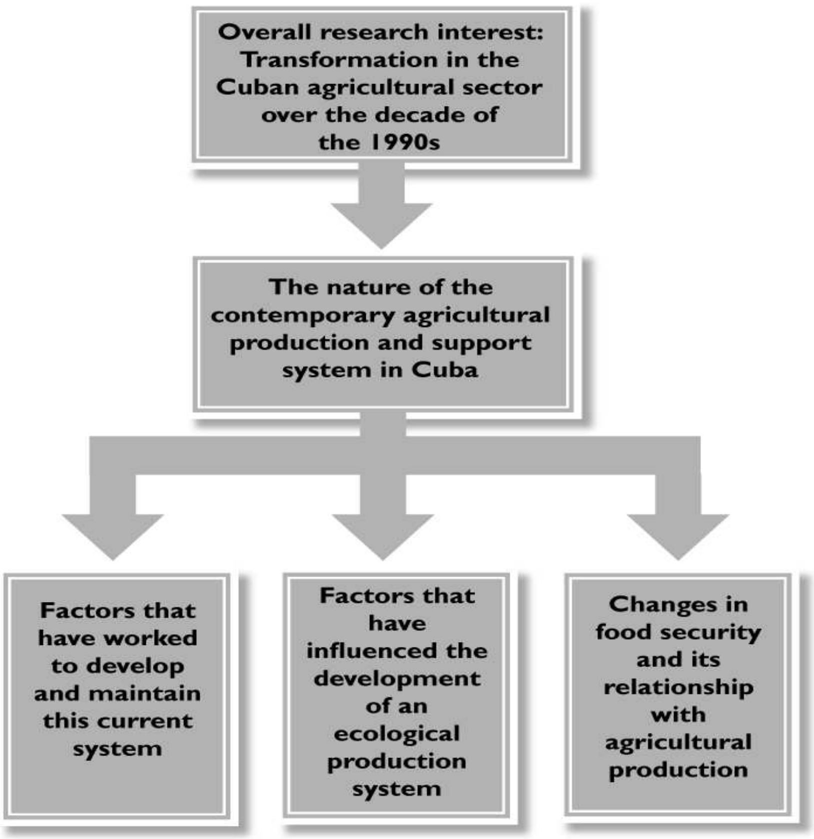
The overall research aims are as follows:

Goal of the research: To contribute to the understanding and development of more ecologically sustainable agriculture and food systems, capable of meeting multiple objectives of food security, environmental and human health, and renewable natural resource use.

Objective of the research: To evaluate the implications for both the agricultural sector and the food system, of the impact of a widespread reduction in petroleum-based inputs, drawing from the Cuban experience.

1.4.2 The emerging research questions

Figure 1.2 Research issues responding to the research objective



[14] Notwithstanding the handful of invaluable, individual efforts, e.g. Lane, 1997; Deere, 1997; Mesa-Lago, 1998; Enriquez, 2000; and the work of Rosset at the Institute for Food Policy Research, e.g. Rosset & Benjamin, 1994; Rosset, 1997.

Reports that have come out of Cuba were largely qualitative and anecdotal. What was actually going on in Cuban fields over the whole country? Was Cuban agriculture ecological? Even if dramatic changes had not taken hold, what were the coping and learning strategies emerging in this sudden and enforced situation? Had Cuba been able to feed itself without petroleum-inputs, and whether or not this was so, what policies and strategies had been implemented in a bid to achieve food security? Would Cuba choose to remain this way even after ‘the Special Period’? A hierarchical set of research issues emerges, as shown in Figure 1.2.

1.4.3 Overview of thesis design

Any attempt to evaluate the production and food system over a whole country is ambitious, especially when the country is relatively secluded and reticent, as was the case for this research. Notwithstanding the extensive research planning that took place, the final research design developed as an emergent product of the research process, rather than through rigid adherence to a fixed framework. In particular it was governed by the opportunities encountered in the field, which in turn affected not only the methodology but also the development of the analytical framework. Through this process, both direct and indirect responses and insights are provided to meet the overall research objectives.

Chapter One has set the tone for the rest of this thesis by providing an overview of the importance of the experiences of Cuba, not only as an example of a more sustainable, less chemically-dependent form of agriculture, but also as a means of reassessing the global food security debate. From this, **Chapter Two** continues with a more detailed contextual setting of the situation: summarising the agricultural history of Cuba and events leading up to the crisis of the early 1990s, and the short-term coping strategies that followed. This account is necessary in order to understand some of the subsequent choices of theory and methodology used. **Chapter Three** considers ecological agriculture in generic terms, characterising its production and support systems, and the transitional phases involved in moving toward such a production approach. This provides a benchmark against which the Cuban experience may be compared. This chapter then goes on to draw up a more detailed analytical framework of agricultural and food systems, to explain possible variances happening in Cuba, in terms of change, its main drivers and challenges. **Chapter Four** describes the research approach and methodology used, explaining the reasons for the choice of approach. It introduces the four field themes through which analysis was made: a snapshot of maize production in Havana Province, cropping systems and their institutional support across three provinces, the trends of the food system, and the extent and dynamics of organic agriculture. Following this, **Chapter Five** sets the scene for the subsequent empirical chapters by providing an overview of the institutional and organisational structure in Cuba in the 1990s, and a summary of the main changes reported to have occurred in the early to mid 1990s. This helps to understand the roles, linkages, and changes involved. It also sets high expectations by summarising the reported successes of Cuba’s urban agricultural achievements.

There then follow five chapters that descriptively analyse the field evidence, in the form of discrete studies on specific themes or perspectives. The first of these, **Chapter Six**, presents the results of a scoping study that followed the developments of a Cuban research project on participatory plant breeding in the province of Havana, and the farms involved in this project. Analysis of this provides snapshot evidence of contemporary field conditions in Cuba. From this case study, **Chapters Seven** and **Eight** go on to discuss the results of the second and major stage of fieldwork, which covered a wider range of farm types, and their support institutions, across three Cuban provinces. Through the perspective of the external and internal dynamics of actors and institutions within a livelihood context, these chapters provide deeper insights into what Cuba has achieved in terms of production, and on the support for, and challenges to, more sustainable systems. **Chapter Nine** puts this in the wider context of the Cuban food system, discussing its operational changes over the 1990s as Cuba struggled to ensure food access for the population. The concluding empirical chapter, **Ten**, draws in on the development of the organic agricultural movement in Cuba, the extent of organic production, and its relationship with the State.

Drawing the research process together, the overall outcomes of Cuba's efforts to ensure food security through increased domestic production are discussed in **Chapter Eleven**. The final chapter, **Twelve**, concludes by examining the institutional learning process which took place, the challenges emerging for the mainstreaming of ecological agriculture, and the implications of the Cuban experience for global food security.

2 CUBAN AGRICULTURAL AND FOOD SYSTEMS UP TO AND INCLUDING THE CRISIS OF THE EARLY 1990s

"When historians finally conduct an autopsy of the Soviet Union and Soviet Communism, they may reach the verdict of death by ecocide."

Feshback & Friendly, 1992, p.1

2.1 BACKGROUND

2.1.1 Introduction

This chapter provides a brief history of the agriculture and food system in Cuba leading up to the 1990s, and describes in more detail the crisis period of 1989 to 1993/4. This sets the context for the subsequent transformations that have occurred, and the speculation that has arisen, stimulating the enquiry of this thesis.

2.1.2 The agro-geography of Cuba

Located just south of the Tropic of Cancer, the archipelago of Cuba, part of the Greater Antilles chain, is formed of approximately 1,600 Caribbean islands, the largest of which - Cuba - lies only 160 km south of the Florida Keys, and commands the main entry to the Gulf of Mexico. Long and narrow (described by Cubans as 'the sleeping alligator'), this island is 1,200 km in length, 40-290km in width, covers 110,900km^2, and is mountainous for 20% of its land surface. A map of Cuba and its location is shown in Figure 2.1. Three different mountain ranges can be distinguished: the highest and most complex, reaching heights of 2,000m, in the eastern provinces of Santiago de Cuba and Guantanemo; the central low ranges of Cienfuegos and Sancti Spiritus; and to the west, the limestone hills of Pinar del Rio. The other 80% of the land surface consists of more gentle rolling hills and extensive lowlands, with deep red and sandy clays, and fertile alluvial soils in the flood plains. Around the main agricultural provinces of Havana and Matanzas, 75-90% of the soil is red clay and can reach depths of 8m or more (Weeks & Ferbel, 1994; Hatchwell & Calder, 1995).

Being a subtropical island, relative humidity is high at 75%, while annual temperature fluctuations are small at an average minima and maxima of 22.6^{o}C and 27.6^{o}C. The rainy season lasts from May to October, and 80% of total rainfall occurs during this time, followed by a dry season from November to April. Over most of the island, the average annual rainfall exceeds 1,000mm, with a minimum annual average of above 650mm. Regionally, rainfall is highest in the north-west of the island and in the mountain areas, whilst eastern regions are relatively dry. Although rivers are plentiful, the island's narrow, elongated form means that much of this fresh water runs off quickly seawards, with little retention other than where captured by human intervention. The east coast is subject to hurricanes from August to October, and droughts are also common.

Figure 2.1 Map of Cuba and its Caribbean location

Just over half of the total land area, 6.7 million ha, is currently in agricultural use, with 4.5 million ha under cultivation (MINAG, 1996), and 12% of total land area is under irrigation (ODCI, 1998). Although this total cultivable figure is high, only 8% of soils are highly productive, whilst over 60% of this agricultural area is of low productivity, largely due to erosion, acidity, low organic matter and salinisation[15] (Duran, 1998). Although agriculture accounts for only 5% of GDP[16] in Cuba (EIU, 1998), historically it has made a major contribution to the Cuban economy, with sugar, tobacco and coffee being important export products. Other major components of the economy are petroleum, chemicals, construction services, nickel, steel, cement, agricultural machinery, and biotechnology.

Sugar, as historically the most important export crop, covers a large area throughout the country. It is grown on the better soils and, because of the highly mechanised approach to production, on flat areas. Tobacco is the second most important export crop and is traditionally grown in the provinces of Pinar del Rio, Holguin and Sancti Spiritus, though with more recent promotion by the Ministry of Agriculture it is starting to be cultivated in other provinces. Potato, an important and popular staple of the national diet, is produced largely in the provinces of Havana and Matanzas which have the most fertile and deep soils on the island. Large-scale horticulture is predominantly centred around the capital - in Havana and Matanzas Provinces, while grazing and permanent pastures are concentrated in the east of the country; the east having less fertile, more erodable and shallow soils. Tree crops such as coffee, cocoa and citrus are found in the mountainous eastern regions of Santiago de Cuba and Guantanemo.

Cuba has a population of 11,142,6000, 75% of whom reside in urban areas. Statistics on ethnic composition vary: Funes (2002) suggests that the population is largely Caucasian (66%), with 22% being mixed (*mestizo* or *mulatto)* and 12% black, whereas ODCI (1998) identify 37% as being Caucasian and 51% mixed. Population growth rate stood at 0.42% in 1997, literacy at 95.7%, and life expectancy 75.2 years (ODCI, 1998).

2.2 THE FOOD PRODUCTION SYSTEM UP TO 1989

2.2.1 Early and colonial food production

Pre-Columbian food production

Cuba's agricultural history has been one of colonialisation. The original inhabitants of Cuba, the Ciboneys or Guanahatabey, are believed to have arrived there over 6,000 years ago from South

[15] 2 million ha are affected by salinisation, mainly in the east of the country (FAO, 1986).
[16] Gross Domestic Product

America and were primarily fisherfolk and gatherers. They maintained their traditional lifestyle until the arrival of the Arawak tribe from South America and the Caribbean, 1,500 years ago. The Arawaks, or Taino, were settled farmers who cropped a large proportion of their diet, mainly maize and cassava supplemented with sweetpotato, squash, beans, peanuts and fruits such as guayaba, guanabana and pineapple. Cassava in particular played an important role: the bitter variety was grated, leeched and toasted on ceramic griddles to produce a bread known as *casabe*. This bread, a central part of the diet, could be stored for long periods of time without spoiling. Religious ceremonies focused around cassava production and the provider of cassava or *Yucahu*. The Arawaks possessed a good knowledge of ecological aspects of agriculture. For example, they used assemblages of species with different growth patterns so as to minimise competition for soil and moisture resources – often on elevated mounds or *conucus*, and the strategic use of nitrogen-fixing legumes to enhance soil fertility. They also practised slash-and-burn agriculture which, given the low population density, was relatively sustainable. They later fell victim to European genocide and left little record of their cultural history, although remnants and descendants can still be found in Cuba (Rosset & Benjamin, 1994; Weeks & Ferbel, 1994).

Colonial food production

From a European perspective, the major group of colonialists were the Spanish, Columbus arriving and claiming the island for Spain in 1492. By 1511, land was being distributed to Spanish settlers who started to develop sugarcane plantations. By the 18th century, over 650,000 African slaves - mainly from Nigeria - had been brought over to work these plantations. Coupled with the extensive and large-scale cattle ranches, a sharp contrast had already emerged between these and the small- and medium-scale crop-based systems and farmers. By the 19th century, the sugarcane plantations had become the most mechanised in the world, producing almost one-third of the world's sugar. Its growth had been dependent on slave labour, but after the abolition of slavery in Cuba in 1886, manpower was augmented by the arrival of Mexican Indians and Chinese.

Toward the end of the 19th century, the United States increasingly became the major agricultural trading partner and financier. After the successful War of Independence against Spanish rule, from 1895 to 1898, a small group of US farmers came to dominate ownership of the main plantations: 13 of sugarcane *latifundios* were producing 70% of total sugar output, while small, diversified farms had dropped from 90,000 in 1895 to 38,130 by 1934. At this time, 95% of land was in private hands, and Cuban small farmers held land - *minifundios* - largely through tenancy, sub-tenancy, share-holding and land administration. In contrast to the intensively farmed *latifundios*, these small farmers practised more traditional methods, with a low use of inputs. In 1945, for example, irrigated land occupied only 1-2% of total agricultural area, no pesticides were used, and farmers did not generally own tractors or other machinery. Feeling exploited by the US monopoly, these small farmers organised a variety of citizen movements that aimed to eliminate the *latifundios*.

By 1958, 73.3% of the land was in the hands of just 9.4% of the land-holders (Nova, 2002). The *latifundios* held over 4 million ha of land uncultivated, at a time when 200,000 Cuban families were landless and 600,000 people unemployed (Funes, 2002). Illiteracy and disease were also rife, with rural dwellings rarely having electricity, sanitation or fixed running water. The staple foods of the small farmer were rice, beans, roots and tubers. Only 4% of these farmers consumed meat on a regular basis, 11% milk and 20% eggs (Knippers Black et al., 1976: Nova, 2002). Rural and urban lower-income diets were extremely starchy, with a high fat content[17]. The Cuban agricultural worker's weight was said to be 16 pounds (7kg) under the national average, and 35% of the population suffered some form of nutritional deficiency (Knippers Black et al., 1976).

Feelings of insecurity were exacerbated by the monocultural dependency on sugarcane; every price fluctuation on the world sugar market was felt in the Cuban economy that depended on this crop for 75% of the total value of its exports. Internally, farm gate prices were low and yet the

[17] Yet the poor quality diet was also out of choice: green vegetables were in low demand, and the abundant tropical fruits were eaten only sparingly (Knippers Black et al., 1976).

difference between these and retail prices ranged between 800 and 3,200%, while many imported products could feasibly be grown within the country (Nova, 2002).

2.2.2 The post-Revolution farming system

Agrarian reform

On the 1st of January 1959, Fidel Castro marched into Havana and declared the Revolution. The US-backed dictator, Batista, fled the country, followed, over subsequent years, by many large land owners (and also by possibly over half the middle class), as the revolutionary government brought in sweeping agricultural reforms (Knippers Black et al., 1976). From the outset, this new government paid great attention to the agricultural sector; as it was rural people who had fought for the Revolution. In this sense the Revolution was Agrarian rather than Proletarian (Schusky, 1989). In fact, even prior to the Revolution, in 1958, Castro's rebel army had brought in an agrarian law stating that farmers who were working State land of less than 62 ha should become the owners of that land, and farmer tenants on private land of less than 26 ha should receive the land for free.[18]

On 17th May of the same year, the First Agrarian Reform Law was implemented, its main aim being to order the removal of the *latifundios*. It did this by reducing the maximum area allowed to be kept in private ownership to 402 ha, while dividing the rest of the land among 200,000 tenant farmers and agricultural labourers. The only exception to this was land dedicated to export crops or supplying urban areas; here land area owned ran up to 1,342 ha. Batista supporters were specifically targeted: their land was confiscated without compensation, and foreigners were not allowed to own sugar factories. At the same time, every farming household with more than five members was supplied with 27 ha to live on, and the right to buy up to 67 ha. Funes (2002) notes that at this point, the encouragement of small farmer production was tending toward less industrialised methods of farming.

The Second Agrarian Reform Law was introduced four years later, in 1963. This changed the structure further, by specifying that all land holdings of more than 67 ha would be nationalised, and that all agriculture was to be centrally organised. Many more farmer land-owners and professionals fled the country, taking their agricultural knowledge with them. However, many other large land owners responded by dividing their remaining lands into smaller farms amongst close family members and embedding themselves into the peasant economy. In addition, and according to Puerta (1998), they ran down their holdings, which would adversely affect production for years to come. Meanwhile, many farm labourers migrated to the cities.

The free market also disappeared. Farmers had to produce pre-determined crops and sell them to the State, based on an agreed plan. According to Castro, and in line with Marxist-Leninist principles, this system would increase production. Farmers were also required to form co-operatives, to facilitate the introduction of mechanised and large-scale production methods and scientific technologies. In this year, nearly 70% of land and 80% of sugarcane volume became under State control (Seraev, 1988).

Prior to the Revolution, only very limited areas had been subject to chemical fertilisation, and mechanisation was limited to rice and sugar cultivation. Increasing the level of agricultural technology was a priority of the Revolutionary government. New equipment and inputs were imported, supplemented by a few fertiliser-producing complexes scattered around the country. One of the largest was at Nuevitas, which had an annual capacity of 200,000 tons of ammonium nitrate, 160,000 tons of nitric acid, 110,000 tons of ammonia, and 35,000 tons of urea. Approximately fifty large dams, and more small ones, were constructed during the early post-revolutionary years (Knippers Black et al., 1976).

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[18] Puerta (1998) suggests that in those early days, only one tenth of small farmers were without some legal claim to land, but it was this small proportion, in the east of the country, which influenced the revolutionary government's early agricultural policies of land redistribution. Subsequent policies and agricultural reforms changed to those of greater State (political) control.

Political and productive specialisation

Politically, Cuba was abolishing market-led capitalism, nationalising foreign-owned enterprises, and instituting many Soviet-style agrarian and industrial measures. As soon as the First Agrarian Reform Law had been implemented, the US cancelled its contracts for the purchase of Cuban sugar, and the Soviet Union stepped in with a high offer (Murphy, 1999). Relations with the United States deteriorated to a low point with the US attempted invasion of the Bay of Pigs in 1961, and the Missile Crisis of 1962. After the Missile Crisis, in 1964, the US imposed a total trade embargo against Cuba: exports to Cuba had been forbidden since 1960, but imports of Cuban goods were now also banned. Although the Missile Crisis had shown Russia to be untrustworthy, this embargo pushed Cuba to further aligning itself politically and economically with the Soviet Union and the Socialist bloc.[19] The revolutionary government converted into the Cuban Communist Party (*Partido Communista de Cuba*). As Cuba was unable to sell on the world market, it became dependent on the Socialist bloc for resources it could not, or did not, produce itself: petrol, gas, certain foodstuffs, fertilisers, pesticides and machinery. These were purchased largely with the revenue from its sugar, which it continued to sell to the Soviet bloc on favourable terms (prices paid were, on average, 5.4 times higher than the world market price). Such a dependent relationship was formally acknowledged in 1972 when Cuba joined the Council for Mutual Economic Assistance (CMEA).

This political alignment was also apparent in the agricultural sector, which adopted a Soviet-style, industrialised agricultural strategy. At the start of the Revolution, the State had intended to reduce the area of land devoted to sugar and diversify in order to better meet its food security needs (Ríos et al., 2001; Nova, 2002). However, this did not happen due to a combination of factors. Some experimentation in this direction did not produce immediate, favourable results (Deere, 1996). At the same time, the brief economic boom in the 1960s was based on short-term strategies, while longer-term investment in the land declined (Schusky, 1989). The strong demand and high prices from the Soviet bloc, the need for export revenue, and the ideal natural, social and infrastructural conditions for its production, all contributed to the continued monoculture of sugar (Nova, 2002). This was specifically promoted by President Castro who invested heavily in the industry in order to attempt record harvests. By the end of the 1960s, domestic production of food had declined at the expense of industrial expansion; sectors were heavily developed for the industrialised production of cattle and dairy, pigs and poultry, rice for national production, and citrus for export.

The further industrialisation of Cuban agriculture

Given the hierarchical structure of pre-Revolution agriculture, Cuba found itself with few agronomists or technical specialists, most of them having fled the country. Traditional farmers still existed, but the prevailing political outlook placed greater trust in science and technology than local knowledge, and so Cuba developed a national agricultural system using imported technical expertise; mainly from Eastern European countries. This led to the development of modernised, large-scale systems using techniques that had been developed in temperate regions, systems that were similar to, but more intensive than, the previous US-style plantation agriculture. The emerging Green Revolution technologies of the 1960s and ‘70s were then readily compatible with this approach, with their monocropping over large extensions, intensive use of machinery (tractors, harvesters and aviation), chemical fertilisers and pesticides, as well as use of intensive livestock feeds. The State applied this approach to all its farms, which by that time comprised over 70% of the country's agricultural area and especially around the capital. At 1975, 48% of cultivated area in Havana Province was under monoculture, 34% under ‘accompanied’ monoculture, and 18% was relatively diversified (Zequeria Sanchez, 1980). Interestingly, because of the socialist approach, the credit packages of the Green Revolution were not implemented, and thus small farmers did not

[19] Throughout the 1960s and 1970s, Cuba functioned as a Soviet satellite for disseminating its political beliefs to developing countries, encouraging revolutionary movements in Latin America, and sending troops to support causes in Angola and Ethiopia.

incur debts to the same extent as in other countries (Funes, 2002). Nevertheless, in the move to eliminate small farming systems and encourage rural-to-urban migration, much traditional knowledge was lost, and the rural population declined from 56% of the total in 1956 to 28% in 1989 (Pérez Marín & Muñoz Baños, 1992).

These decades also saw the 'chemicalisation' and 'tractorisation' of agriculture (Pérez, 2002; Ríos, 2002). Pest control became based exclusively on chemicals, with predefined norms for each crop. Cultural and traditional control methods were abandoned. With the appearance of new and resistant pests, the State Plant Protection System (INISAV) was created in the mid 1970s, and along with it a cross-country network of early warning stations. This encouraged a more controlled use of pesticides, and cut their usage by half. By 1982, Integrated Pest Management (IPM) was implemented as official State policy, and with this started a small line of research on biological control agents. MINAZ (the Ministry of Sugar) pioneered alternative approaches as early as 1980 through establishing a National Programme for Biological Pest Control, and constructing fifty small-scale centres for the production of biopesticides for sugarcane in 1985. By 1988, MINAG (the Ministry of Agriculture) approved a similar programme (Pérez, 2002). The use of chemical fertilisers was brought somewhat under control when the Ministry of Agriculture established the Directorate of Soils and Fertilisers, with various soils research institutes. This also reversed the trend of deforestation which had existed since pre-Revolution times, although soil degradation continued overall, due to the effects of intensive chemical use, heavy machinery and large-scale irrigation (Treto et al., 2002). Some research was being done in the 1980s on recycling sugarcane wastes, green manures and the use of biofertilisers, but little was practically implemented, save for compost and worm humus which were applied to sugarcane systems from 1984 onwards. In terms of mechanisation, from the Revolution up to 1990, the number of tractors increased from 9,000 to 85,000, while oxen numbers decreased from 500,000 to 163,000 over the same period (Ríos & Aguerreberre, 1998). Meat and dairy production was made more efficient in the 1980s through improving pastures and producing feeds through local crop by-products, though these had difficulty competing with the cheap imports from the Soviet bloc (Monzote et al., 2002).

Agricultural research also took on the Green Revolution principles and especially the concept of biotechnology (Bode et al., 1998). For economic and ideological reasons, the national research sector grew to become one of the largest amongst developing countries, with 2,500 scientists and an annual budget of $45 million by 1985 (Casas, 1985). The Ministry of Agriculture combined 17 research centres and 38 experimental stations under its auspices, with additional centres under the Ministries of Higher Education, and Science and Technology (Funes, 2002). In terms of international collaboration, Cuba maintained networks with international organisations during the post-revolutionary period, and particularly with the Food and Agriculture Organisation, on whose Council it had sat as a member since 1979. Relations also existed with the CGIAR,[20] in particular with IPGRI[21] but also through exchange of genetic resources with a range of CG centres and associates. Within the Caribbean region, Cuba was also active in commodity research and development of crops such as sugar, citrus, maize, bean and potato (ICPPGR, 2000).

By 1985, irrigation covered 26% of total cropped land, largely for sugar cane (46%) but also rice (20%), citrus (12%) and pastures (10%) (Alvarez, 1994). Chemical fertiliser use amounted to 192 kg/ha, and pest and disease controls to 9,500 tons (or US$ 80 million) per annum. At 1989, 1.3 billion tons of fertilisers were being imported, an increase of over 900% from 1958 figures (Alvarez & Messina, 1992). For pesticides, Cuba was importing 10,000 tons in 1989 (an increase of 200% from 1965) and 17,000 tons herbicides (3,300% increase from 1965). Animal feed imports had risen by 900% from 1965. Overall, 94% of fertilisers, 96% of herbicides, and 97% of livestock concentrates were being imported (Funes, 1997). Meanwhile, the value of imports of agricultural machinery had risen by 250% between 1970 and 1989, peaking in 1984 when 90,000 tractors were being used (Díaz, 1997).[22] Box 2.1 provides a description of the intense range of types and source

[20] Consultative Group on International Agricultural Research.
[21] International Plant Genetic Resource Institute.
[22] In 1985, for example, there was an average of one tractor for every 37 ha in Cuba, compared with one every 55 ha as the global average (Figueroa, 1999[a])

of agricultural inputs and implements, showing that while there was dependence on the Soviet Union and other CMEA members, Western European countries also played a significant role in supplying inputs. Figure 2.2 depicts how Cuban agriculture had higher levels of fertilisers, mechanisation and irrigation than the US and certainly more than other Latin American countries. All this signified high agricultural investment: between 1960 and 1990, 25% of all domestic investments went into the agricultural sector (Díaz González, 1999). Productivity nevertheless was relatively low (*ibid*), although production of selected produce more than doubled since the start of the Revolution (Murphy, 1999), and growth in production of selected crops between 1976 and 1989 is shown in Figure 2.3.

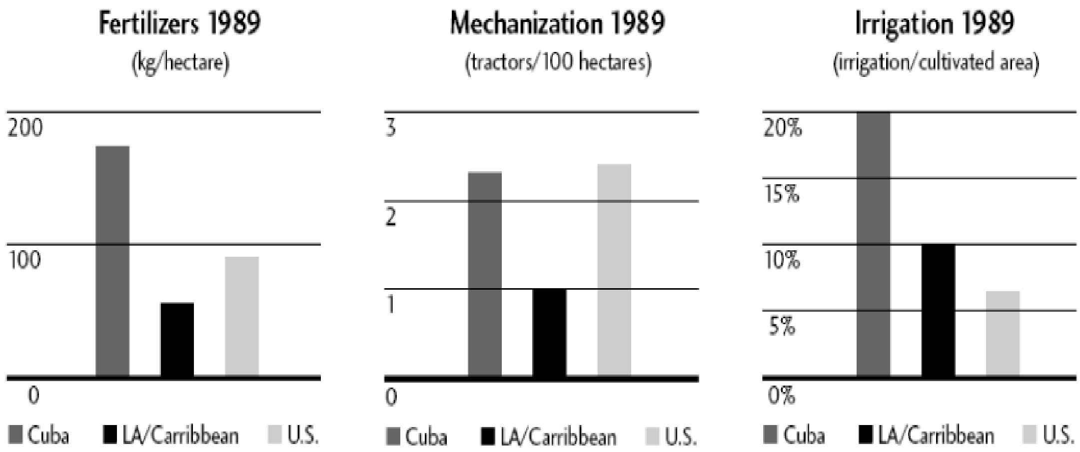
Box. 2.1 Sources of inputs used in Cuba up to 1989

"*Until 1989, the majority of the fertilisers came from the USSR, with some quantities imported from the German Democratic Republic and a few Western countries. Herbicides and other pesticides were purchased mainly from Switzerland,both the Federal Republic of Germany and the German Democratic Republic, the United Kingdom and other Western countries. The USSR was the main supplier of animal feed, while the Netherlands sold substantial quantities in several years and minor quantities were imported from the Federal Republic of Germany, France, Peru, Chile and other countries. Agricultural tools came from Spain, Italy, the USSR and Eastern European countries.*

Almost all of the tractors were imported from the USSR although, in several years, some were purchased in Italy and the German Democratic Republic. All sugarcane loaders and cane wagons were imported from the USSR. Bulldozers were purchased mainly in France, the USSR, Italy and Japan. The vast majority of diggers and cranes were imported from the USSR, although some were purchased in the United Kingdom and the German Democratic Republic. Tractor wagons came mostly from the USSR and, in some years, from Sweden, the United Kingdom and France. Water pumps were imported mainly from the USSR while Bulgaria, the German Democratic Republic, France, the United Kingdom, and Italy sold some quantities to Cuba in later years. Finally, spare parts were mainly provided by the USSR but some shipments also came from Romania, Bulgaria, the German Democratic Republic and Italy."

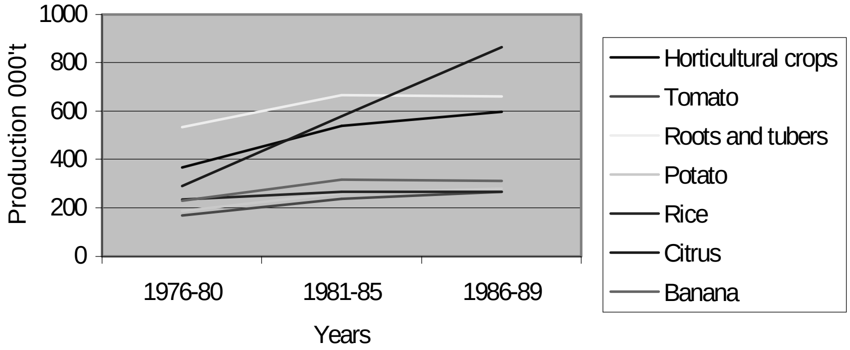
Source: Alvarez & Messina, 1992 p. 1-2

Figure 2.2 Comparison of fertiliser use, mechanisation and irrigation between Cuba, the USA and other Latin American countries



Source: Pérez, 2000, cited in Sinclair & Thompson, 2001

Figure 2.3 Average annual growth in selected agricultural produce, 1976-1989 (000't)



Source: Nova González, 1999

Despite this move towards "Soviet style" agriculture, some authors point out that Cuba never became the Caribbean equivalent of the monolithic Eastern European communist system (e.g., Gey, 1988; Eckstein, 1994). Because Cuba did not force collectivisation to the same degree, so private farmers still remained (Sinclair & Thompson, 2001). Nevertheless, other sources do draw similarities to the Soviet model in terms of collectivisation, centralisation, and egalitarianism (e.g. Mesa-Lago, 1998), and to both the Soviet and US models in terms of the large-scale, export orientation, subsidies, mono-crop focus, high levels of mechanisation, and dependency on chemical inputs (Gey, 1988; Mesa-Lago, 1998; Sinclair & Thompson, 2001). Díaz González (1999) notes that there was a relatively low level of productivity and efficiency, and perhaps more importantly, that 80% of agricultural employees - State farm workers - were on lower salaries than those of employees in other economic sectors and that they enjoyed few other incentives. Nevertheless, unlike other non-European communist countries such as North Korea and Taiwan (Schusky, 1989), which systematically invested the proceeds of agriculture into industrialisation, Cuba re-invested much agricultural revenue into developing rural infrastructure such as irrigation, transportation, fertilisers, rural education and health. This strategy accentuated Cuba's dependence on agriculture. Cuban officials were aware of this vulnerability from early on; and believing the future to lie in technological expertise, they also invested billions of dollars in developing biotechnology, IT, health and robotics (Rosset & Benjamin, 1994).

2.2.3 Types of farming system in the 1980s

Cuban farms were divided into State and non-State. After the agrarian reforms of the Revolution, approximately 30% of agricultural land was owned by individual farmers, and since that time the State made various attempts to integrate them into the centralised and specialised planning, production and distribution system, by purchasing or renting this land (Ramírez Cruz, 1984: Zimbalist & Eckstein, 1987). This led, by the late 1980s, to four main types of farm organisation: State farms, Agricultural Production Co-operatives (CPA), Co-operatives for Credit and Services (CCS), and individual farmers. In 1989, private production contributed to 35% of national production and 48% of export foodstuffs, despite the fact that it covered only 20% of total agricultural area and had lower investments (Nova, 2002; Nova, 1994). Each of the four main types of farm organisation in Cuba are discussed below.

State farms (*Fincas Estatales*)

Covering 80% of cultivable land, State farms were the main producers of staple foods such as rice, milk, beef poultry, roots and tubers, and of sugar, citrus and coffee. Their activities also covered forestry. These farms received priority over private farms for the receipt of production inputs, technical assistance, credit, investments and new technology, and housing and social services were provided as incentives to workers (Puerta, 1998). They came in various organisational forms and under different ministries. Under the control of the Ministry of Agriculture were non-sugarcane farms and people's farms (*Granjas de Pueblo*). The Ministry of Sugar controlled sugarcane plantations and agro-industrial complexes (CAIs) (Cole, 1998), while the Ministry of Home Defence also operated production units. All produce went to the State food procurement agency, Acopio.

Non-State Farms

Non-State farmers held the major responsibility for subsistence crops such as beans, maize and vegetables, as well as for tobacco and cocoa (Martín, 2002). These farms were characterised by land ownership: that the land was owned by the farmer or the co-operative rather than by the State. The farmers themselves were classified as peasant farmers or campesinos. There were three types of non-State farm, as follows:

i) **Credit and Service Co-operative, CCS** (*Co-operativa de Credito y Servicio*)
Commencing in 1962, the State encouraged independent farmers to organise themselves into co-operatives of 35-75 members, each with an elected management consisting of president, vice-president and administrator. Land was held privately, but assets belonged to the State. Credit relations were between the bank and the co-operative rather than directly with each farmer, and services offered to the members included the sharing of equipment such as a truck for marketing purposes, or a tractor for cultivation. Produce could be marketed by a co-operative representative. Each CCS member made an individual production plan with Acopio, for some of his/her produce. Not all co-operatives managed to arrange group access to credit and services (Miedema & Trinks, 1998).

ii) **Agricultural Production Co-operative, CPA** (*Co-operativa de Producción Agropecuaria*)
The second oldest type of production co-operative in Cuba, CPAs were initiated in 1977. Here, farmers were encouraged to pool their land, labour, livestock and materials such as tractors and other tools into collective property, and all investments and production outputs were shared. If land holdings were dispersed, the State may give the co-operative the inter-lying land in perpetuity. This attracted non-land owners and skilled staff to join the co-operatives. Members who pooled their own land and goods/materials were compensated. The co-operative may found a community, with a primary school, small clinic, recreation area and houses, and electricity. CPAs tended to be larger than CCSs, with membership ranging from 50 to 200 per co-operative. Staff were also more numerous, consisting of a president, and heads of production (an agronomist), economics, machinery, veterinary resources, plant health, and politics. Members were commonly grouped into work brigades of between 10-20 people, each with a brigade head. The staff met fortnightly, and members every month. Acopio visited regularly to make and oversee production plans with the co-operative staff and heads of brigades. Plans were made for the majority of production. Politics was embodied in the co-operative, with some members being active in the local ANAP or PCC. Both membership and productivity of the CPAs declined steadily during the late 1980s (Martín, 2002). This was due to the level of State control that made them unattractive to potential new campesino members (Deere, 1996; Deere et al., 1992), and correspondingly the increasing proportion of agricultural labourers who held little stake in, and therefore care for, farm performance (Miedema & Trinks, 1998).[23]

iii) **Independent farmers** *(campesinos independientes, parceleros)*
Despite the efforts of the State to collectivise, these farmers chose to remain independent on their own land and rely on their own productive capacity. Some received land in perpetuity from the

[23] One opinion from the field was that many older people who could not manage their own land pooled it into CPA co-operatives rather than passing it onto their children, and in this way the traditional passing of land down the generations was broken (KI/10)

State. They did not fall under any State organisational enterprise, and although they could still follow a production plan and sell this produce to the State, this likely comprised only a small part of their total production. Access to inputs was controlled, although they made their own investment plans. These farms were small (up to 26 ha), mixed, and largely produced for subsistence purposes. Their numbers also declined toward the end of the 1980s (Martín, 2002).

In terms of socio-economic differences between these farm types, comparative studies during this period are rare. One undertaken in 1991, by Deere et al. (1995), found that since 1959, farm income levels had improved dramatically, especially for the private sector, while regional differences had lessened over that time. At the same time, all types of agricultural households, be they working individually, in a co-operative or for the State, relied on multiple income sources.[24]

2.2.4 Food collection, distribution and markets

The ration system and planned production

Since 1959, State politics had favoured centralisation of the market in order to guarantee equal distribution and stable prices (Benjamin et al., 1984). In 1961, the State food procurement and distribution entity, Acopio, was formed to deal with the majority of food collection and marketing. Wages were raised substantially so that workers could afford more and better foodstuffs. However, this strengthened purchasing power was intensified by the decrease in expenses such as rent and electricity, and coupled with a decrease in production due to the changes in farm ownership and organisation, meant that existing food stocks became depleted (Alvarez, 2004). Therefore, in 1962, Cuba established a food ration system to control the sale and flow of food, administered by the Ministry of Internal Trade (MINCIN). This system allowed the population to purchase a set, moderate quantity of basic products, or *canasta basica*, at a negligible price. This ration provided most items, such as rice, beans and cooking oil (Rosset & Moore, 1997; Oliveros Blet et al., 1998). As domestic production of some foodstuffs increased, so they were taken out of the ration system and sold freely, and when they became scarce they were added in again (Alvarez, 2004). In 1968, as food shortages increased, direct farm sales were partly curtailed, and specialised 'production plans' instituted whereby the campesino farmers would agree with the State to supply a set number and quantity of crops for the ration. This plan included agreement on planting areas and cultivation practices, and planning was undertaken through the local State farm 'Enterprise', which would supply the farmer with credit, inputs and technical assistance such as it was already using for its own production activities (Deere, 1996).

By 1971, rationed foods provided a daily quota of 1,427 calories. The ration was rather lacking in variety, but did guarantee a basic food security for all. Subsidised food could also be obtained through the canteens of factories and schools. Unrationed food at that time could be obtained through own garden production, restaurants and the black market (Knippers Black et al., 1976). This situation eased off as the major food shortages disappeared toward the end of the 1970s. In 1979, a Social Security System was established, which included assistance components for the most vulnerable and specifically old people, disabled, single mothers, children and youth. This led, for

[24] Campesino farmers have, according to Lehmann (1985) received an extraordinarily good deal from the Revolution, to the point where the State has lost out. These campesino farmers gained far larger land units than they might have expected after the Revolution, and opportunity was provided for nuclear families to farm their own plots of land. At the same time they were in receipt of the same food rations as non-food producers, and there was no great pressure on them to sell their produce to the State. Yet production stagnated due to lack of incentives, and this exacerbated the country's dependence on imports. Burnhill (1985) suggests that the campesino sector could in fact have made a larger contribution to agriculture had it not been for State policy on access to resources, and she provides examples where, in practice, the State sector outperformed the private sector for this reason. Forster (1982) concludes the opposite: that the private sector has outperformed the State, though nuanced in that certain crops such as rice and eggs have benefited from large-scale capital intensive production. Pena Castellanos and Alvarez (1996) support this, suggesting that large-scale State farms were unable to provide the detailed attention required for agricultural activities. Overall it appears that the campesino sector were comfortable and not stretched by the State.

example, to more than 3 million food portions were served, free or at very low price, daily at public institutions such as schools and hospitals in the 1980s (MSP, 1988).

The parallel and campesino markets

Meanwhile, one of Acopio's activities was processing imported raw foodstuffs into products for distribution to work places, school canteens, hospitals and old people's homes. This gave rise, in 1982, to what was termed the 'parallel market' where nationally processed products were available, rivalling similar, imported ones. It supplied preserved meat products, dairy, conserved fruit and vegetables, and contributed to increasing food supply as well as stimulating national industrial production.

An additional source of food was the campesino distribution market which was left to supply areas that the State could not reach. Prices on the campesino market were higher, but they provided greater diversity and were a major source of meat and dairy products. In the early 1980s, the State experimented by allowing the formation of organised campesino 'farmers' markets'. According to Oliveros Blet et al. (1998), this experiment was stimulated by rising prices in the campesino market sector, and by the realisation that the State production sector was inefficient. It was also a way for the State to exert some control over the excess production of the campesinos (Figueroa & García, 1984). This experiment was unsuccessful, and by 1986, these campesino 'farmers' markets' were closed by the State. No legislation had been made regarding marketing parameters, and so intermediaries had emerged who were buying in bulk and speculating on prices, with no limits on their profit levels. Thus these markets did not lead to the desired decrease in food prices, and a sector of the population was growing disproportionately wealthy. In this sense, they were also contradictory to the State goal of the time of encouraging campesino farmers to pool their land (Deer & Meurs, 1992). The range of fresh produce then fell, though this was partially substituted by the increasing growth of the parallel market. All commercialisation returned to State control,[25] and with this, the black market grew.

Dependency on food imports at the end of the 1980s

A major limitation to the food distribution system throughout the 1980s was that, although markets were partially liberalised, the transport system was not, and so products frequently reached the consumer in poor shape. Acopio was notorious for failing to collect produce from farmers, and so wastage was high. Alvarez (2004) calculates that 10-15% of available food was wasted since 1980.[26] Further, any attempt at production diversification was hampered by the continued dependency on sugar as the source of foreign exchange (Enríquez, 1994). By the late 1980s, Cuba was still receiving the balance of its food requirements from the Socialist bloc, including that channelled through the ration and social systems and parallel market system, as shown in Table 2.1.

In 1985, for example, the Ministry of Agriculture was producing just 28% of nationally consumed calories, the rest coming from the Ministry of Sugar and over half from abroad (Casanova, 1994; Garfield, 1999). Estimates are that between 57-80% of proteins and 50-57% of calories were supplied by imports (Felipe, 1995; Murphy, 1999).

At the same time, 53% of arable land was devoted to export crops, and 44% to national foodstuffs (Pérez Marín & Muñoz Baños, 1992; Enríquez, 2000; Nova, 2002). By 1989, 72% of Cuba's foreign trade was with the USSR and 87% with CMEA (Mesa-Lago, 1998), which was supplying all of Cuba's fuel and 80% of its machinery, as well as two-thirds of its foodstuffs. Estimates of the amount of Soviet economic aid to Cuba vary between $600 million and $5 billion per year, through price subsidies and low-interest loans (USIA, 1998).

[25] Figueroa & García (1984) argue that an alternative solution to deal with this non-State marketing would have been to establish 'consumption co-operatives' as were functioning in other socialist countries.

[26] To some authors, such as Alonso (1992), the poor State performance on distribution amply justified the role of the intermediary.

Table 2.1 Main agricultural imports and their contribution to total national food requirements in Cuba, by the late 1980s (%)

Crop	%
Wheat	100
Beans	99
Livestock concentrates	97
Oil & lard	94
Cereals	79
Rice	50
Fish	44
Milk & derivatives	38
Poultry	33

Source: Rosset & Benjamin, 1994; Funes 1997

In a fashion, Cuba was able to supply all of its food needs, but the way that it achieved this proved insufficiently resilient to external shock: Cuba's greatest weakness was its reliance on a single cash crop. Sugar and its derivatives were providing 75% of Cuba's foreign exchange earnings (Enríquez, 2000), fetching far above world market prices which themselves were becoming increasingly volatile. This weakness was not only economic but also environmental and social. Cuba's crops were vulnerable to extremes of rainfall, and, in drought-free years, the island was often hit by hurricanes. From the social aspect, labour demand was highly concentrated around the sugar harvest season, and highly technology dependent throughout the year (Schusky, 1989).

2.2.5 Food consumption and health

Since the Revolution, Cuba had a National Health System, which by the end of the 1980s included programmes for diarrhoea disease control, and improving the status of pregnant women and undernourished children. Within this was seated the National Food and Nutrition Surveillance System (SISVAN), set up in 1977 with the support of UNICEF and PAHO,[27] with the objective of monitoring the population's nutritional status. It undertook the surveillance of mother and child nutrition (through the primary health care network), of social feeding, and of chemical and biological food contaminants. It identified and dealt not only with the undernourished but also the obese (Amador & Peña, 1991). Used as a model system for other countries, Gay et al. (1986) identify its success as based on its horizontal and vertical reach: its ability for nationwide co-ordination of a range of specialised and sectoral institutions, each dealing with food issues, at national, provincial and municipal levels.

Food intake had risen during the Revolutionary period: in 1989, daily food consumption per capita was relatively high at 2,834 calories (including 76g protein) (Deere, 1992), compared to 2,500 calories in 1965 (Amador & Peña, 1991; Ríos et al., 2000). In an analysis of FAO data, Alvarez (2004) notes that between 1980 and 1991, Cuba exceeded the minimum daily requirements of 2,400 calories. In the 1980s, Cuba was one of the very few developing countries with life expectancy and mortality rates comparable to developed countries (Garfield 1999). Similarly, “western” diseases were also more prevalent. Mortality rates due to chronic non-communicable disease increased between 1968 and 1989 (Amador & Peña, 1991). This included a 25% increase in cardio-vascular disease, and an almost doubling in diabetes. Obesity in children and young adults also increased. Conversely, apart from a mild iron deficiency, no other chronic nutrient deficiencies were identified in Cuba prior to 1990 (Amador & Peña, 1991).

Food habits were poor and did not improve with improved economic status. In 1989, a study on changing food habits (Muñoz, 1989) identified that almost a quarter of the population could be characterised by their high intake of energy-related foods: animal fats, sugar and rice, and this group were generally low income and of rural origin. As incomes increased, so did the consumption of these foodstuffs. Amador & Peña (1991) also noted that the increased capacity to acquire food

[27] United Nations Children's Fund and the Pan American Health Organisation respectively.

had not corresponded with a change in food habits. For example, at that time Cuba had the highest per capita sugar consumption in the world, representing almost 20% of total energy intake. Fresh fruits and vegetables were consumed in low levels and seasonally, and only a low proportion of animal intake was fish. Almost the only vegetables consumed were onions, cucumbers, peppers and tomatoes (García Roché & Ilnitsky, 1986). Amador & Pena (1991) suggest that these dietary habits were the most important contributory factor to increased mortality rates.

2.2.6 Signs of change at the end of 1980s

Post-Revolution, Cuba had never fed itself. This was not uncommon – very few countries are completely self-provisioning, but in terms of national security, Castro (1996) admitted: *"During the years of full economic stability and development of agricultural production, the country reached considerably high levels but not enough to satisfy the needs."* Efforts in the mid-1980s to increase productivity by opening campesino farmers' markets had not had the desired outcomes. This was why, in 1988-89 and prior to the crisis, the State instigated a National Food and Nutrition Programme (Plan Alimentario), in order to improve the nutritional status of the population and to increase self-reliance and production. It intended to intervene in production planning, imports, marketing, food preparation and distribution. To encourage better food habits, it aimed to decrease sugar consumption to less than 15% of total energy intake, reduce total fat intake and increase the proportion of vegetable fat, fish and fresh fruit and vegetables (ANPP, 1991). It was an ambitious programme. Amador and Peňa (1991) illustrate the scope of the programme which involved "*co-ordinating the activities of agriculture and animal production, the food industry, domestic and foreign trade, education and mass-diffusion media, public health, and mass organisations in the framework of the National Food and Nutrition Programme…*"

As early as the mid-1980s, there had been awareness in Cuba of the negative influence of agricultural practices on food quality and human health. For example, information from the Food Nutrition and Hygiene Institute showed a positive relationship between zones of intensive use of nitrogen fertilisers, the incidence of stomach cancer, and the increased toxicity of ingested nitrites, and also a general reduction in the nutritive value of food products (García Roché & Ilnitsky, 1986; García Roché & Grillo Rodríguez, 1991). In the late 1980s, nitrate residue levels of domestically produced vegetables were comparable to those reported in East European countries (García Roché & Grillo Rodríguez, 1991). The total daily intake of nitrates was slightly above WHO recommendations, particularly for individuals consuming vegetables, root crops (including potatoes) and rice (García Roché, 1987). Of special concern were the nitrate contents of lettuce and bananas, because these two crops were widely consumed, usually raw, and often given to children. However, residue levels varied enormously between samples, owing to environmental and agricultural variables. García Roché and Ilnitsky (1986) recommended rationalising chemical fertiliser use at this time. In setting limits to vegetable residues, Cuba looked to standards used by CMEA.

During the 1970s and 1980s, other negative impacts of the industrialised farming model were being seen, including large scale deforestation, salinisation, erosion, compaction and loss of soil fertility (Oro, 1992; Ríos, 2002). Specifically, at least 70% of Cuba's soils were affected to some degree by erosion, including on the most fertile and relatively flat regions; soil compaction affected 25% of agricultural land; and between 10 – 32% was affected by salinisation (Espino, 1992; Sáez, 1997; Díaz-Briquets & Pérez Lopez, 2000). Dam construction lead to the contamination of aquifers, and by 1989 agriculture was generating 9 Mt of solid residues and 27 Mm^3 of liquid residues per year, further contaminating groundwater (Atienza Ambou et al., 1992). Yields of the major commodities were also decreasing (Nova, 2002). Castro appears to have been aware of the harmful affects of industrialised agriculture. In a publication on environmental management, Castro (1993) is quoted as saying "*.. the ultimate responsibility for the cumulative environmental deterioration in the Third World as a whole belongs to the developed capitalist world… The principle producers of pesticides, fertilisers and other noxious chemical products.*" (p. 22) and further "*It is recognised today that, as a result of the so-called Green Revolution, agriculture became highly dependent upon* *chemical products, with serious implications for the environment. In addition, this created the conditions for the deterioration of genetic diversity, as a result of cultivating high-yield hybrids."* (p. 31). There was also the realisation that the mono-disciplinary approach to agriculture was not conducive to self-reliance, and that dependency on inputs should be reduced (Murphy, 1999). In addition, the excessively complex structure of the agricultural research sector was being seen to have limited effectiveness[28] (Casas, 1985). This included the centralised food collection and distribution system, which in the 1980s was experiencing further logistical problems (Enríquez, 2000). Unfortunately, before plans for reform could be further developed, the crisis sprung. As Castro explained *"In a critical appraisal of its economic policy carried out toward the end of the 1980s, the government decided, in open consultation, to begin a new development stage with a process of transformations that came to be known as the 'Rectification of Errors and Negative Tendencies'. Before it had time to complete the new policies, the disappearance of Eastern Europe suddenly took place imposing grave consequences on Cuba's external economic relations*[29,30]*(op .cit.)*

2.3 THE CRITICAL YEARS: 1989-94

2.3.1 The crisis

In 1989 and 1990, with the transformations in Eastern Europe and the former Soviet Union, and the resulting dissolution of the Council of Mutual Economic Assistance (CMEA), Cuba lost 47% of its supply of diesel, 75% of its petrol, 45% of its electricity and 78% of its chemical fertilisers and pest and disease control products (PNAN, 1994). Of equal seriousness, food imports, which Cuba was dependent on, dropped by over 50%, as did the import of seeds (Enríquez, 1994). The value of imports fell by 80% from $8,100 million in 1989 to $1,700 million by 1993, of which $750 million was reserved for the purchase of fuel and $440 million for basic food needs (Ríos Labrada, 1999).

Table 2.2 Losses of major agricultural inputs after the dissolution of the Soviet Union

Input	1989 imports	1992 imports	Reduction %
Petroleum (Mt)	13.0	6.1	53
Fertilisers (Mt)	1.3	0.3	77
Pesticides (US$)	80.0	30.0	63
Animal feeds (Mt)	1.6	0.5	72

Source: Rosset & Benjamin, 1993

Because of the reserves and surpluses held in the system - of food, fuel stocks, incoming foreign revenue, medicines and so on, the real effects of these depleted resources only came to a head in 1993-94. They were exacerbated by the extension of the U.S trade embargo, through the 1992 Torricelli Act (and later the Helms-Burton Act in 1996[31]). During this time, GNP fell by almost 50% from $19.3 to $10.0 billion (Casanova, 1994; Funes, 2002). According to Garfield (1999), sanctions added a 'virtual tax' of 30% on all imported goods, because of the more expensive and distant markets that had to be relied upon. However, information from the Bureau of Inter-American Affairs of the U.S. Department of State puts this figure at only 2-3% (USIA, 1998), and

[28] Although no secondary literature was available to provide more details on the actors, strategies and policies of the research and extension processes during this period.
[29] Figueroa (1999[b]) points out that the country was anyway going through an economic recession during the final quarter of the 1990s.
[30] Information from the field suggested that the government had foreseen the crisis, but did not react because of the forthcoming Pan American games that were scheduled for Cuba in 1988-89.
[31] Dominguez (1997) argues that the United States would have taken even more direct action had it not been for pressure from its international partners.

the CIA attribute the decline in GDP to "*the result of lost Soviet aid and domestic inefficiencies*" (ODCI, 1998). Table 2.2 shows the decline in major agricultural inputs between 1989 and 1992.

2.3.2 The post-crisis impact

Economic and agricultural decline

The economy bottomed out by 1994, at which point Cuba was operating at one-third of its industrial capacity.[32] Estimates on changes in State subsidy levels to agriculture vary, from between $6.5 million to $13.5million per year between 1991 and 1994 (a drop of at least half of pre-1990 levels) (Hatchwell & Calder, 1995; Nova, 1995). The national manufacture of fertilisers dropped by 72% from 1989 to 1995 (Mesa-Lago, 1998). Stocks were depleted, and mono-cultural cropping systems without the inputs required to sustain them gave very low yields, whilst no petrol was available to drive the machinery.[33] The State's capacity to produce seed fell by 50% (Ríos Labrada, 1999). Manual labour was scarce, partly because of the previous State drive to urbanisation, and also because there was little incentive to work in agriculture. The agricultural sector contracted by 10.3% in 1992, 22.7% in 1993 and 4.9% in 1994, at which point production had decreased to 55% of its 1990 level (EIU, 2000). Overall, agricultural output dropped from 103.4 in 1989 to 66.6 in 1994 (Mesa-Lago, 1998, based on FAO index).

Agricultural exports fell to record lows (Figueroa, 1999[a]). Sales of sugar halved from 7,000 million tons in 1989 to 3,663 million tons in 1993, with a similar halving in price during the same period, as shown in Table 2.3. As a percentage of hard currency earnings, sugar exports dropped from 65% in 1992 to 40% by 1994 (Hatchwell & Calder, 1995). Citrus production dropped by 60% (Ríos Labrada, 1999). Similarly, it was at this time that domestic production reached its lowest point; for example, national production of roots, tubers and vegetables peaked in 1992 before falling to its lowest levels by 1994 (Figueroa, 1999[a]). The drop in production of major non-sugar crops is shown in Figure 2.4.

Table 2.3 Sugar exports from Cuba, 1989-1993

Year	Sales (MT)	Income (M$)	Average price per ton ($)
1989	7,119	3,920	551
1990	7,169	4,314	602
1991	6,732	2,260	336
1992	6,081	1,220	201
1993	3,662	753	205

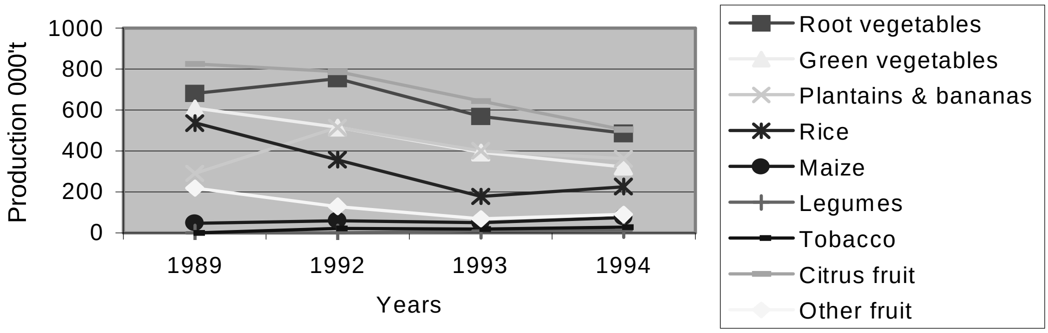
Source: CEPAL, 1997

Dairy and livestock production was also hard hit because of the loss of imported feed (Frische, 1994). For example, maize imports, largely directed for feed concentrate, fell from 720,000 t in 1989 to 95,000 t in 1991. In 1992, the country was producing 69% less pork, 89% less powdered milk and 82% fewer chickens than in 1989 (Hatchwell & Calder, 1995). National fish catches halved, decreasing from 1,071 Mt in 1986-90 to 571 Mt in 1991-95, and imports also decreased. These national catches went for national consumption, apart from lobster, shrimp and tuna, which were sold to foreign markets (including the domestic tourist market).

[32] Between 10-18% of the labour force was unemployed by 1992 due to the closure of industrial plants and exacerbated by the return of Cubans who had been posted abroad. Enrolment in school and university also decreased due to the disincentive of employment opportunities. The housing deficit increased up to 1.1 million units by 1993. Average disposable income decreased by 46% due to the increase in price of consumer goods, and the gap between highest to lowest paid worker rose at the expense of state sector workers (Mesa-Lago, 1998). During this period, several reports highlighted the hard economic times facing Cuba, and the accompanying unrest among the population (e.g. Schmid, 1991; Klepak, 1991; Robinson, 1992; Kaufman 1992).

[33] One of the few impact studies at grassroots level, undertaken in three municipalities of Cuba, estimated that supplies of fertiliser to the campesino sector were reduced by 40-50% (Deere et al., 1994).

Figure 2.4 Decline in annual production for major crops between 1989-1994



Source: Figures 1989-1996 Economic Commission for Latin America & the Caribbean, based on official Cuban statistics to 1995, in Miedema & Trinks, 1998

Impact on human health

Although Cuba was still receiving large quantities of food aid (donated or subsidised) from East European and former Soviet countries (Miedema & Trinks, 1998), in the period of 1993/94, average caloric intake dropped by as much as 30% compared to the 1980s (Rosset, 2002). Estimates of the magnitude of the decrease vary. Oliveros Blet et al. (1998) cite a drop from 2,885 kcal in 1989 to 2,310 kcal in 1994, while Figuaroa (1999) estimates an average of 2000 kcal/day between 1992-94. Mesa-Lago (1998) was less optimistic, citing a drop from 2,845 kcal/day in 1989 to 1670 between 1989-94. This figure is similar to that from the National Office for Statistics that also provides lower figures for 1994, as shown in Table 2.4. A source in the local office of the FAO showed a per capita drop of 40% in protein, 64% in fat, 67% of vitamins A and C, between 1989 and 1993 (Díaz González, 1999).

Table 2.4 Changes in the food consumption at level of macronutrients

Macronutrient	Year			Recommended level
	1989	1993	1994	
Energy (Kcal)	2,845	1,863	1,948	2400
Proteins (g)	77	46	48	72
Fats (g)	72	26	29	75
Carbohydrates (g)	-	362	370	360

Source: National Office of Statistics, 1997

During the worst years of the crisis, the main, and only, food stuffs available were sugar, rice, roots and tubers. Dogs were a visible indicator of food availability, as they lived on food waste that during this time was all used for human consumption. At this point, everyone lost weight and was malnourished, and some deaths can be directly attributed to starvation (MH/R/3). Mortality rose amongst older adults; mainly due to the lack of medicines to control chronic infections and parasitic diseases - influenza, tuberculosis, diarrhoea,[34] suicide, asthma, and heart disease. Mesa-Lago (1998) estimates a rise of 48 to 53 between 1989-93.[35] Other age groups were more resilient. The incidence of tuberculosis rose dramatically due to poor nutrition, inadequate housing and unsanitary conditions.

Vitamin deficiency was the cause of an outbreak of an eye disorder called ‘optic neuritis’ between 1993 and 1994, which affected 45,000 people (Hatchwell & Calder, 1995). About 20,000

[34] The death rate from diarrhoeal disease increased 250% between 1989 and 1994 (Moore, 1998).
[35] Yet significantly, Mesa-Lago also notes that infant mortality rates continued to decline between the same period, from 11.1 to 9.4 per 1000.

people went blind. This epidemic was attributed to the combination of an inadequate diet (specifically essential amino acids) and toxicity - possibly of cyanide from smoking – and exacerbated by weaker human states due to increased more physical activity.[36] Kirkpatrick (1996) correlates the emergence of this epidemic with the cessation, five months previously, of supplies of food and medicine from the USA Symptoms included stressed behaviour, skin rashes, and obvious weight loss, and although these symptoms were found among both rural and urban populations, campesino*s* with their own land were less affected than State farm workers.[37] The epidemic became a real national crisis and the State responded by distributing multivitamin complexes, which appeared to help bring the epidemic under control.[38]

Inevitably the Special Period had an impact on food habits. One study in a traditional district of Havana City (Nunez Gonzales & Buscaron Ochoa, 1995) compared eating habits prior to 1990 with the period 1993-94. They found that the number of people having breakfast and lunch decreased from 90% to 60%, and 83% to 58%, respectively. Almost all the population still had dinner, but snacking decreased from 64% of the sample group to 42%. Other changes included a decline in the incidence of inviting guests for meals, and in family meal reunions.

The 'parallel market' gave way, as did the networks of work cafeterias and agricultural markets. The majority of the 11,416 State establishments selling prepared food virtually disappeared between 1990-93 (Granma, 1995). In the informal and black market sectors, food prices escalated owing to the devaluation of the Cuban peso. The marketing of food products was left in the hands of Acopio and Frutas Selectas, but due to transport difficulties the food would rot before it reached the consumer (Murphy, 1999). More seriously, much of the food sent from farms never reached the market but was siphoned onto the black market (one third of food was lost this way in 1994) (Hatchwell & Calder, 1995). Incidence of theft from fields and State warehouses increased. The evolving National Food Programme became focused on achieving a minimum level of self-sufficiency, particularly of roots, tubers and vegetables. It was from this context of disaster and the need to find workable, innovative alternatives that interest in, and appreciation of, ecological practices in agriculture began to grow.

2.3.3 Summary

The review of events leading up to the collapse of the Soviet bloc provides a more nuanced understanding of Cuba's historical agricultural and food strategies, as well as the extent of impact of the crisis. On the one hand, Cuba had placed a high priority on ensuring food supply for its population, but the means by which it sourced the food was not sustainable. A large percentage was imported and was dependent on a fragile foreign exchange mechanism. The remainder was produced through a production system that was inappropriate to both the agroclimate and the internal economy. The practice of investing sugar profits into rural strengthening rather than industrial development may have proved to be both its downfall and its saving grace: there was nothing to fall back on when the sugar income failed, but it was this strong rural capacity that apparently enabled Cuba to survive and even bounce back during the 1990s.

Subsequent chapters identify and analyse the coping strategies put into place to deal with the crisis, within both the agricultural and food sectors in Cuba. They also examine the extent to which Cuba is operating an ecological production system. They are based on field research undertaken in Cuba. In order to guide this research and make sense out of and analyse the information collected, a

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[36] For more details, see Gay et al., 1994; Porrata Maury et al., 1995. A similar epidemic – combining poor health with smoking - occurred in Cuba in 1896 when Cubans were fighting for independence against Spain and the rural population was forced to move to urban areas, leading to a drop in food production. Cuban researchers had noted similar epidemics in some European countries at the end of WW2, such as the Netherlands, amongst British POWs in Japan, and in the civil war in Spain.

[37]This was one reason for the subsequent restructuring of farms, to improve nutritional supply to the rural population (MA/R/3).

[38] Though a traumatic period, the epidemic had a positive outcome in bringing together several sectors such as the Ministries of Agriculture and of Health. More standing was also accorded to the health sector (MH/R/3).

set of concepts and tools is required. The following chapter, 3, identifies and discusses generic concepts relating to ecological agriculture and food security, and proposes a framework for the subsequent analysis. Chapter 4 goes on to provide an overview of the way in which this fieldwork was undertaken.

3 FOR THE WANT OF PETROL: A FRAMEWORK FOR UNDERSTANDING CUBAN COPING STRATEGIES

"*We often persuade ourselves that everything is simpler than it actually is, dealing with complexity by presuming it does not really exist. The challenge is to deal with complexity. We can begin to take up this challenge by relying on the most valuable asset we have: our capacity for critical thinking.*"

Gareth Morgan, 1986

3.1 INTRODUCTION: FRAMING THE RESEARCH QUESTIONS

3.1.1 Ecological terminology

Cuba's crisis provides a unique example of an entire nation that has been forced to adapt to a situation of low petroleum-based inputs; one that therefore very likely had to increase its reliance on ecological strategies. The term 'ecological' has already been used in previous chapters, to avoid terms such as 'organic', 'ecological' or 'agro-ecological' that have taken on specific meanings, including sets of often contested standards, systems for certification, rural rights movements, and so on. At the onset of the study, and notwithstanding the enthusiastic reports headlined in Figure 1.1, it was not clear to what extent Cuba had actually taken a more 'organic' route in the sense of an agreed set of organic principles. One of the research issues was to examine this. For the time being, therefore, one might safely assume that the crisis had at least forced Cuba to try to restore its agriculture and food security in a severely resource-scarce situation in terms of fossil energy, chemical fertilisers, and chemical pest and disease controls. Cuba was therefore forced to develop an agriculture that implicitly included a higher incidence of alternative, ecological (organic) inputs, techniques and technologies. It may even have developed a proactive system of ecological agriculture.

3.1.2 The purpose of this chapter

Looking at Cuba's adapted agricultural system and the way it developed holds relevance from several points of view, as explained in Chapter 1. In the first place, there are no other documented examples of an ecological agriculture being taken up on a nationwide basis. Studying Cuba's experience might therefore provide insights into the types of support required to put such a system in place and maintain it, as well as into the implications for the wider food system and food security. These insights might in turn have a wider applicability for other countries. At the time of writing, the Millennium Development Goals have been given wide attention, especially the need to reduce poverty and hunger in Africa. A key point is improving the ability of African countries to feed their own people in conditions that are of necessity characterised by low external inputs. Industrialised countries also need to consider transforming their agricultures so as to reduce their reliance on fossil fuels of which reserves are limited. The case of Cuba also might shed some light on the question of whether a low-petroleum or ecological approach to agriculture is capable of meeting food security requirements, an issue which is highly contested.

The preceding chapter described the situation in Cuba leading up to and including the crisis of 1989/90. This sets the scene for continuing with the research objective set out in Chapter 1, that is:

to evaluate the implications for both the agricultural sector and the food system, of a widespread reduction in petroleum-based inputs in Cuba. Such an evaluation involves looking at the transformation in the Cuban agricultural sector over the decade of the 1990s. In order to do this, an analytical framework is required, that is, a set of concepts and tools to both guide the research and make sense of and analyse the information collected. These concepts and ideas integrate to give a meaningful interpretation of the phenomena and relationships being studied (Rap, 1997). That is the purpose of this chapter.

3.1.3 Conceptualising the research questions

This chapter provides a perspective, or conceptual framework, for analysing the type of agricultural system that is being implemented in Cuba. In setting out such a framework, the characteristics of organic and industrialised agriculture are defined, and the intermediate grey-green shades of less-industrialised and ecological approaches and transition phases similarly characterised. This will assist in defining the type of agriculture that pertains to Cuba. The crisis, and the lack of petroleum, affected not only the production system but also its institutional support, which in turn impacted back on production, whether intentional – through policy or incentives, or unintentional as institutions struggled to survive. The key characteristics of agricultural support systems, and the ways in which they may impact on production, are examined. This raises the issue of the kinds of support that might be required to more fully express an ecological production system. Finally, the third important issue for this thesis is the extent to which Cuba was able to feed its people with the low-petroleum system it had in place, and food security is examined in the light of more ecological approaches.

These issues are complex and multi-disciplinary, if not inter-disciplinary, and are dealt with in this chapter by focusing on specific sets of theoretical perspective: (1) a perspective with which to determine the kind of low-petroleum agricultural system that Cuba has developed, (2) a perspective that addresses the issue of how Cuba managed the transition and adaptation, with a focus on institutions; and (3) a perspective that allows for assessment of whether Cuba has managed to achieve an adequate food system for its people.

3.2 UNDERSTANDING THE NATURE OF A LOW-PETROLEUM-BASED AGRICULTURE (AS A BENCHMARK FOR WHAT MIGHT BE FOUND IN CUBA)

3.2.1 Fathoming organic agriculture: collective and individual perceptions

Defining organic production systems

To understand the type of agriculture that Cuba has in place, organic agriculture is taken as one end of a continuum, with industrialised agriculture as the other end. Whilst many lower-income countries already provide examples of operating in a low-input-by-default context, this study is inspired by the notion that Cuba has, by the end of the 1990s, achieved something more than this. In this thesis, the following definition of organic agriculture is used.

"*Organic agriculture is holistic production management systems which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system. Terms such as "biological" and "ecological" are also used in an effort to describe the organic system more clearly.*"

(FAO/WHO, 1999)

As an approach to farming, organic agriculture involves working with components of the farm – soil, water, plant, animal, biodiversity - as an integrated, eco-systemic whole. It seeks to adapt and enhance ecological processes by building on the principles found in nature, of diversity, adaptability and resilience, synergy, nutrient and matter recycling, regeneration and conservation of resources, and biological regulation. The concept of health is central to the complex set of relationships between soil, plant and humans, as a means to ensuring both resilience and optimal development.[39],[40] Three core management strategies, or principles, support this complex relationship (Mansvelt & Lubbe, 1999): i) maintaining semi-closed and integrated systems (including high levels of recycling of components), ii) supporting natural balance through diversity in time and space, and iii) respecting and encouraging integrity both of the organism to fulfil its inherent potential, and of man's position with respect to nature.

Organic agriculture as a philosophy and a social movement

Woodward (2001) notes that although the conceptual terms of organic agriculture came from three schools of thought[41] (the biodynamic school of Steiner, the organic-biological school of Muller and Rusch, and the organic school of Howard and Balfour), there is a central core of agreement about:

i) the concept of the farm as a living organism tending toward a closed system in respect to nutrient flows, but responsive and adapted to its own environment;
ii) the concept of soil fertility through a 'living soil' which has the capacity to influence and transmit health through the food chain to plants, animals and man;
iii) the notion that these linkages consist of a whole system within which is a dynamic yet to be understood; and
iv) the belief in science and that while these ideas might be challenging orthodox scientific thinking, they should be explored, developed and explained through appropriate scientific analysis.

These conceptual schools were all Europe-based. In Britain, the term 'organic' was coined around 1940 to describe farming systems which were dynamic, living, balanced organic wholes, in similar fashion to the traditional meaning of organic chemistry: the study of the chemistry of organisms (Conford, 2001). Other, non-European farming approaches which share similar practices and philosophies and which are included under the organic umbrella for the purpose of this thesis are agro-ecology (Gliessman, 1998), permaculture (Mollison, 1988), and natural farming (Fukuoka, 1978). Agro-ecology in particular adds strength to the organic farming concept in that it emphasises "*the application of ecological concepts and principles to the design and management of sustainable agroecosystems*." (Gliessman, 1998 p. 13). Yet as with organic agriculture, its knowledge sources are derived not only from science, but also from farmers and accumulated field experience (Kishore, 1997).

These concepts outline the basic philosophy behind organic agriculture. It has also been defined as a social movement united by basic values (Michelsen, 2001[a]; Goewie, 2004). Vogt (2000, quoted by Baars, 2001), for example, identifies at least 50 pioneers of the organic movement. These pioneers, active in the late 18th and early to mid 19th centuries, were not only involved in agriculture but also had interests in medicine, diet and food preparation, anthropology and social welfare. By

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[39] A leading organic historian, Philip Conford, puts it: "*An organic view of life implies awareness of the way in which things are interconnected, with the health of human beings and animals inseparable from the health of crops, which in turn is inseparable from the health and fertility of the soil. To extend the connections further, it follows that the health of the individual cannot be considered in isolation from the family, nor the health of the family in isolation from that of the wider community*." (2001, p. 21). Conford also stresses the precautionary principle as a key factor in decision-making around technology use.

[40] Walter-Toes et al. (2004) apply the concept of agro-ecosystems' health to capture the wider food and human health relationships.

[41] Goewie (2002[a,c]), on the other hand, characterises the value differences of four types of organic farming: biodynamic, ecological, biological and new conservation.

1972, national organic movements had come together to create an international umbrella organisation, the International Federation of Organic Agricultural Movements (IFOAM), which provides a global voice for the movement and unites over an agreed set of organic principles.

The development of market-oriented organic agriculture

Since the 198Os, organic agriculture has developed a contemporary "standards based" coping strategy in order to maintain economic viability and protect the organic identity. This market differentiation, through certification and labelling, has become almost intrinsic to the current perception of organic agriculture. For example, the FAO/WHO Codex Alimentarius Commission Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (1999) includes in its definition of organic: "*Organic production systems are based on specific and precise standards of production….*" One of the principle roles of IFOAM is the setting of these organic standards, as listed in Box 3.1.

Box 3.1 Basic Standards of the Organic Movement

- production based on cyclical principles for nutrients, energy and water
- soil fertility maintained at least after each harvest
- farming techniques should not irreversibly burden or drain the environment
- intent to produce foodstuffs with a high nutritional value
- intent for production costs to be covered by market prices
- *minimal use of fossil fuels*
- animal welfare in line with their needs and behaviours
- maintenance of an attractive landscape and natural environment in and around the farm
- farming techniques ride on the back of the principles and workings of self-organising ecosystems
- trade to be honest and fair
- intrinsic capacity of species protected so that they are able to maintain self survival
- maintain options open for the ongoing autonomous evolution of natural systems.

Source: IFOAM, 2000

These standards reflect not only agronomic but also social values (and also include attention to the use of fossil fuels). Overall, organic agriculture appears to be a form of husbandry based on a set of meta-principles concerned with systems' health, these principles resonating with schools of ecologically-oriented conceptual thought from various countries, and which are sufficiently universal to support a global, like-minded movement. The development of market-oriented organic products, backed up by organic standards and certification, has given organic agriculture a contemporary meaning.

Differing perceptions of organic agriculture

Organic agriculture is a niche activity, and the agricultural sector as a whole holds indifferent or unfavourable perceptions about it (Kinsella, 1995; Leferink et al., 1998). Popular perceptions tend to describe it in the negative – that is *"a production system which avoids or largely excludes the use of synthetic compounded fertilisers, pesticides, growth regulators and livestock feed additives"(USDA, 1980),* or instrumentally in terms of its environmental benefits (Tovey, 1997). Farmers producing organically are perceived to be doing so only because they cannot afford to purchase industrialised inputs (Ruben & Lee, 2000), and in this sense it is seen as a deficiency or lack. Michelsen (2001[b]) suggests that organic agriculture is not perceived as having a direct interest in, or ability to, produce high yields. Lampkin (1990) identifies and refutes four such misconceptions: 1) that it does not use chemicals; 2) that it simply involves substituting agrochemical inputs for organic ones; 3) that it is simply the continuance of traditional, low-yielding agriculture; 4) that it requires a complete change of lifestyle for the farmer.

Possibly the biggest variance in perception surrounds its use, or non-use, of agrochemical inputs, and this is especially significant in the Cuban context. Although organic thinking was built up around several key principles, Poincelot (1996) argues that the main divergence between sustainable and organic approaches occurs with the use of agrochemicals. Organic agriculture may be judged on its ‘chemical-free’ reputation; the presence of even naturally-occurring toxins are considered damaging to the organic image (Avery, 1998). Analysis of organic standards and recommendations shows an avoidance of most off-farm inputs where possible, whether organic or chemical. The importance lies in the degree of closure of the system. As Lampkin (1990, p. 2-3) explains: "*..organic farming is a system which seeks to avoid the direct and/or routine use of ready soluble chemicals and all biocides whether naturally occurring, nature identical, or not. Where it is necessary to use such materials or substances, then the least environmentally disruptive at both micro and macro levels are used*.".[42] Similarly, the IFOAM Basic Organic Standards (IFOAM, 1996) explain that even ”*non-synthetic mineral fertilisers and brought-in fertilisers of biological origin should be regarded as supplementary and not a replacement for nutrient cycling”*. The permaculture approach allows for the careful and appropriate use of non-biological resources under two conditions: i) that they are only used at the initial stages of a conversion; and ii) that they are used to create long-term, sustainable biological systems and an enduring physical infrastructure (Mollison, 1988).

Fathoming more deeply, the early organic movement was concerned with agrochemicals because of the mindset they represented rather than purely on their potentially toxic properties (Conford, 2001), and Woodward (1999) argues that the roots of organic agriculture came about before the use of synthetic fertilisers was large enough to become an issue. The agro-ecological movement of Latin America places more emphasis on the importance of other attributes such as land tenureship arrangements, semi-closed systems, and diversity, and its concern around agrochemicals is the degree to which farmers may become dependent on external agents (Altieri et al., 1998)[43] This idea of appropriateness in time and place is echoed within some organic development initiatives which recognise the usefulness of fast-acting agrochemicals in short-term, emergency situations (e.g. Wright & Harvey, 2005). Similarly, organic research is experimenting with the integrated use of chemical inputs where, for example, their negative effects can be disabled (e.g., Zimmer, 2000; Havinga, 2004). So while agrochemical inputs are not banned from (non-market) organic agriculture, the extent to which alternative strategies are employed is given more importance than within the rest of the sector, and underlying this are beliefs and perceptions around the impact of agrochemicals and equally around possible alternatives. If the use or non-use of agrochemicals is not such a strong determining feature of organic agriculture, then would Cuba’s scarcity of these inputs naturally imply that it is farming organically?

The other major area of difference over the nature of organic agriculture is concerned with the development of organic standards and certification. Here, perceptions and attitudes vary greatly both within and without the organic movement. Negative associations have arisen: costly organic produce is less affordable to the majority of the consumer population,[44] and the stringent production and inspection criteria may be inappropriate or too costly for the farmer.[45] This market-orientation has led to organic production being perceived as based on standards rather than principles (e.g. Sherriff & Howe, 2002), a perception especially common in lower-income regions where the organic concept has been imported as an income-generating, development initiative. In Latin America in particular, the organic model has been all but rejected as a neo-colonial strategy, in the knowledge that meeting the minimum organic standards does not necessarily mean that the

[42] The application of botanical insecticides may also have serious side effects and environmental impacts (Altieri, 1995; Pretty, 1995).

[43] “*While the definition of the agroecological approach does not exclude the use of chemical fertilisers and chemical pesticides, it argues that such chemical inputs should be used only as a last resort*.” (Pinstrup-Anderson et al., 1999, p.25).

[44] Under current market conditions, organic food costs approximately 20-50% more than non-organic, arguably prohibiting access by the poor.

[45] Given that organic philosophy is concerned with societal health (e.g. see the concerns of Picton (1943) over the rural and urban poor), this current market situation sits incongruently and may be seen as a temporary coping strategy to uphold organic values in the 20th and 21st century industrialised food system (Michelsen, 2001a).

full agro-ecological potential has been achieved.[46] For these regions, the alternatively named agro-ecology is promoted, and from the Latin American perspective is seen primarily as a social movement: "*Agroecology is the eco-management of natural resources through collective social action which provides an alternative to the crisis of modernity*." (Sevilla, 2004). Meanwhile the debate within the organic movement about the relationship between principles and standards continues (e.g., this issue was up for discussion at two consecutive Biofach congress meetings in 2003 and 2004).

Perceptions as affecting the choice of farming approach

Therefore, organic agriculture as a farming approach is both rejected and accepted based on the interpretation or perception held. Cuban farmers, scientists and policy makers have had to make decisions around a situation of low-chemical-input availability. They may have been influenced by, or share similar views to, the Latin American tendency toward agro-ecology. At least, it is likely that varying perceptions are held, and these may have influenced the degree of uptake of organic, or ecological, production methods in Cuba. To start with, this indicates that individual and collective perceptions are important factors for analysing the decisions behind the support for, and practise of, the mainstream agricultural production system in Cuba.

The idea that people have differing perceptions rests in the concept of constructivism. Rather than there being one given reality (the realist-positivist perspective), each person, or group, constructs, and continually reconstructs, its own reality (Kloppenburg, 1991). Such construction is based on sense-making processes: a set of cognitive values, beliefs, perceptions and accrued experiences, and it is these with which the individual, or group, observes, understands and learns (Kolb, 1984).[47] So although from a positivist perspective there is a given form of mainstream production in Cuba, it is these constructed realities that explain why this approach is chosen and sustained, and which also, therefore, hold the key to change.

3.2.2 Industrialised agriculture and triggers for change

The organic antithesis: industrialised agriculture

Notwithstanding that traditional, nature-based forms of agriculture have been ubiquitous since the emergence of agrarian communities, a more clearly defined organic agriculture, and the organic movement, emerged as a coherent entity once a sizeable alternative had presented itself. In the case of Europe, for example, this emergence was in response to the industrialised production of chemical fertilisers[48] and the rapid spread of urbanisation in the nineteenth century (Conford, 2001).[49] Because this new, non-conventional form of agriculture came of age with the Industrial Revolution and the technological possibilities emerging therefrom, because it was based on the Revolution's underlying concepts of standardised, mass production and consumption, capital accumulation, and reliance on large amounts of fossil energy and industrially produced inputs, so it was termed industrialised (Kaltoft, 2001). Box 3.2 provides a definition.

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[46] Studies show a wide variance in the way in which organic farms operate, some more 'industrialised' than others (Hall & Mogyorody, 2001).

[47] There is some difference of opinion over attributing individual characteristics to the collective. Parson & Clark (1995) note that collective learning may be autonomous and irreducible to individuals; whereas Wertsch (1991) argues that there is such close interaction between social environment and individual learning as to make them jointly determined. The actual process may lie somewhere between this.

[48] Based on the chemist von Liebig's rejection of humus in favour of the use of chemical components as a plant growth medium (Conford, 2001).

[49] Specifically for Britain, major triggers were the Repeal of the Corn Laws in 1846 which pushed through free trade and a decline in British agriculture, and the post-World War Two drive for mass food production and related consumerism (Conford, 2001).

Box 3.2 Definition of industrialised agriculture

The dominant agricultural approach of the twentieth century in industrialised countries relies upon manufactured pest and disease controls and fertilisers, and emphasises maximising production through simplification, the use of external technologies, and minimising labour requirements (Pretty, 1998[a]). Goewie (2002[b]) classifies mainstream, intensive and conventional agriculture within this industrialised group, and also suggests integrated, precision, high-tech and certain sustainable definitions as falling within it. An industrialised production system is associated with socio-economic issues of external dependency, long marketing chains, cost externalisations, and free-market principles as a driving force. Guiding and driving all this is a particular set of attitudes and perspectives surrounding agriculture, such as the belief that mankind can break free from and take control over the natural environment and natural processes, and that this is a positive step. The development of GM crops is a contemporary example of this belief.

The organic movement grew in opposition to the industrialised approach, with several key areas of disagreement ranging from farm level natural resource management to the economic regime.[50] The industrialised model – of competitive yield maximisation over the short-term, was held as incompatible with the organic model of collaborative optimisation of outputs and synergies over the long term. Table 3.1 lists the principle characteristics of an organic compared to an industrialised farming system. An important underlying difference stressed by other authors is that industrialised agriculture is based on reductionism and mechanistic thinking, while organic agriculture is based on holism and systems thinking (Capra, 1997; Smeding, 2000; Mäder et al., 2002).

Table 3.1 Comparison of characteristics between organic and industrialised farming systems

Organic farming system	Industrialised farming system
Emphasis on ecological soundness. Observation intensive, responding to environmental feedback. Technology intensive. Can be highly productive. Focus on the whole farm. Emphasis on resource development and use of natural processes. Relies on local application of principles. Requires the farmer to be an expert. Requires multi-level management and adaptive management of dynamic environment.	Emphasis on economic profitability. Self-referential practice. Technology intensive. Assumed as usually highly productive. Focus on component technologies. Emphasis on use of inputs and suppression of natural processes. Relies on widespread adoption of uniform technologies. Requires the farmer to use other people's expertise. Requires farm-level management and ecosystem control to reach specific goal.

Source: Röling & Jiggins, 1998

Triggering alternatives to the mainstream

A major, and similar, trigger for stimulating an alternative, organic or ecological agriculture in other parts of the world has been the experience of certain negative impacts of Green Revolution technologies,[51] such as in parts of India (see for example Sinha, 1997; Shiva, 2001).[52] In these less-industrialised countries, the socio-economic inconsistency of industrialised agriculture with local,

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[50] For example, over the degenerative effects on human health (McCarrison, 1945; Wrench, 1972); the loss of rural community and rural unemployment (Hyems, 1952); the loss of soil humus, soil life, and the recapturing and recycling of nutrients (Balfour, 1943; Howard, 1940), the loss of biodiversity and variety (Stapleton, 1943); and the danger in substituting new scientific findings for accumulated experience and ecological principles (Massingham, 1942; Stapleton, 1943).

[51] Negative impacts of Green Revolution technologies, identified by Hazell (1995) include the destruction of beneficial insects, waterlogging and salinisation of irrigated land, pollution of groundwater and rivers, poisoning of farm workers, and excessive dependency on a few improved crop varieties.

[52] Sinha (1997) describes how, in India, the realisation of the destruction of the agroecosystem by Green Revolution techniques has led farmers and scientists to develop alternatives – "*perhaps a non-chemical agriculture*" which includes the reviving of traditional techniques and identifying cheaper and ecologically safer alternatives to agrochemicals, such as biofertilisers and biocontrols, sewage farming and saline agriculture, and systems which produce more nutritious foods with shorter harvest cycles. However, the author notes that "*farm and food policy in India has to change its outlook before there can be a second green revolution*".

community-based systems is perhaps more pronounced than for industrialised countries (Crucefix, 1998; Bakker, 2003). Other driving forces, or triggers, of change are for commercial, health, quality of life, environmental,[53] religious, philosophical or moral reasons, and are seen as much in less-industrialised countries as in industrialised (Fernandes et al., 1997; Merlo, 1997; Harris, 1998; Anandkumar, 1998; Hall & Mogyorody, 2001). Unifying these cases is a conscious decision to turn away from one approach, and toward another.[54]

Cuban agriculture, on the other hand, had operated on an industrialised basis since the large-scale *latifundio* system of sugar and cattle production established in the early 20th century, and this system had only intensified further with the Revolution of 1959. Although, as noted in Chapter 2, there had been some concern over the negative environmental and productivity impacts of this approach toward the late 1980s, no obvious attempt had been made by the State to choose an alternative approach prior to the crisis. Therefore, any major change in the 1990s was likely to be, at least at first, 'by default' - out of survival necessity rather than through a conscious choice, and this may have strong implications for the experiences encountered by the Cuban agricultural sector.

3.2.3 Searching for ecological agriculture

Other alternatives to industrialised agriculture

These debates are somewhat polarised. Aside from standards-based organic agriculture, and agribusiness or Green-Revolution driven industrialised agriculture, lie more moderate approaches and opinions, and shared husbandry techniques. For example, a raft of non-organic, alternative production approaches exist. The most common ones are some forms of sustainable agriculture, low-input agriculture, integrated agriculture (including Integrated Pest(icide) Management IPM), conservation farming, and, more recently, eco-agriculture. Could these be termed ecological? These approaches have less clear, more subjective boundaries as to the degree of industrialised techniques and technologies they employ; often being defined in relation to something else, or a lack of something, rather than by their own, positive principles and attributes.[55] This lack of clarity neither encourages the farmer (or researcher) to seek alternative approaches nor indicates to the consumer the quality of produce, and may equally include industrialised technologies (such as in the case of IPM and eco-agriculture). The use of the word 'input' is ambiguous, in that agrochemicals, knowledge, seeds and compost are all inputs. Finally, Pretty (1995) and Dovers & Handmer (1992) argue that, for these types of integrated and low-input agriculture, the lack of clear consensus over definitions and objectives means that little concerted action can be taken over policy support.

When is less-industrialised not ecological?

Although these alternatives to industrialised agriculture may not be classified as organic, any one or more of them may be operating in Cuba. In terms of process, they are a move away from industrialised. Here it is argued that they are not necessarily ecological if they do not confirm a greater reliance on ecological principles or the intent for such. That is to say, for example, that a *knowledge-poor*, low-external-input system which continues by the large to degrade may not be ecological. Similarly, an Integrated Pesticide Management system which could, all else being equal, use more biological controls but *chooses* not to, may neither be ecological. In this sense, the presence of ecological farming practices may be a move away from industrialised, but knowledge and intent are key to identifying ecological agriculture as a whole farming approach. This is

[53] Arising from Africa and Asia is a long history of concern over the impact of agricultural technology on the environment, rooted in the colonial administration, and these legacies have pervaded many organic initiatives, e.g., Anderson, 1984; Beinart, 1984; Anderson & Grove, 1987; Blaikie, 1989; Ellis, 1994; Neumann, 1997; Salih, 1999.
[54] Making such a conscious decision may also signify the turning point between traditional and ecological agriculture; the former being 'by default' and the latter being intentional.
[55] For example, McNeeley & Scherr (2001) define eco-agriculture in terms of its low level of damage to the environment.

important in determining both the nature and direction of agriculture, as well as in planning and organising a joined-up agricultural sector. Following this, four statements may be made concerning this enquiry into the nature of a petroleum-scarce agriculture in Cuba:

In Cuba we would expect to find: a less industrialised agriculture.
In Cuba we are likely to find: an increase in use of ecological inputs, techniques and technologies
In Cuba we may also find: a relatively greater reliance on ecological principles and knowledge.
In Cuba we might even find: an intentional, mainstream process of conscious action in an ecological direction.

Hence we begin to see a difference between a petroleum-scarce and a post-petroleum agriculture.

3.3 TRANSITION STAGES BETWEEN INDUSTRIALISED AND ECOLOGICAL FARMING SYSTEMS

3.3.1 Transition processes

In examining the agricultural system that has emerged in Cuba as an adaptation to the crisis, there are diverse but specific criteria that help to identify the extent of change and the type of mainstream farming in operation. Even for ecological farming, which by its nature has less of a set template but rather is a continual learning process, there are agreed principles as well as some characteristic practices. By extrapolating from studies on local and regional ecological farming systems already in place, and on the transition process involved, we can identify what might be seen in Cuba.

Ecological production systems differ from industrialised not only in terms of their technical management of natural resources (Pretty, 1995), but the whole land use system alters. Of critical importance is that the knowledge base also changes, from the use of generalised and widely applicable ‘solutions’ to locally and contextually specific ones that draw on local resources. Overall, the farming system would change dramatically, and evidence suggests no overwhelming technical problem to this (Woodward, 1996).

3.3.2 Steps and stages of a transition

A number of empirically-based transition models have been proposed for categorising the series of steps or phases of a transition (Mollison; 1988; MacCrae et al., 1990; Altieri, 1995, 1998; Pretty, 1998[a]), and Cuba may be at one of these phases. Table 3.2 compares these different models. Two major steps are common to all these models: 1) reducing the intensity of industrialised agriculture through rationalisation; and subsequently or simultaneously 2) a substitution by ecological inputs and techniques. Three of the models define a final phase of redesign which entails an emphasis on working with natural systems and processes over input use, while Pretty's model instead 'hands over' the design to communities. McRae et al. stress that only the final phase, with its site- and time- specific design and management approach, will avoid the current problems in agriculture, but they suggest that the earlier stages are cheaper to implement and so more popular with policy makers. McRae et al. and Mollison see an organic-type of approach as being the final stage, while Altieri, of the Latin American school, associates organic with substitution rather than redesign, and Pretty prioritises social demands over specific farming techniques for the final stage. The time frame for the transition period varies between 1 and 8 years.

Table 3.2. Comparison of models of the transition phase between industrialised and ecological agriculture

Approach	Steps toward ecological agriculture			
Mollison (1988)	**Year 1: Contemporary/western agriculture**	**Year 4: Transitional and conservation farming** The focus for change is on costings.	**Year 8[1]: Permaculture** 70% crop land to forage farming. Animal forage grains replaced with tree crops, forest cover increased, low or no tillage methods adopted, some/all fuel produced on farm.	
MacRae et al. (1990)	**Step 1: Increased efficiency** Conventional (monoculture). External solutions to internal problems; emphasis on compartmentalisation and control; single short-term, biochemical imported curative solutions to local problems. Includes precision agriculture and IPM.	**Step 2: Substitution** Low input and sustainable agriculture, eco-agriculture. Efficiency increased to reduce inputs and wastes, and then substitution by benign inputs. Includes LEISA techniques and IPM.	**Step 3: Benign design and management** Regenerative, organic, biological, biodynamic, ecological, permaculture, bioregionalism, natural. Internal solutions to internal problems, integration, balance, response to feedback, complex, long-term local approaches to global problems.	
Altieri (1995, 1998)	**Phase 1: Input withdrawal** Conventional agriculture. Progressive chemical withdrawal. Biodiversity increases. Productivity declines.	**Phase 2: Efficient input use** Conventional agriculture. Rationalisation of agrochemical use through IPM and INM. Biodiversity increases. Productivity declines.	**Phase 3: Input substitution** Organic agriculture. Using alternative, low-energy inputs. Biodiversity increases. Productivity low.	**Phase 4: System redesign[2]** Agro-ecological. Diversified farming systems with optimal crop/livestock ratios to encourage synergism so that the system supports its own soil fertility, natural pest regulation, and crop productivity. Biodiversity and productivity increase.
Pretty (1998[a])	**Step 0: Conventional modern farming** Industrialised agriculture. Damage to environment, human health, loss of biodiversity and landscapes, loss of jobs and farms, decreased social capital.	**Step 1: Improved economic and environmental efficiency** Adoption of information-intensive technologies and practices for precision farming. Production costs fall.	**Step 2: Integrating regenerative technologies** Incorporation of regenerative technologies. Labour demand increases. Some conventional technologies dropped.	**Step 3: Redesign with communities.** Centred on community economic and social activities, with sustainability as an emergent property of such. Regenerated natural and social capital. Bioregional development. Requires institutional reform and supportive policies.

[1] The changeover could, however, be done in a minimum of three years. [2] Here the transition from phase 1 to phase 4 could take between 1-5 years.

In terms of managing the transition, Pretty (1998[a]) suggests that a change in behaviour and practice may pre-empt a change in attitude, a view supported by empirical evidence of Hall & Mogyorody (2001).[56] By contrast, Lampkin (1990) and Goewie (2002[a]) identify a change of attitude as being a crucial prerequisite to a change of practice. All these transition models assume some degree of intent. In Cuba, this was, at least initially, not the case.

3.3.3 Characteristics of transition at farm level

At the farm level, research suggests that the adoption of ecological techniques is likely to imply changes in three main areas: land use, agronomic techniques, and human resources. Stocking rates would be lower, and land currently put to meat and dairy production would need to be freed-up for other uses (Warkentin & Gertler, 1977; Harnapp, 1988). In terms of land use, large-scale mono-cropping would decrease, with a corresponding increase in mixed farms and mixed cropping practices, although ecological farming may also involve a mutually beneficial exchange of resources between neighbouring, specialised crop and livestock enterprises (van Keulen et al., 1998). The area of cereals, oilseeds and silage crops may be reduced, whilst that for leys, fodder crops, vegetables, potatoes and pulses may be larger (Offermann & Nieberg, 2000). Average size of land holding would decrease, given the biophysical limitations on the capacity to expand and specialise (Cambell & Coombes, 1999).

Box 3.3 Key characteristics of an ecological farming transition

- increase in production of vegetable protein and decrease in animal protein
- increase in land put to legume and green manure crops, and decrease in pastures and grazing
- reduce or eliminate external inputs of chemical fertilisers and pesticides, and significantly decrease feed concentrate
- increase in mixed farming and mixed cropping
- wide knowledge base in local ecology, biology and environment
- reliance on and increase in observation, understanding and good management practices
- control by prevention rather than cure
- increase in labour requirements
- increase in use of enhanced traditional techniques and local knowledge
- increase in local innovation
- production principles based on spatial and temporal diversity, optimal use of space and resources, water conservation, control of succession and protection of crops
- presence of wild areas
- internal combination of production and consumption activities
- productivity optimised in the long-term rather than maximised in the short-term
- use and re-use of local resources
- value placed on total farming system production rather than yield of one commodity
- informed use of modern scientific knowledge and appropriate technologies
- specific avoidance or absence of techniques which cause imbalance, destroy or alter life forms, deplete resources or work against natural principles (such as genetically engineered organisms, soil-compacting machinery, intensive monoculture, intensive irrigation and groundwater use, use of dead livestock in feed rations).

Source: Mollison, 1988; Sattler & Wistinghausen, 1992; Altieri, 1995; IFOAM, 1996

Changes in agronomic techniques would include the elimination of chemical use, the use of regionally-bred and adapted varieties and breeds with more in-built resistance, a focus on rainwater and run-off capture rather than groundwater exploitation, and a generally more diversified and

[56] These models are based on a transition in a non-market oriented scenario. In the case of a managed transition to certified organic production, organic regulations provide directional guidelines within a specific timeframe. In this case, the rationalisation of industrialised agriculture may be bypassed, while the further reaches of the final systems redesign phase would not be required for certification purposes.

complex production system (McRae et al., 1990). Human resource requirements are estimated to increase by approximately 20%, although this estimate includes labour for on-farm processing and direct marketing and is based on a temperate European context (Offermann & Nieberg, 2000). Farmers practising ecological agriculture would have to substitute knowledge, labour and management skills to make up for the foregone added value of external inputs (NAS, 1989; Pretty, 1995), and would require greater flexibility to apply principles to their own location-specific situation. Box 3.3 summarises the main characteristics of an ecological farming system.

3.4 CHARACTERISTICS OF INSTITUTIONAL SUPPORT SYSTEMS

"*Facts and actors as such in the affairs of life mean precisely nothing; it is their mass interrelationships and interactions that mean everything.*"

Sir George Stapleton, 1956 (cited in Conford, 1998, p. 197)

3.4.1 Understanding the factors and actors involved in institutional support

Even in post-crisis Cuba, its production system is a factor not only of the external impacts resulting from the crisis, but also, as we have seen earlier, of individual and collective perceptions, and of its institutional support system. The categorisation of more or less petroleum-dependent farming approaches drew on a relatively well-developed body of knowledge on farm-level transition. What has been less fully explored is the way in which such farming systems would be institutionally supported – by government policy, by research, by extension services, by the private sector, and by markets. Farmers occupy the key position of having the primary relationship with the natural resource base, and the way in which they engage with these supports is also crucial. If the structure of agriculture is changed, or is to change, significantly, this has huge implications for the human networks that exist around agriculture, and implies some major changes in extension, research, and the policy environment (Röling & Wagemakers, 1998).[57]

The previous section has already identified two key factors for ecological systems as being knowledge and intent, and this section takes these two factors as entry points into understanding institutional support systems. It then goes on to consider institutional mechanisms and processes for coping with, and adapting to, external pressures for agricultural change. Finally, it pulls these issues together by defining a framework for structuring and analysing the institutional factor and actors in Cuba.

3.4.2 The role of knowledge in agriculture

From transfer of technology to knowledge systems

Farming communities, for centuries, largely operated their own, localised support systems, involving interchange of knowledge, goods and services, with low-bulk, high-interest items – such as seeds - being transported and traded over larger distances. With the onset of industrialisation - of agriculture and transport - these inputs became externalised and farmers were perceived as recipients or clients. The emerging support system tended to be technically focused and linear in operation, with technology being developed and then transferred to the farmers. Over the last three decades has grown the realisation that farmers may have something to contribute, and with this the growing concept of more complex support systems, feedback mechanisms and networks. Within this framework, knowledge is given high priority as a key tool for farmers to better manage their own agro-ecosystems and especially to reduce or replace external inputs, and so such frameworks have been termed Agricultural Knowledge Systems (AKS).

[57] Ter Weel & van der Wulp (1999) argue that such changes are necessary for a raft of alternative farming approaches, including, but not only, ecological.

The earlier focus on the linear transfer of technology has therefore given way a systems perspective that emphasises the emergence of agricultural development from the interaction of key parties or stakeholders in the system (Röling & Engel, 1991). This system must implicitly involve a learning process of subjective human enquiry, as stakeholders or actors deal with each other's different outlooks, agree on problems, become more aware of the system and how they fit into it, and move toward the objectives. This institutional support model, the AKS, has developed to include a wide range of actors and linkages within the agricultural sector and has been extended to include to stakeholders in the agro-food chain (OECD, 2000).

Section 3.3 identified the importance of both knowledge and intent in contributing to the development of ecological farming systems. Supporting evidence from research into institutional knowledge systems highlights the importance of facilitation of learning, of the presence of supportive institutions, and of conducive policy as decisive factors in the adoption of sustainable farming practices (Engel et al., 1990; Bawden & Macadam, 1991; Van de Fliert, 1993). Röling & Jiggins (1998) have proposed an Ecological Knowledge System (EKS) as a purposeful (intentional) learning perspective for helping farmers and other land users to increase their expertise in the sustainable management of complex ecosystems. More recent application of the EKS concept (by Steins, 1999; de Boef, 2000) indicate that the EKS is useful as a tool to enhance ecological sustainability. In this sense, not only the presence of knowledge, but also the learning process and purposeful support of this, is important.

Knowledge as supporting agriculture

"*You don't need to be a weatherman to know which way the wind blows.*"

Bob Dylan

Within the EKS framework, an issue of concern is the type of knowledge appropriate for ecological agriculture. Section 3.2 has already hinted at a different knowledge base. Industrialised agricultural knowledge looks to science as the source, which historically has followed a positivist-reductionist approach. Thus investigation requires breaking down a complex issue and examining the discrete components in isolation (Röling, 1996; Wolfert, 2002). Industrialised or mainstream science is concerned with knowledge that has been provided by controlled and repeatable experiments, and causal relations between action and reaction. Research concerning sustainable production systems may not dwell comfortably within this, as such systems are based on process indicators such as nutrient and energy cycles, decomposition and succession. Further, discrete components are influenced by being removed from their whole. Research on indigenous AKS and EKS (for example, Biggs & Clay, 1981; Richards, 1985; Warren et al., 1989; Woodley, 1991; Thapa, 1995) have identified how they differ from formal agricultural science in that they concentrate on continual adaptation of knowledge and are less formal in terms of both their social organisation and its research methods. Farmers have been found to hold sufficient ecological knowledge to develop technological responses where formal science has been unsuccessful, and because of the nature of the knowledge, its understanding requires a participatory approach by external agents.

In this sense, ecological knowledge arises and is driven not only by formal science study, but through the use of cognitive, intuitive and experiential learning from inter-actions with the natural world (Goewie, 2002[a]; Wright, 2004). The acquisition of this knowledge has been termed ecological literacy (Pretty, 2002). Orr (1996) defines ecological literacy such "*We take the idea of literacy a step further, intending not only an understanding of the language of the environment, but also its grammar, literature and rhetoric*." Factors important for the agricultural knowledge base in Cuba may therefore include not only scientific perspectives, but also levels of participation, and the degree to which decisions are based on non-formal knowledge.

3.4.3 Institutional factors influencing agricultural change

Institutions as supporting farmers

Institutional support for agriculture is a complex field and one that is frequently overlooked in free-market economies; the institutional purpose or intent being not so much to support specific farming approaches as specific market orientation. Institutions in the sense of this thesis are not only the buildings and staff, but also the "*humanly devised boundaries or rules that structure human interaction or activities*" (de Boef, 2000). That is, agricultural systems are embedded in a complex network of institutions that include marketing chains, insurance, land tenure and land development, water management, financing, advice, learning and expertise development, legal structures, political representation, and so on. Yet one reason why it is hard to make changes is that this huge institutional support system, which provides employment far in excess of the number of primary producers, lives by the continuation of the underlying farming structure (MacRae et al., 1993).[58] This is not to say that change in farming approach would necessarily involve less complexity, but that its institutional structure and composition may change, requiring different sets of skills, relationships and, possibly, decision bases. In order to understand the changes in institutional support that accompanied, and were involved in coping with, Cuba's agricultural response to the crisis, changes in two areas will have affected the degree to which they can usefully support farmers.

1) Mechanisms for mutual engagement. A key ingredient is the extent to which an institution is able to socially engage. That a large part of public agricultural research is spent on sustaining the researchers themselves and on semi-privatised research organisations, sometimes loses sight of the principle objective of benefiting farmers (McRae et al., 1990). Another part of the reason for this self-serving nature of agricultural research is that farmers have not developed an effective demand for research services. So one aspect of institutional support is the extent to which public agricultural organisations and farmers actually engage with each other. Within this is the system of internal incentives, whereby public agricultural organisations such as research are rewarded for things that have nothing to do with their outward contribution. Typical is the reward for publications in refereed journals read by a small number of peers, while farmers are not exposed to these results nor benefit from the research. In order to change this, incentive systems need to support linkages between institutions and their client groups. In Cuba, this would mean the extent to which alternative approaches have become embedded in appropriate and supportive institutions. It would also cover the level of participation within the research sector, and the extent to which farmers may have gained more influence as a result of the crisis.

2) Overall co-ordination mechanisms. In terms of making institutional arrangements for motivating or driving the system, the literature distinguishes three approaches: coercive (regulation), calculative (market) and collaborative (social interaction) (Smith, 1989). Regulation involves a central power that regulates, invests in projects, creates infrastructure, and so on (Van Woerkum & Aarts, 1998). Markets emphasise the voluntary exchange of values by which problems are solved and mutual interests taken care of (Goldblatt, 1996), and includes other farmer incentives and disincentives. Social interaction involves negotiation and agreement on concerted action, with institutions and rules emerging from this (Maarleveld, 2003). Most agri-institutional systems are mixes of these three co-ordination mechanisms (Hood, 1998), with a strong emphasis on markets in industrialised countries. This market orientation puts downward pressure on prices (a price squeeze) in most industrialised agricultural systems and is a key mover of innovation. However, it also serves to externalise the costs of a so-called more efficient agriculture and pushes less competitive farmers out of business. This 'treadmill effect' (Cochrane, 1958; Rőling, 2002), of compete-or-crumble, is a

[58] McRae et al. (1990) point out that particularly when there is no proactive political objective to promote ecological agriculture, decision makers tend to postpone action until there is either overwhelming scientific data to support such or overwhelming negative effects of the prolonged inaction.

driving institution of industrialised agriculture. Prior to 1989, Cuba eschewed market mechanisms; farmers were obliged to sell their produce at a fixed price to the State. The crisis may have forced the government to give farmers more of a stake in the system, to reward them for their contribution to food security, and it may have used market mechanisms to support this. In this sense, the overall co-ordination approach may have changed post-crisis, and this will have had implications for production.

Purposeful support for ecological agriculture

Several authors have suggested policy, research, extension and learning support mechanisms which may be conducive for ecological agriculture, all relating to regulatory and market mechanisms, and with significant changes required in terms of mutual engagement (Biggs, 1989; McRae et al., 1990; Pretty, 1998; Mansvelt & Lubbe, 1999). Key characteristics of an ecological support system are listed in Box 3.4.

Box 3.4 Key characteristics of an ecological support system

- location-specific management and policies
- increase in participatory extension methods and other mechanisms for social engagement
- focus on knowledge and learning over technology diffusion
- focus on managing agro-ecosystems instead of on add-on component technologies
- institutional decentralisation
- tendency away from free-market as the dominant co-ordination approach
- policy/regulatory support for alternative practices, and reduced support for industrialised practices
- application of holistic and systems principles
- inclusion of indigenous and informal knowledge bases in decision making

3.4.4 Institutional coping and learning strategies

From the above, it is clear that the crisis in Cuba must have instigated some degree of institutional change in order to cope with, and possibly stabilise, the situation. Institutions were impacted by the crisis and this impacted farming strategies. Coping, the process through which actors make relevant adaptations to the environment as they perceive it, may be passive, active or creative (Huang, 1998). Thus, coping with the crisis might mean ignoring it or shutting down, or at the other extreme, completely reorganising the whole system. The knowledge systems perspective has put forward learning as a crucial factor for change, and the degree of learning will influence the ways in which institutions were able to usefully support farmers, for example, the degree to which ecological farming became institutionally embedded or whether it was simply treated as a short-term coping strategy. Similarly, if the co-ordination of agriculture became more incentives- and market-driven, this may trigger learning over a readjustment of ideological perspective in socialist Cuba.

Learning itself is a series of iterative cycles in which the learning entity and its environment are linked through a process that combines cognitive and behavioural processes such as perception, reflection, intentionality, and action (Maarleveld, 2003). For example, the common learning cycles of March and Olson (1976) and Kolb (1984), comprise a (non-linear) process of observation (experiencing), understanding what has been observed, thinking/reflection on this, and experimental action. In this way, environmental occurrences – such as the crisis - affect individual and institutional cognition and agency, and this goes on to determine choices – such as farming strategies, which in turn have environmental consequences which feedback to the individual and institution. This learning cycle provides a model for the dynamics between individuals, institutions and their environment.

This learning may bring change in existing rules, such as the application of alternative production practices. When a system experiences a more dramatic problem, as happened in Cuba, then held theories and beliefs may need to be revised and other theories brought into use instead. This means a more fundamental reconceptualising of goals, perceptions and relationships that is undertaken through a second learning loop (Argyris & Schon, 1978; Argyris & Schon, 1996). It is here that beliefs and goals concerning the terms of mutual engagement in agriculture may be more fundamentally changed. Triple loop learning occurs when the essential principles on which the organisation is based come under discussion and occurs over a longer time period. This triple loop may, for example, entail an ideological change to a more adaptive institutional management approach (Holling, 1995). Swieringa & Wierdsma (1992) describe the organisational results of these single, double or triple learning loops as improvement, renewal and development respectively, and in this sense a correlation can be seen with the agricultural transition process described in Table 3.2.

3.4.5 An institutional framework: from learning to livelihood systems

The rural livelihoods framework

As discussed, the production system in Cuba is a factor of the external impacts resulting from the crisis, of individual and collective perceptions and coping strategies, and of the mechanisms of the institutional support system. A framework that embraces this, which purposefully seeks to capture the dynamics of rural production and to identify adaptive and coping strategies in times of crisis is the Rural Livelihoods Framework (RLF). The RLF is similar to the EKS in its concern with linkages, interactions, influences and processes, yet it also embraces the wider external influences, the factors internal to the individual or group, and the possible entry points for reform through policy and institutional change (Kaag et al., 2004).

The rural livelihoods concept takes as its point of departure that livelihoods involve more than the one- or two-way exchange and use of resources, including knowledge, but that other influential factors are involved. In doing so, recognises the centrality of actors' cognitive factors - such as interests, interpretations, experiences and knowledge (Arce & Hebinck, 2002). This is described by Long (2001) as agency: *"The notion of agency attributes to the individual actor the capacity to process social experience and to devise ways of coping with life, even under the most extreme forms of coercion. Within the limits of information, uncertainty and other constraints (i.e. physical, normative or politico-economic) that exist, social actors possess 'knowledgeability' and 'capability'. They attempt to solve problems, learn how to intervene in the flow of social events around them, and to a degree they monitor their own actions, observing how others react to their behaviour and taking note of the various contingent circumstances."* (Long, 2001, p.16). Long (2001, p.6) also notes that it is not only single individuals who have agency but also groups of actors and organisations.[59] Using this perspective, we can the extent to which change was brought about by external circumstances, and the degree to which actors took a role in change.

Modifying the RLF for the Cuban case

Some modification of the standard RLF framework (Scoones, 1998; Kanya, 2000; DFID, 2001) was required for this study,[60] in order focus on the overall context and vulnerability of the rural agricultural sector in Cuba, on farmers' livelihood assets, agency and strategies, the institutional structures, processes and agency, and the outcomes in relation to production strategies. The concept of the agricultural knowledge system remains an inherent part of this framework. Figure 3.1 shows the modified rural livelihoods model as the main theoretical framework of this thesis.

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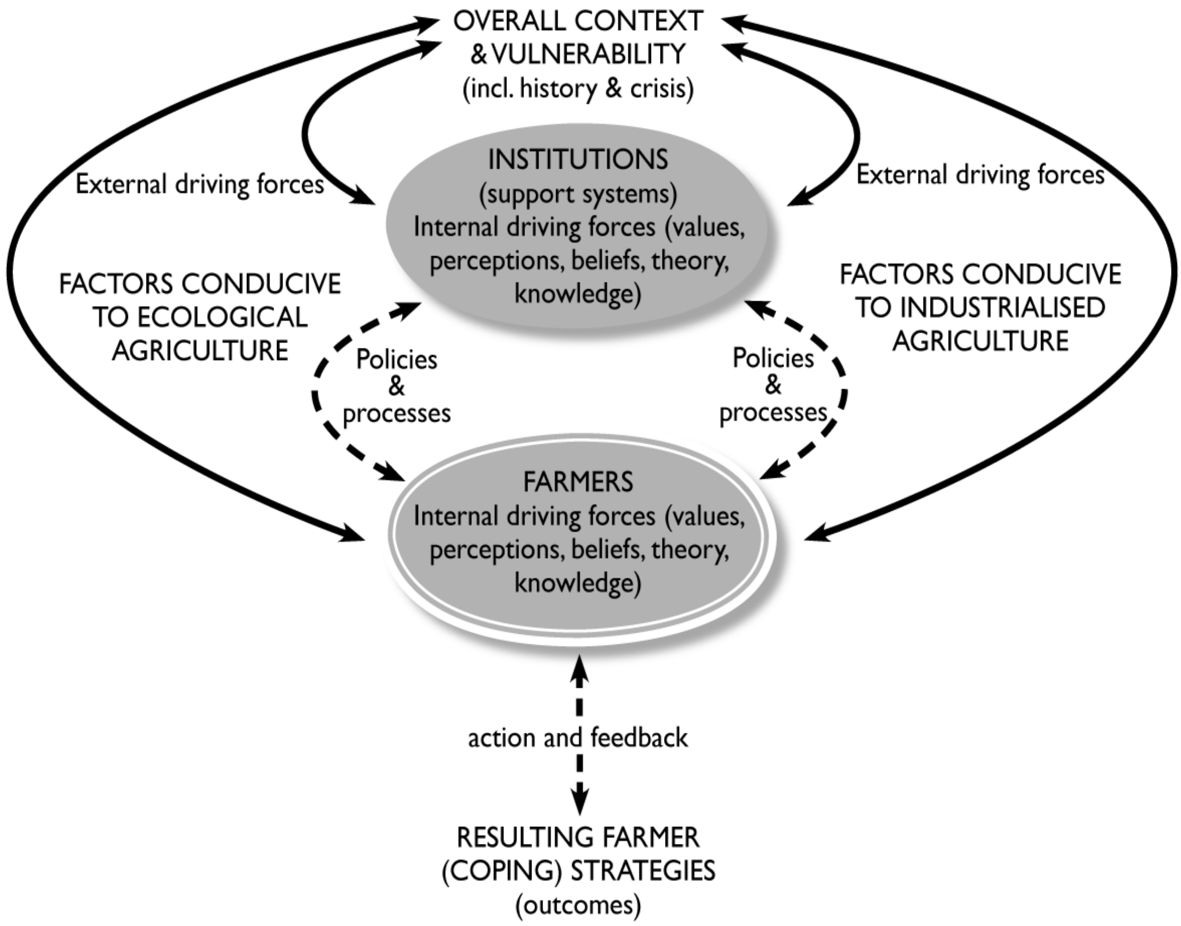
[59] When it comes to cognitive processes and decision-making, Hutchins (1995) argues that individual cognition is a cultural process which is part of a larger system, but that because of our fixed perceptions of individual human boundaries we mistake "*the properties of complex socio-cultural systems for the properties of individual minds*" (p. 355).

[60] This RLF framework not originally considered useful in the Cuban situation, largely because of the unique political context whereby the State is in control of specific forms of capital and where the farmers are (or were) not seen as decision-makers. It was only taken up after an initial field visit confirmed its utility once some adaptations had been made.

Figure 3.1 The dynamics of rural livelihood interactions and their driving forces as a theoretical framework for this thesis



The first modification was that the core focus of the normative model - the household – was replaced by individual actors or groups of actors. This is because the focus of this study was not on individual farming families but on farmers working as part of co-operatives within a type of 'collective household'. The second modification was that the notion of the individual applies not only to farmers but also to other actors in the framework, such as researchers, ministry representatives, and so on, with each actor or group having his, her or its own set of assets, structures, influencing contexts, and weaknesses. Cuba's centralised system means that farmers in Cuba do not hold the same degree of individual decision-making power over their production strategies as do farmers in most other countries. Therefore the study examined the emergent strategies and outcomes as a function of interactions between all actors, rather than just the farmers.

Third, whereas the normative RLF model places market and other economic trends within a general context of vulnerability, an ecological agriculture would not necessarily imply that co-ordination through markets was the main driving force, nor that agriculture can be properly represented as a simple exploitation of natural resources. Such trends may instead be regarded as outcomes of organisational processes, differentiated from biophysical contexts. This adaptation emphasises that economic factors are man-made and can be more readily engineered for change. Finally modifications were made inn order to better account for the potential of farmers to influence their environment through feedback mechanisms - both the institutional arrangements (e.g., by non-compliance, negotiation or clout) and the overall context (e.g., by reducing vulnerability through resilience building).

3.5 FOOD SYSTEMS AND FOOD SECURITY

"*The failure to maintain a healthy agriculture has largely cancelled out all the advantages we have gained from improvements in hygiene, in housing, and medical discoveries*."

Sir Albert Howard, 1945

3.5.1 Feeding the population through a low-petroleum-based agriculture

Following on from the enquiry into what Cuba's agricultural sector had achieved and how, the final research issue rests on the ability of its agriculture and food system to meet national food security needs. It looks into whether Cuba had been able to feed its people after the crisis, and whether changes towards a low-petroleum, and possibly ecological, production system may have affected this ability. This section first describes the concepts of food systems and food security, and then goes on to unravel some of the issues surrounding the interaction between these two concepts. It focuses on global food concerns, partly because of uncertainties over the wider impact of the crisis on Cuban food systems, and also so as to highlight issues which Cuba may have encountered in its own attempts to feed its population over the 1990s.

3.5.2 Low-petroleum-based food systems

The contribution that any form of agriculture can make to food security is nested within the dynamics of the global food system, which itself is placed as a subsystem of the global economy (Corsani, 1986). This food system, as described by Tansey and Worsley (1995), can be used to discuss *"the how and why of what we eat"*. Individuals operate in this system as end-consumers and as actors who maintain it. Tansey and Worsley estimate that approximately one quarter of all workers in the world are involved in the food industry. Although this appears high, the figure was closer to 90% in the late eighteenth century (White, 1962), and in some countries this proportion still pertains.

Goodman and Redclift (1991) describe how the current global food system operates on an industrialised basis, and is largely run and maintained by western economic institutions. Agricultural production forms a small part of this food industry, which relies on a continuous supply of (cheap) raw materials to be transformed into added-value products. The agribusiness sector combines industries upstream from production which supply inputs such as livestock feed, machinery, biocides and fertiliser, and industries downstream which are involved in marketing, processing and distribution activities (Tracy, 1993). Despite its power and influence, the agribusiness industry manages to remain largely unaccountable in the food security debate, even though its activities help shape access – or not - to both global and regional food supplies.[61]

As the industrialised food system has developed around structurally compatible processes (Goodman & Redclift, 1991), it may be inferred that these component parts are more compatible with industrialised agriculture than with ecological. The current incongruency between ecological production systems and the industrial food system in the US is discussed by Vos (2000) and DuPuis (2000). Policy and existing structures may work against the development of ecological food systems, even if they claim to support it. In the case of the emergence of Community Food Security (CFS) groups in the US, which were formed in order to relocalise food systems, Pelletier et al. (1999) found that, although the values of these groups appeared compatible with those articulated at national policy level, their activities were impeded by a variety of government regulations, uneven levels of community support and financial cutbacks. Several studies have sought to identify ways in which such localised schemes might be better able to survive (McMichael, 1994; Ward & Almas, 1997; Royer & Rogers, 1998).

[61] The industrialised food system has been criticised from various quarters for its prioritisation of private interests, its monopoly and the ensuing fiscal and food security imbalance (e.g. Clunies-Ross & Cox, 1994; Lyson & Raymer, 2000; Pearce, 2002).

Triggered by the multinational corporate power base, a conceptual antithesis has arisen: food sovereignty, whereby each nation holds the right to decide for itself the nature of its food and production policies and processes as they support its regional and local contexts, whilst respecting international agreements for maintaining global systems health of the human and natural environment (Forum for Food Sovereignty, 2002). Within the concept of food sovereignty, ecological agriculture is the accepted norm (Rengham & Windfuhr, 2004).

If ecological production is unable to exist widespread within the mainstream industrialised food system, this suggests that reforms in the food system may be required, or conversely triggered by major changes in production. Although there is little empirical evidence of this on a large scale, several authors have suggested key components of a health-focused food system. These include, at individual level, the provision of nutritious food, the qualities of which are related both to ecological production techniques and to it being fresh and relatively unprocessed (Lang, 1999); and at community level to equitable systems of access and distribution that often involve linking local production with local consumption (Pugliese, 2001).

3.5.3 Feeding the population: critical food security issues

The three pillars of food security

The FAO (2002[a]) provide the following meaning for food security: *"Achieving food security means ensuring that sufficient food is available, that supplies are relatively stable and that those in need of food can obtain it."* Providing universal access to adequate, nutritious food has three components: *availability* – that there is an abundant and continuous supply of food*; access* – that there is means for everyone to obtain the food available; and *nutritional adequacy and utilisation* – that the accessible food is of the required nutritional value and it can be utilised to meet dietary needs (FANTA, 2001; FAO, 2001).

The need to improve food access

Ensuring food security is understood as a complex issue and not only concerned with food quantities. An estimated 24,000 people die every day from hunger-related disease (Rau, 2001), that is, from lack of food, inadequate food, and weakening of the human system so that it is more vulnerable to disease. The 1996 World Food Summit set a goal of halving the number of undernourished people in the world by 2015,[62] a goal that has been criticised as being an unacceptably low target over an unacceptably long period of time (Windfuhr, 2001). It is now considered highly unlikely that even this goal will be met. Food insecurity is not only a southern issue. According to recent FAO estimates (FAO, 2001), there are 815 million undernourished people in the world,[63] of which 777 million are in developing countries, 27 million in transitional countries, and 11 million in industrialised countries. In the United States in 1999, 8.7% of households were classified as food insecure (Andrews & Nord, 2001), and in the UK in 1999, about 8 million people ate a diet below the WHO recommended nutritional targets (Lang, 1999). This global spread, including in wealthy countries, indicates that food security is not only a factor of poverty.

Notwithstanding certain debate, since the mid-1970s the world has produced enough food to provide everyone with a minimally adequate diet (Cohen & Reeves, 1995), and there is currently an overall surplus (Conway, 1997; IFPRI, 2001). Macro-level studies indicate that there is, and will be for the next few decades, more than enough food to feed the world (Bindraban et al., 1999; Shapouri & Rosen, 2001; Pinstrup-Anderson & Pandya-Lorch, 2001; Lomborg, 2001). Even an environmentally-oriented production (avoiding the use of nitrogen fertilisers and biocides) would produce four times more food than required globally (Penning de Vries et al., 1995). According to

[62] To reach the WFS goal, the number of hungry people needs to fall by 22 million a year. At 2001, its overall rate was 6 million a year (FAO, 2001)

[63] This is one-eighth of the world's population according to Wiebe et al. (2001).

FAO (2001), only a small increase in production would suffice to meet future food needs if its growth was accompanied by more equitable access to food, and economists generally agree that achieving a sufficient quantity of food will depend on how the world chooses to act rather than on its technical feasibility (Pinstrup-Anderson & Pandya-Lorch, 2001; Rosegrant et al., 2001). The critical period may be the next fifteen years. Conway (1997 p. 21) states "*If we can achieve a well-fed world by then* [2020] *it should be possible to meet future demands, provided the resource base has been adequately protected*." The key for achieving this is to ensure a more equal distribution (Rosengrant et al., 1995), or alternatively as Cohen & Reeves state (1995, p.3) "*to ground our choices in ethical values*".

The emerging challenge: food quality

Although a rights-based approach to food security embraces both quality and quantity issues (Windfuhr, 2001, FAO, 2001), food quality and diversity have historically been overlooked. UNICEF estimates that one third of the world's 6 billion population are affected by food-related ill health, such as primary nutrient deficiencies and corresponding illnesses in both industrialised and less-industrialised countries (Baker, 2001; WUR, 2002; Motluk, 2002). The overfed may also be malnourished, and their numbers in the world rival that of the underweight (Gardner and Halweil, 2000). Obesity numbers in developing countries is rising,[64] mainly in urban areas with western diets and in rural areas where new technologies reduce the need for physical activity (FAO, 2002[b]). This implies that not only a more equal distribution, but factors which encourage consumption of a more healthy, balanced diet are a major part of any solution to food insecurity (Burslem, 2004).

In contrast, the intrinsic nutritional quality of foodstuffs has declined dramatically over the last century. As well as the devaluing of nutrient content through processing, the nutritional content of fresh fruits and vegetables is decreasing: mineral levels in UK fruits and vegetables fell by up to 76% between 1940 and 1991(McCance & Widdowson 1940-1991; Mayer, 1997; Baker, 2001), and a similar trend has been seen in the United States (Bergner, 1997). This decline is attributed to agricultural practices: both a selecting-out in the process of plant breeding, and to soil and water deficiencies. In this sense, the agricultural sector has a crucial role to play in ensuring food of sufficient quality, and indicates that health is a multi-sectoral issue. Both the hungry and the overweight "*share high levels of sickness and disability, shortened life expectancies and lower levels of productivity - each of which is a drag on the country's development*." (Gardner & Halweil, 2000).

3.5.4 The agricultural response to food insecurity: maximising yields

Juxtaposed with these emerging food security issues, strategic agricultural policy responses target yield increases, liberalisation of markets and diversification out of farming (e.g. DFID, 2004; USAID, 2004[65]). Significant yield increases are part of any solution, but there are convincing arguments that an uncontexualised approach of yield maximisation may be damaging to achieving food security goals and even exacerbate long-term food insecurity (Goodman & Redcliffe, 1991). First, this focus diverts attention – and funding – from other equally important contributions that agriculture can make, such as of guaranteed harvests, increased environmental resilience to shocks and stresses, and ensured local availability of a diverse range of quality food. Second, high-yielding techniques have shown to be effective on agro-climatically homogenous lands, but proven to be less appropriate for the more marginal lands[66] and most food-insecure farmers for whom high yields

[64] For example, 41% of Colombians are overweight and 36% of Brazilians, while in Namibia 21% of women are overweight, 23% in Zimbabwe, and 45% of women in Middle East and North Africa (IFPRI, 2001).

[65] In 2004 for example, development policy of the USA and UK combines a strategy of increasing productive yields and agricultural consolidation, with encouragement of poverty and food security reduction through market-driven scenarios (DFID, 2004; USAID 2004). These policies also encourage diversification away from agriculture and rural areas as a more viable means of survival.

[66] These so-called marginal lands contain a large proportion of the world's biodiversity hotspots, and more importantly, their poor infrastructure and vulnerability to risk of flood and drought may make the intensive use of chemical inputs

rank alongside, but not above, issues of risk avoidance and food utility (Bindraban et al., 1999). Third, and related to the previous, certain high-yielding practices have already resulted in vast tracts of degraded land, yield declines and other serious side-effects in the medium to long term, and have led to a loss of livelihoods and/or significant additional expense (Tansey & Worsley, 1995; Conway, 1998; Pingali & Rosengrant, 1999; Oldeman, 1999).[67] [68] In this respect, a more holistic perspective, which pays attention to all these factors, appears to have a key role to play (Rengam & Windfuhr, 2002).

Ecological agriculture is put forward as a major component of more holistic strategies (such as that of food sovereignty, already mentioned). However, concern over its lower-yielding performance, and therefore inappropriateness in terms of providing sufficient food for the global population, challenges this role (Rabbinge & van Latesteign, 1998; FAO, 1998; IAC, 2003). This concern is justified if one examines the performance of certified organic agriculture in temperate regions, where conversions have shown initial yield drops of an average 20% compared[69] with industrialised, partly through losses due to pest and disease and partly because of the less intensive nature of the ecological system (Goewie 2002[a]). In tropical zones, the concern focuses around the ability of ecological agriculture to sustain soil fertility that is seen, alongside water, as the main constraint to production. It is argued that, even if integrated with ecological techniques (e.g. Singh et al., 2001), expanding the use of chemical fertilisers will be essential to solve the soil fertility problem in most low-income countries (Pinstrup-Anderson et al., 1999; Gruhn et al., 2000).

Yet beyond these generalisations is an increasing body of empirical evidence that ecological approaches can achieve significant yield increases over both traditional and industrialised agriculture, and especially in natural- and socio-economic-resource-poor regions (e.g., Pretty & Shaxson, 1997; Souza, 1998; Altieri et al., 1999; McNeely & Scherr, 2001; Mäder et al., 2002; Rundgren, 2002; Parrott, 2002; Pretty et al., 2002; Parrott & Marsden, 2002). Hilhorst & Muchena (2000) emphasise that certainly for the case of Africa, local, field level soil management is required and generalisations cannot be made.

3.5.5 Reframing food security

If food security is viewed from the ecological food systems perspective, a raft of factors alongside yield and production performance, and incomes, contribute to achieving and sustaining high and long-term food availability, access and utilisation. These are suggested as follows:

- Food availability:
  - maintenance of cropping intensity through more concentrated diversification and higher total yields, as opposed to mono-cultural specialisation,
  - reduced degradation of productive land, coupled with the ability to regenerate and work marginal lands,
  - diversity of production and lengthening cropping seasons to broaden the availability of basic foodstuffs,

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uneconomical, while the poor soils cannot sustain monocultures of annual crops. Careful, ecologically-centred management is argued as a necessity (McNeely & Scherr, 2001; Hazell & Garrett, 2001).

[67] As an example, an investment intervention in market-based, irrigated mono-cropping if high value export crops on the flat plains of Yemen disrupted the farm economy for 90% of farmers who had been maintaining the successful traditional hillside terrace systems (Milroy, 1990).

[68] Environmental degradation is expensive. Fifty percent of naturally occurring nutrients and organic matter have been lost from Canada's prairie soils due to industrialised agriculture (Rees & Wackernagel, 1996). In Australia, agricultural losses due to land degradation are about A$600 million annually (Tansey & Worsley, 1995). The UN estimates that the global income loss to desertification is US$42 billion. Meanwhile, the health costs for pesticide use in regions of the Philippines were estimated as US$ 20 – 200 per hectare, so much so that the net benefits were higher if no pesticides were used (Rola & Pingali 1993).

[69] Critics of comparative analyses argue that the benefits of ecological agriculture are lost in reductionist yield comparisons (Goewie, 2000). Whereas output of any one specific crop may be lower on an ecological farm than on an industrialised one, total farm yields are higher (Altieri et al., 1998).

- avoidance of post-harvest losses, through local processing, promotion of whole foods (including incorporation of non-uniform ‘rejects’), and shorter marketing chains,
- awareness of seasonal limitations to availability.

• Food Access:
  - localised and short production-consumption chains,
  - affordable prices and food exchange mechanisms,
  - an increase in the people involved in, or with direct links to, production,
  - access to nutritious foodstuffs rather than any foodstuff,
  - more complex food linkages and distribution networks,
  - price differentiation according to proximity of production.

• Food nutritional adequacy and utilisation:
  - strengthening linkages between food production, processing and consumption, both within
  - households (home food production) and between producers and consumers,
  - education on food nutritional values, and agronomic and post-harvest means for their enhancement[70],
  - consumption of a diversity of fresh produce.

The problem of food insecurity appears far greater than the agricultural sector alone can, or should be called upon to, solve. Yet from the above, agriculture may significantly contribute by addressing strategic issues. Looking wider than yield performance implies the need for a better, systems-based understanding of both the nature of the problem and the potential of agriculture. Could Cuba provide an example of a nation whose agricultural sector had taken on ecological thinking, and forged a different, yet successful path for feeding its people from the current industrialised mainstream?

[70] Recent studies, including a review of over 400 published papers comparing the quality of organic and non-organic foods (Zanoli & Gambelli, 1999; Stolze et al., 2000; Heaton, 2001; Worthington, 2001; Rembialkowska, 2005) conclude that there are no health advantages of consuming industrialised produce over organic, and several for the converse including lower levels of pollutants and contaminants and higher micronutrient levels.

4 RESEARCH APPROACH AND METHODOLOGY: PLANNING AND PRACTICE

4.1. INTRODUCTION: ACTIVATING THE RESEARCH PLAN

The key predicament underlying this research, as developed in Chapter 1 was that, even though there is the potential, and inarguably a necessity, to develop a more sustainable agriculture, there are few examples of this having been achieved on a large scale. Evidence suggested that Cuba, partly by force of circumstance – the reduction in petroleum-based inputs, had undergone such a transition, and investigation of this process would have implications for our understanding of how an ecological agriculture might be more broadly adopted. Based on this, Chapter 3 developed and discussed a framework for analysing a set of key research issues and questions. Summarised here are the main, key variables of these questions that will guide field methodology.

1) What is the mainstream agricultural production system operating in Cuba at the end of the 1990s?
Responding to this question involves a field assessment of rural agriculture in contemporary Cuba, in terms of how the production system was affected by the reduction in petroleum-based inputs. The production systems identified may then be discussed in relation to industrialised and ecological characteristics and transitional phases (as described in Table 3.1 and Box 3.3 of Chapter 3). Key variables for analysis are:

- types and levels of agricultural inputs
- types and levels of other agricultural techniques employed
- knowledge levels on farm
- yield impacts of the reduction in petroleum
- wider impacts of the reduction in petroleum on the farming system

2) What are the coping strategies involved in developing and supporting this current production system?
This response involves identifying the coping strategies which have worked to shape the current production system, in terms of the internal and external factors or driving forces of both farmers and farms, and actors and institutions in the agricultural support system, within the petroleum-scarce, livelihoods context. Key variables for analysis are:

- farm and institutional structures and assets
- experiences, beliefs and knowledge
- service provision/access to resources, knowledge and technical support
- policies, laws, incentives and markets

3) What are the factors involved in shaping the extent of an ecological production system?
Whether or not mainstream production in Cuba was ecological, responding to this question entails teasing out the specific influences on the extent of its development. These influences include both support and challenges, and relate to the current debate surrounding the performance and appropriateness of ecological agriculture as discussed in Chapter 3. Key variables are the same as for question 2, but here they relate to specific characteristics of a more ecological support system

(as described in Box 3.5 of Chapter 3). A longitudinal analysis will explain how the current situation has been reached, as well as identify requirements for the further development of ecological agriculture in Cuba.

4) To what extent has food security been resolved in the context of a petroleum-scarce agriculture and food system?
Here, the coping strategies are identified which have attempted to improve and/or maintain food security, and an assessment made of their effectiveness in relation to availability, access and adequacy of food supplies. The nature of the relationship between food security and the changes in agricultural production is emphasised. Key variables are:

- national policies and processes for food availability and access in terms of supply and distribution
- institutional and household coping strategies
- levels of self-sufficiency
- levels of nutritional awareness and dietary health

4.2 FORMULATING THE RESEARCH APPROACH AND METHODOLOGY

4.2.1 Methodology for working in uncertainty

Grounded theory as a starting point

Both the shortage of available data and uncertain research circumstances within Cuba meant that a reference framework was developed rather than an *a priori* hypothesis. In this case, grounded theory was the most appropriate theoretical approach for dealing with such empirical uncertainties. This approach allows for the collection of empirical data around which theory is gradually built. As such, and in contrast to other approaches, it does not rely on a preconceived hypothesis of reality (Strauss & Corbin, 1990). Yet grounded theory is iterative and can also be used to confirm, elaborate and modify existing theories if any would be used (Strauss & Corbin, 1994). For this study, grounded theory could therefore be used to evaluate the validity of secondary information on the status of agriculture in Cuba, to draw in empirical evidence on coping strategies employed, and to elaborate and modify existing theory on ecological agriculture and food security.

Exploratory and opportunistic approaches

The research circumstances also influenced the field work approach. Given the lack of local (Cuban) impetus for this research, exploratory, opportunistic and documentary approaches were selected over more interactive options. A further parameter to the scope of field work was of a practical nature; the modest financial resources of the project, which would affect transport, fees of counterparts and assistants, execution of large-scale surveys, and so on. Exploratory research, meanwhile, would be appropriate in that it was flexible enough to cover most eventualities. Although it uses mainly qualitative methods, it also draws on existing supportive quantitative data, and samples research objects in their natural circumstances. Further, the research questions, sampling procedure, analysis and theory construction can be constantly reframed (Zyzanski et al., 1992; Rap, 1997). Most crucially in describing the exploratory approach appplied in this thesis, "*sampling is purposive rather than random; the concern is with information richness, not representativeness*" (Dangbégnon, 1998, p. 54). In this sense, the analysis is descriptively rich and does not assume generalities.

It should also be noted that the author was sympathetic to the potential for alternative solutions in agriculture, and if left unacknowledged, this might influence the choice and direction of investigation in the field. Even grounded theory with its relative lack of hypothesis cannot avoid accusations of bias, given that the researcher chooses the thematic building blocks from literature and constructs the thematic research criteria (Ilberry & Maye, 2004). To minimise such bias, a strategy of pragmatism was adopted, rather than of allegiance to one specific paradigm (Quinn Patton, 1990).

Preparation of qualitative and quantitative methods and tools

The social sciences frequently favour qualitative over quantitative research, as the former provides depth, detail and individual meaning to a people-oriented investigation, whilst a quantitative approach provides a more succinct and parsimonious overview (Quinn Patton, 1990). The two are not mutually exclusive, and at the outset of this investigation much reliance was placed on both secondary quantitative data and qualitative anecdotal information. For primary data collection, the macro-nature of some of the research questions (such as the level of uptake of more ecological farming practices) suggests that a quantitative approach would be appropriate, although it was not evident that this would be possible in practice. Therefore options for the field work investigation were left open, and methodological tools were prepared which could be adapted to either approach. These included the design of both questionnaires and semi-structured surveys, and the development of a selection of data collection tools from the Participatory Rural Appraisal (PRA) and Rural Appraisal of Agricultural Knowledge Systems (RAAKS) toolboxes.

For a number of reasons, a quantitative questionnaire would be very useful. First, there was little such secondary information already available at regional and local levels, and the aim of this research was to look at what was happening on a broad scale. Second, previous experience of the author had shown that data gathered from questionnaires could make a vital contribution to identifying trends and factors not immediately visible from a more qualitative approach (Fernandes et al., 1997). Third, this would act as a triangulation point and back-up to qualitative information gathered. Fourth, it was unknown which tools would encourage more realistic responses; whether respondents would feel more comfortable talking in an open discussion, or more mechanically responding to questionnaires. Therefore, for each of the research questions, key criteria were designed to be used as quantitative indicators, particularly if a time series of detailed statistical information could be obtained, and could also serve as guidelines for later questioning through a qualitative approach. Case studies were considered an appropriate, complementary method, in order to organise pieces of evidence, and stories, from a broad range of sources and over time. In addition, multi-method triangulation (Denzin & Lincoln, 2000) would be used as a means of examining secondary data by reference to primary data as well as for gaining different actor perspectives. In view of these uncertainties, a re-evaluation of the appropriateness of methodologies and data collection would be undertaken after the initial field work period.

4.2.2 Agrochemicals as a guiding thread through the system

A major focus of the research would be on the agricultural support system, and therefore the sources of information could come from all parts of the agricultural sector, i.e. from farms, research and extension, policy and more. Yet it would not be possible, given the time and resource limitations, to make a detailed analysis of the whole sector. Therefore a focus on the use of agrochemical inputs was chosen as a guiding thread of the investigation, around which other factors could be linked. This choice was made for the practical reason; the loss of agrochemical inputs was one of the driving forces behind Cuba's apparent move to ecological agriculture, and also because input use is one of the key quantitative criteria used to differentiate between ecological and other forms of agriculture. Poincelot (1986), for example, argues that the use of agrochemicals is the main divergence between sustainable and ecological approaches. So the plan was to trace the use of agrochemical inputs and alternative strategies throughout the system, and through this to gain a perspective on the agricultural production and support system in Cuba.

4.2.3 Identifying information sources and stakeholders

The first stage of data collection would be undertaken in Europe, where secondary data would be collected from resource centres with an interest in Cuba. Through a snowball approach (McCall & Simmons, 1969), this process would also help in identifying individuals and groups currently and previously involved in Cuban agriculture (through development or research activities), who might also be potential sources of primary and secondary information.

Table 4.1 Pre-field work stakeholder analysis of groups or institutions having interest in the decrease in agrochemical availability in Cuba

Stakeholders	Estimated affect of the decrease in agrochemicals on stakeholder	Relative priority of interest (for the author, 1 = highest)
Producers: State Farms, New Type State Farms, UBPC, CPA, CCS, Parceleros	Monocultural yields decreased, labour & time increase, change in management & information sources, (gender roles?).	1
MINAG Departments (incl. of Urban Agriculture, Food Security)	National agricultural policy changes. Food deficit – affects foreign trade.	2
17 State agricultural research institutes and regional sub-entities	Research on soil fertility, pest and disease control, and wider implications (incl. change in knowledge source/attitudes).	2
Sanidad Vegetal (National Institute of Plant Protection) and regional sub-entities	Research/extension shift of whole framework. Expansion?	2
ISCAH (Supreme Direction of Agricultural Universities) and regional sub-entities	Research on agriculture and related topics.	3
Emprezas (State Support Enterprises)	Change in knowledge and technology for extension and support.	2
Acopio/SCC (Support for more independent farmers)	Change in knowledge and technology for extension and support.	2
MINAZ (sugar) and sub-entities	Attempting to retain monocultures – receive priority on State inputs.	4
ANAP (farmer organisation)	Change in knowledge and technology.	2
ACAO (organic movement)	Opportunity to progress.	1
CAI (Agro-industrial centres)	Production decreases? Inefficient?	3
Ministry of Environment & Ministry of Water	Pollution issues.	4
Ministry of Education	Associated research on agriculture.	4
Ministry of Health	Food security and health issues.	3
Ministry of Trade	Reduced exports and higher price of imports.	3
Agribusiness export entities?	Trade constrained.	3
Consumers - rural - urban	Lower food availability.	3
PCC & other socio-political groups	General interest/co-ordination.	4

In Cuba, further secondary information would be collected from resource centres of relevant State Ministries, agricultural research centres, libraries, agricultural support centres, international representations, and conferences[71]. In order to identify potential sources of primary information, a

[71] Here it should be noted that much secondary information was unavailable to the author pre-field, given the 2-5 year time lag of publications coming out of Cuba, and the unavailability of data. Rosset comments in relation to data access "*Obtaining any figures at all is very difficult, owing to the longstanding reluctance of the Cuban government to release them and to post-crisis cutbacks in data compilation and publishing*." (1996, p. 67). See also the comments of Mesa-Largo (1998), in footnote 9.

preliminary stakeholder analysis was made, shown in Table 4.1. The list of stakeholders was drawn from a contemporary analysis of the Cuban knowledge system, by Miedema & Trinks (1998). The most relevant individuals and groups were identified by estimating the extent to which they would be affected by a decrease of agrochemical availability.

As the research would not be able to cover all types and forms of farming in Cuba, a preliminary shallow sweep would be made, in order to identify the most promising and interesting farming types for a more detailed follow-up analysis, and also to identify other suitable provinces for a regional comparison to be made.

4.3 THE EMERGENT FIELD WORK MODEL

4.3.1 The field work stages

During the early stages of the project, efforts were focused on developing links within Cuban institutes and identifying potential collaborators. Yet despite meticulous prior planning, it was only once in Cuba, and after several months of visiting different research institutes, reframing the research project, and negotiating with different Ministries, that a host institute could be officially confirmed and a project agreement signed. This enabled official permission for the go-ahead of the research. Major contributory factors to the delay included sensitivities about foreigners undertaking particular kinds of research, and the research budget which was considered way below that normally expected of foreigners.

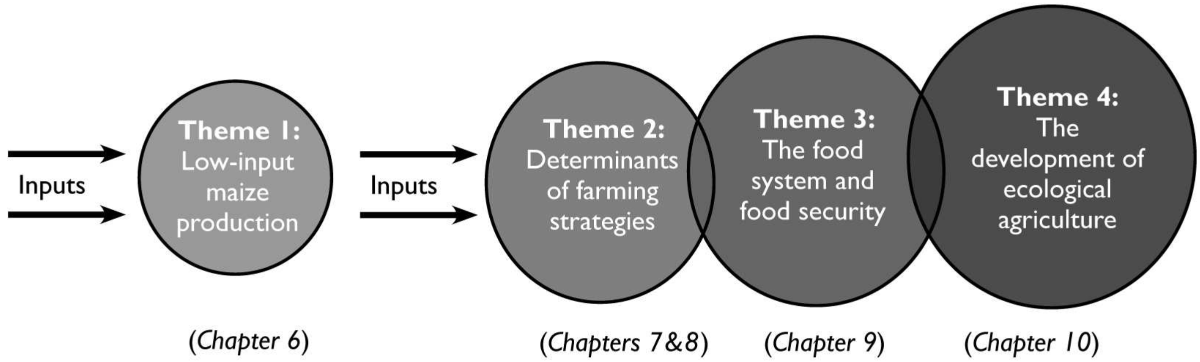
An arrangement was made with the National Institute of Agricultural Sciences (INCA), to work under the umbrella of their new Participatory Plant Breeding Project. Although the initial research phase was therefore shorter than planned – just eight weeks, a relationship of trust was built up with the project team and research institute, and on this basis a second period of field work could be organised around a more ambitious and longer project, in co-operation with the team’s sociologist. The first field work period resulted in a case study on three farm co-operatives in Havana province. The second period was undertaken over three subsequent trips to Cuba between 1999 and 2001, and looked at a wider range of farm co-operatives and their support systems in the provinces of Havana, Cienfuegos and Holguin.

4.3.2 The emergent field work model

Therefore, the field work was undertaken in two distinct phases, hosted by the National Institute for Agricultural Sciences (INCA). In the first phase, from May to July 1999, a discrete research project was formulated and undertaken to fit in with the institute’s Participatory Plant Breeding (PPB) Project, on low-input maize seed and crop production. In the subsequent phase, (from October 1999 to March 2000, and then September to December 2000, and May 2001), a larger project was undertaken to identify the determinants of farming strategies across 3 provinces. Within these two phases (including from the time the author first arrived in Cuba in January 1999), other information relating to the research interests on food security, and on institutional aspects of ecological agriculture, was gathered.

In this way, a field work model emerged, with the ‘red thread’ uniting the two main phases being the use of agrochemical inputs. This thread provided both an entry point and a vehicle for piecing together the surrounding ‘reality’. Four issues or themes were looked at, which though not thematically related to their neighbours, were important in terms of their sequence along the thread, as this represents the incremental learning process by the author. Thus each field theme in the model is a different shade and progressively increases in size, to represent increases in the level of understanding and in the depth of research questioning as local trust grew. Figure 4.1 shows this model. (Note that Chapter 5 comprises the pre-field desk review of Cuban agriculture in the 1990s.) Using the key analytical variables of section 4.1 as a guideline, the information gathered through these four field themes provide material for responding to the research questions.

Figure 4.1 The field work model



4.4 FIELD THEME 1: SUPPORTING LOW-INPUT MAIZE PRODUCTION IN HAVANA PROVINCE

4.4.1 Background

A new project on Participatory Plant Breeding (PPB) was about to commence at INCA, in the province of Havana, and the groundwork had already been laid in terms of planting up field trials and mobilising farmers. The aim of the project was to diversify and improve the varietal structure of maize crops for low-input conditions, through a diagnosis of farmer needs, the participatory development of a selection of appropriate materials (collected from regions of high-genetic resource potential), the propagation and dissemination of these materials by the farmers, and the dissemination of methodologies to other plant breeding programmes.

Within this project, an evaluation of the use of agrochemical inputs had relevance for both the PPB Project and for the author. If the project aimed to be stimulating or supporting low-input production, then one indicator of success would be that input levels were reduced or remained low, and alternative input use could also be considered. A baseline of current levels of input use in relation to variety would therefore be required. This was the project developed and carried out between May to July 1999. The fieldwork methods are described below. The geographical location, farm types, and farms to be visited were already determined by the PPB Project, which in its early stages was working with three specific CPA co-operatives. Significantly, these farms were host to a national research project for on-farm agro-ecological trials, called the Agro-ecological Lighthouse Project.

4.4.2 Objective

As support to the PPB Project, this study's objective was to identify the role of pest control and soil fertility strategies in relation to sustainable seed management systems (under the working title 'Supporting the Management of Low-Input Maize Varieties'). This would be undertaken by examining the dynamic role of industrialised and ecological strategies during the introduction and first cropping cycle of new, 'low-input' seed materials. Although involved only in the initial activities of the PPB Project, this study would collect and provide the information required for future project activities.

4.4.3 Methods

Three methods were used for data collection: secondary data reviews, institutional meetings, and farm visits. The planned activities, methods and time schedule are shown in Table 4.2 below.

Table 4.2. Outputs, activities and time schedule (Field Theme 1)

Output	Activity	Method (time)
1. Description of the use and facilitation of pest and fertility strategies of the focus farming communities for selected crops.	1.a) General review of general soil fertility and pest & disease management strategies, for maize seed management, and their facilitation. 1.b) Review of the above in the three focus farming communities and their municipalities.	1.a) Literature review in libraries, and meetings with appropriate personnel. (3 weeks) 1.b) Meetings with representatives of the 3 focus CPA co-operatives and local support personnel (2 weeks)
2. Analysis of the impact of introduction of new low-input maize varieties on production strategies and their facilitation, for maximised sustainable yields.	2.a) Identification of soil fertility and pest and disease management strategies, post-introduction of new maize seed, for the first cropping season, in the 3 focus farming communities. 2.b) Analysis of data.	2.a) as with 1b) (1 week) 2.b) (2 weeks)

TOTAL 8 weeks

Institutional meetings

Official appointments had to be made through INCA staff to visit key personnel within research institutes, Ministerial departments and farmer organisations, at national and provincial level. Tools used included a semi-structured interview supported by a checklist of topics (see Box 4.1). In all, 32 such interviews were held.[72]

Production site visits

Two residential field visits were made to the municipalities of the three CPA co-operatives: Batabanó for the CPA 28 de Septiembre, and San Antonio de los Baños for the CPAs Gilberto Leon and Jorge Dimitrov. Where possible, visits were also made to neighbouring CCS co-operative producers. Key contacts (either the President or the Head of Production of the co-operative) were identified in each CPA, to assist in identifying respondents.

The methods prepared for farm data collection were a structured semi-quantitative survey (Box 4.2) aimed at the head of each household within the co-operative, semi-structured interviews (Box 4.3) with key co-operative workers, and the use of participatory diagnostic tools of farm walks, seasonal calendars, historical transects, impact flow diagrams, and problem-causal trees. Thirty eight individuals participated in the interviews and surveys.

The aim of the structured survey was to ascertain the level of knowledge on seed management, seed systems, and the use of industrialised and ecological inputs. As time was a major constraint (and as Cuba has a high literacy rate of 97%), the survey was distributed amongst the key farm contacts, and completed forms collected back at an agreed, later date. Any queries relating to the survey could be dealt with by the key contact in each co-operative. This was an experimental methodology, to see if satisfactory quantitative data could be gathered in this way. If the response was poor, then resulting data would be used qualitatively.

[72] Key personnel were interviewed from: INIFAT (Depts. Plant Breeding, Agronomy); IIHLD (Depts. Plant Breeding, Extension); INCA (Depts. Plant Breeding, Nutrition and Biofertilisers); Instituto de Suelos; Sanidad Vegetal; CIGEA; Faculty of Geography, University of Havana; Fundación de la Naturaleza y el Hombre; Empresa Productora de Semillas Varias; Servicio de Inspección y Certificación de Semilla; Centro de Investigaciones de Psicología y Sociología (CIPS); Empresa de Cultivos Varios, MINAG, Batabanó Municipality; ANAP Havana Province, Batabanó and San Antonio de los Baños; CREE, Instituto Politécnico Agrario República de Argelia, Batabanó Municipality. In addition to these key institutes, individuals within other state institutes were also contacted for wider information and to locate further secondary data.

Box 4.1 Checklist of topics for institutional meetings

General Topics
- Potential for technology packages (seed-fertiliser-pest control)
- Linkages with other institutes
- Training given and received

For Research Institutes[1]
- Sustainable research and extension

On crop breeding
- Breeding strategies for industrialised and low-input production
- Crop input response and input recommendations
- Genetic resources, flows and variability centres
- Selection criteria

On soil fertility
- Soil fertility strategies for maize
- Relation between soil fertility and variety

On pest and disease control
- Pest and disease control for maize
- Relation between pest control and variety

On extension
- Extension information and techniques for maize
- Target farmer selection

For Ministry[2]
- Strategies for sustainable agriculture

CITMA
- Regulatory control of pollutants

MINAG
- Seed and input strategies and recommendations

For Agricultural Support and Supply[3]
- Regulation, services and training in seeds and input
- Certification
- Seed sources and saving
- Extension and packages

[1] INCA, INIFAT, IIHLD, INISAV, Soils Institute; [2] MINAG, CITMA; [3] Seed Enterprise, ANAP, Mixed Crops Enterprise, CREE

Box 4.2 Headings of structured semi-quantitative questionnaire[73]

SURVEY: SEED MANAGEMENT
Name of CPA/CCS___________ Survey number____ Date ______
- -

1) Issues on management of maize seeds
   - varietal improvement
   - seed conservation
   - general seed management
2) Issues on input management for maize:
   - management of chemical inputs
   - management of ecological inputs
   - integrated management
3) General knowledge and experience

[73] For a full version of the questionnaire, see Appendix II.

Box 4.3. Checklist of topics for meetings with CPAs

General issues

- Co-operative infrastructure
- Production systems.

Topics around maize production

- Seasonal calendar (include gender and labour)
- Varieties, erosion and sources of variability
- Traditional knowledge
- Selection criteria, seed saving and seed flows
- Use of inputs, management practices and costs
- Postharvest use
- Services and training

Topics around the introduction of new low-input varieties

- Conduction of trials and monitoring
- Probable input management strategies.

4.4.4 Discussion of methods used

Secondary data reviews

Largely due to the conditions of the Special Period in Cuba from 1989 to the present day, there was a lack of up-to-date international literature coming into the country, very limited access to internet sources, and lack of resources for institutes to continue publishing their scientific journals. As a result, much research was not widely disseminated and remained in the hands of the researchers themselves. Obtaining access to it required time to build up contacts and confidence. This, combined with the time constraints of the author, meant that some literature could not be accessed.

Institutional meetings

A similar circumstance was encountered when carrying out interviews, as time, and multiple visits, were required to build up trust and confidence (particularly with a non-Cuban), and there was insufficient time for this. As such it became apparent that the diagnostic participatory tools were not appropriate, as even the simplest of them required a level of mutual confidence. Some respondents appeared nervous even if notes were taken during an interview, or if reference was made to a checklist of questions. Others did not appear comfortable with using the visual tools, such as for making a schematic of institutional linkages and rankings. Some RAAKs tools were briefly tried out and met with the same response; one respondent refused to pick up the pencil.

Production site visits

Surveys

After some experimentation with its application, the surveys were handed out to each farm worker with the help of the key contacts. This method was most preferred by the farmers; when initially distributing the surveys, some workers refused on the grounds that they could not write, and others that they lacked the confidence to undertake the task. Names were recorded and the survey forms collected back at a pre-arranged date. A total of sixty surveys were distributed amongst the three CPAs, of which 25 were completed, i.e. 42%. This high return rate yielded more than the author would have been able to undertake on a face-to-face basis. The key contact at one CPA modified the method by arranging for 5 workers to answer one questionnaire between them. The survey was also completed by three neighbouring producers.

Overall, just over 12% of the total number of workers within the three focus CPAs responded. Response rates ranged from 9% in CPA Jorge Dimitrov to 19% in CPA 28 de Septiembre. Respondents to the survey included co-operative presidents, heads of production, heads of *fincas*, farm workers, agronomists, and mechanics, with a relatively high proportion of heads of *fincas*.

Thus it can be assumed that the responses received are not representative of the whole workforce of each co-operative but that they show a higher level of literacy and formal knowledge than the average.

Diagnostic tools

The same reactions to the diagnostic tools were encountered in the production site visits as with the institutional meetings. Thus most of the data was collected in the form of relaxed, semi-structured interviews. A seasonal calendar was attempted in several cases, though the author was unable to pass control of drawing the diagram over to the respondent.

4.4.5 Review and adaptation of the line of enquiry and the theoretical framework

Through talks with CPA farmers during this first field work phase, it became clear that the input that they lacked most and which most affected their production was petrol, the scarcity of which was considered far more of a constraint than that of agrochemical fertilisers or pesticides. The constant cry was "*falta petroleo*!" After this had emerged, it was impossible to ignore the petrol factor. Thus, the red thread was subsequently broadened to include consideration of fuel and machinery, both at the farm level, and at the institutional level where institutes such as of agricultural mechanisation and irrigation would subsequently be included.

A second adaptation was to the theoretical framework, whereby the Knowledge Systems perspective – the relationships between actors involved in policy, research, learning and its facilitation, and farmers – was expanded to a modified Rural Livelihoods Framework in order to better capture the driving forces and interactions which were shaping the emergent coping strategies. This adaptation has been described in more detail in Chapter 3, and was used primarily as a tool to frame the field analysis.

4.5 FIELD THEME 2: DETERMINANTS OF FARMING STRATEGIES, 3 PROVINCE-WIDE

4.5.1 Background

The concept for this second research project emerged through discussion with Cuban colleagues, on how to obtain a broader view of the changes that had taken place in Cuban agriculture, and how current farming practices and their support systems may act as an entry for exploring ecological production. Cuban colleagues suggested exploring the issue of technology change, the use of sustainable technologies, and their effects at different levels. A research project was thus formulated on this subject, one which would be mainly qualitative and would attempt to take a broad view of developments in more than one province. As the previous project had concentrated on CPA co-operatives, this new project would aim to compare production strategies on two different farm types which may show variance in their use of technology. These types were: the private CCS farms, which were generally traditional and perceived to be using low input practices, and State or ex-State (UBPC[74]) farms, which were generally large scale and had a tradition of high input use.

This time, two crops would be used as a vehicle for exploring the wider farming system. Maize would be maintained for continuity with the previous project. A second, contrasting, crop was searched for; one with potential for commercial organic production (and export). Whilst there was no such production at this time, the potential of several crops, including sugar cane, citrus, banana, mango and salad vegetables, was being investigated at pilot scales in the country. Banana appeared to have the most potential. Together with maize, it was common on farms as a subsistence crop, yet it held higher national priority for production planning and receipt of inputs. Moreover, organic

[74] Basic Units of Co-operative Production, a new type of non-State farm described in chapter 5.

bananas were a commodity attracting considerable interest at the time in trade relations between the Caribbean and Europe. Finally, the author enjoyed eating bananas.

4.5.2 Objective of the study and research questions

Under the working title 'Sustainable Technology Innovation and Use', the objective of this study was to deepen knowledge on technological changes, the use of sustainable technologies, and the factors which served to support this. Consideration of technologies which were adopted in the wake of introducing new crop varieties would provide a knowledge base for the PPB Project. At the outset of this research, the introduction of new varieties of both maize and banana crops, more suited to low input and ecological farming styles, was underway. This would facilitate comparison between high external input, low external input/alternative input, and more ecological production systems.

The output would be a diagnosis and analysis of sustainable technology changes, innovation and use in the agricultural sector, and the structures and processes which facilitated this. It would specifically look at the main farm-level technology changes and innovations and their facilitation at macro-level, the main social impacts of, and challenges to, these changes, and the ways forward for development under the current conditions.

4.5.3 Methodology

The work plan

For each of the two contrasting types of production unit: ex-State farms and CCS co-operatives, individual farms would be selected which were producing both maize and banana. The workplan for each province is shown in Table 4.3.

Table 4.3 Research outputs, activities and time schedule per province (Field Theme 2)

Output	Activity	Method (time)
1. Overview of the main technology changes, innovation and use at farm level.	Identify the main elements within the focus farming communities.	Meetings with technology users in two municipalities. (4 weeks)
2. Overview of impacts and challenges at farm and macro levels.	Identify the impacts and challenges at a) farm and b) macro levels.	Meetings with a) technology users in two municipalities, and b) local, municipal and national level personnel. (2 weeks)
3. Analysis of ways forward for development under current conditions.	Obtain recommendations of ways forward at farm and macro level.	Meetings with technology users and facilitatory personnel. (2 weeks)

Total 8 weeks (per province)

Study locations

The research was initially carried out during October to December 1999 in the focal region of the PPB Project: the municipalities of San Antonio de los Baños and Batabanó, province of Havana.[75] In each municipality, two CCS and two ex-State (UBPC) co-operatives were visited, and interviews held on each with specialists in farm management, in maize production, and in banana production. From January to February 2000, and through contacts from the PPB Project, the same study was replicated in the more central province of Cienfuegos, with the help of the National Botanic Gardens which provided accommodation, transport and a guide. Permission for a third study in Guantanemo province was turned down, the area being a restricted-zone national park. Therefore

[75] Similar research was also undertaken in one municipality of Havana city, the results of which feed into the discussion on urban agriculture in Chapter 5.

another location was selected, based on contacts of the PPB project, in the eastern province of Holguin. Here, research was undertaken between September to December 2000, supported by a local host institute, ETIAH.[76]

Information sources

The key actor groups were as follows:

- Production: heads of maize and banana production, and administrative staff, on selected farms.
- Facilitation/extension. Municipal level: ANAP, MINAG, CREE. Provincial level: ANAP, MINAG, Seed Production Enterprise, ACTAF.
- Research: INIFAT, INIVIT, IIHLD, Soils Institute, Sanidad Vegetal.
- Marketing: Acopio, Fruta Selecta.
- Policy: MINAG, CITMA.

A total of 83 producers and 125 support professionals were interviewed, over the three provinces. Over half of this number were in the Province of Havana, partly because this housed the headquarters of the agricultural institutions (Ministry, research etc.), and also because, due to the field work taking longer than had been estimated, two municipalities were studied in Havana as opposed to one in each of Cienfuegos and Holguin.

Methodological tools

Box 4.4 Methodological tools

At producer level (for each UBPC/CCS farm)

- Producer questionnaire for use with president/head of production.
- Production and farm figures from administration office of each farm and/or municipal MINAG where possible.
- Diagnostic tools for interviews with heads of *fincas*/brigades in charge of maize and banana production on each farm.

At institutional support level (inputs, research, extension and collection/marketing services) in municipality/province

- Checklist of questions

At policy level (ANAP, MINAG) in municipality

- Checklist of questions

Box 4.5 Basic diagnostic RRA tools

Tool: Seasonal calendar

Objective: To extract information on the main production activities of the year for maize/banana and their relation to climate, labour, disease etc.

Method: Draw a 16 month time line and ask the respondent to chart the main production activities for maize/banana during the last year (bed preparation, sowing, weeding, input applications, harvesting, postharvest activities, storage). Then ask the respondent to give details on:

- amount and type of labour required for each activity,
- amount and type of inputs including seeds, irrigation, and machinery use (and critical times for pest/disease attack).

In cases where new varieties have been introduced, ask the respondent to do a similar exercise for the new variety.

Tool: Problem-causal analysis

Objective: to ascertain and clarify the real causes and effects of the problem of reduction in inputs.

Method: Make a list of the causes and effects of the problem of reduction of inputs. Start building a ‘problem tree’ by showing the effects of the problem. Then do the same, for the causes. Discuss which causes can be tackled by the farmers themselves.

[76] Territorial Agricultural Research Station of Holguin.

The methods used for the field work are shown in Box 4.4. Semi-structured surveys and checklists of questions (see Appendix I) were used to assist dialogue with key actors, and basic diagnostic RRA tools prepared, the two most successful as shown in Box 4.5. A questionnaire was used for farms (see Appendix II).

4.5.4 Discussion of methods used

Sampling and selection of field sites

The selection of provinces was largely pre-determined by the PPB Project. Within the provinces, the selection of municipalities was decided by the host institute, based on familiarity and relations with certain municipalities but also on practical concerns such as ease of access. As a result, not all the farms visited were producing both maize and banana, and therefore more farms were included in the study. There was less differentiation in technology use between farms than within them.

Applying the field tools

Within the field work team, a routine became established of identifying a farm, applying the questionnaire with one member of farm management, and then meeting with on-farm specialists in maize and banana to run through the checklist of questions and more participatory tools. The questionnaire took 3 hours for its first application, but with experience this was reduced to an average of one hour. For the UBPC farms, better results were obtained when two respondents were present, as their individual responsibilities were more limited and they did not have a complete picture of the operations of the farm. It was notable that many UBPC workers had very low levels of knowledge. Some of the CCS farmers also lacked confidence in answering the questionnaire, and had difficulties in following its structured format. Although the focus on two crops had been deliberate in order to simplify the context for the respondent, in practice this limited discussion as it did not capture the full range of innovations being made on-farm, and so methodological changes were made. A widely encountered challenge was that respondents were more accustomed to promoting positive achievements than to analysing or evaluating and especially from a social perspective. Further, farmers were reluctant to provide accurate information on production quantities in case it led to their production plan being increased with Acopio.

Adapting data collection tools

The questionnaire had been designed to gather quantitative data relating mainly to the current year. To ascertain longer-term trends, the author had prepared another quantitative form for completion by farm administrators. However, given the recent changes in land tenure and in institutional responsibilities, it proved very difficult to ascertain whether such information existed, or to access it, at both farm and institutional levels. Because of this lack of quantitative data, it was not possible to run statistical analyses.

The two RRA tools most effective for drawing out relevant information were found to be the seasonal calendar and the problem-causal tree. The first of these could also be used to incorporate a longitudinal dimension by comparing with previous cropping years. The success rate of the problem causal analysis varied. Notwithstanding evidence from the field, suggesting that the central production problem of the tree might be a lack of petrol or of agrochemicals was met with denial by some respondents.

The field work team

During the first fieldwork phase, the author had undertaken all the work herself. For this second perspective, the author worked at various times with 1 to 3 researchers and field assistants. At times, the team would split into two, with one member applying the quantitative questionnaire, whilst the others used the qualitative tools. (To maintain quality control, the author had gone through the questionnaire with the team members prior to its application.) The tools were continually discussed and adapted. Where responses were found to be identical, such as on market prices or farm regulations, so the line of questioning was dropped. Inspired by the accruing levels of understanding and confidence by the team, other lines of enquiry were added. Throughout, a degree of quantitative consistency was maintained in order to compare different geographical regions.

One challenge encountered was the difference in backgrounds of the team members. In particular, the author was a generalist and trained in participatory approaches, whereas the other team members were more specialised and held presumptions about the issues under study. On the other hand, the team members made a considerable contribution to the project, contributing different knowledge and insights, and stimulating responses and interactions which the author, as a non-Cuban, would have been unable to achieve alone. One field assistant, for example, himself a longstanding ecological farmer and consultant, was able to establish rapid trust to the extent that the respondent would open up with some rich anecdotal story. Another team member had the curiosity and nerve to confront and question certain institutional responses.

4.6 FIELD THEME 3: FOOD SYSTEM TRANSFORMATION IN THE 1990s

4.6.1 Background and methodology

Methods

A higher level objective of the PPB Project was to contribute to sustainable food security in Cuba. Although the two discrete research projects already described did not explicitly tackle food security, primary data to respond to this third field perspective was gathered on an ongoing basis within these field work periods between 1999 and 2001. Supplementary data was also gathered through visits to the provinces of Villa Clara and Las Tunas, and through other individual farm visits, interviews and informal meetings with urban and rural householders, farmers, agricultural research and extension agents, and representatives of municipal, provincial and national departments of the Ministries of Agriculture, of Science and Technology, and of Public Health.[77] These included with entities specifically involved in food distribution security: Acopio, Frutas Selectas, and the Institute for Nutrition and Food Hygiene (INHA). A significant amount of secondary information was also obtained in-country.

Tools

A checklist of field research questions is shown in Box 4.6. In addition, the standard farm questionnaire (of Appendix II) was modified to include an addition on food security, as shown in Box 4.7, and this was applied during field work in Cienfuegos and Holguin.

4.6.2 Discussion of methods used

Much of the understanding developed on this theme came from secondary information, and much of this from literature that was only available within Cuba. It should be emphasised that issues surrounding food supply and security were sensitive for the Cuban authorities. Sometimes it was not possible to gain access to specific documents or to arrange interviews with key official functionaries in the food system. This official sensitivity prompted a certain caution, perhaps over-caution, by the author in broaching the topic. Nevertheless, as field work progressed and questions relating to food supply were included in discussions, little avoidance was encountered amongst

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[77] Attempts were made to contact other Ministries related to the food sector, such as of Exterior and Interior Trade, and of Food Industry, but interviews were not granted.

grassroots respondents (farmers, householders) to answer these questions. In daily life, Cubans were very receptive to talking about their food supplies and difficulties in obtaining certain foodstuffs. In retrospect, more primary data could have been gathered on this issue.

Box 4.6 Checklist of questions relating to the food system and food security

Policy aspects

What is the national food policy?

Issues: background philosophy, change to agriculture, productivity, national strategies (agric. inputs, credit, research and extension, market and distribution, strategic reserves, monitoring and early warning, nutrition and dietary practice), national level food supply trends

Institutional aspects

Nature of the institute? (Structure, regional specificity, staffing, age, mandate, linkages, funding, information and service provision)

Institutional strategies for coping with change since 1989? (research strategies - project duration, participation, interdisciplinary, target priority groups, research training, M&E, use of local knowledge, diffusion of results)

Future strategies and priorities? (including if more inputs enter the country)

Changes in food security since 1989? (import/export trends, national production - quantity and type of produce, rationing, local markets and prices)

Perceived coping strategies of the people?

Current levels of food security? (include regional differences)

Methods for measuring food security?

Impact of changes in agriculture on the diet? (produce quantity and quality, freshness)

Perceptions on health characteristics of an organic diet?

Changes in the health of the population since 1989?

Opinions on genetically modified food crops?

Food collection/distribution aspects

Changes over the last 10 years?

Changes in the amount and type of different crops produced in the region?

Changes in the number and size of farmers and farms?

Specific changes in quantity of: legumes, indigenous food crops, meat?

Impacts of changes on the degree and type of imports and exports?

Methods for calculating and organising the ration system?

Reasons for Cuba's rationale over food imports/exports?

Changes in incidence of farm worker health through use of agrochemicals?

Perceptions on the degree of balance of the current diet? (compared to 10 years ago)

Perceptions on change in product quality?

For urban and rural dwellers

Number of people living in the household, and sources of financial income?

Sources of food, composition of the rations, and total costs in an average week?

Sources of purchased imported food?

Level of product availability every week?

Other products that could usefully be available in the rations or on the market?

Opportunities for purchasing food products through unofficial channels?

Food purchasing preferences, if money no object?

Compare situation with that ten years ago (quantity, price, type, availability, black market, affordability)? (impact of the agricultural crisis on food intake?)

Perceptions on level of food sufficiency?

Potential for storing food, including type of storage facilities?

If there are children in the household, does the State make special provisions for these?

Perceptions on their consumption of a healthy diet (balance, food quality)?

Type of information received on food and health?

Main types of illness in the household, and possible causes?

Box 4.7 Food security supplement to farm questionnaire

7.5 Where does your weekly food intake come from?

Source	Percentage of total weekly food
Co-operative production	
State food ration	
Agricultural markets	
Peso shop	
Dollar shop	
Self-provisioning	
Other sources	

7.6 Is there more or less food availability since the year:

1988 More [ ], Less [ ]

1993 More [ ], Less [ ]

4.7 FIELD THEME 4: THE DEVELOPMENT OF ORGANIC AGRICULTURE

4.7.1 Background

At the time of the author's arrival in Cuba, and during much of the field work period, ecological and organic agriculture was a politically sensitive issue (for reasons discussed in Chapter 10). This may have contributed to the early delays in obtaining research permission. In the context of the research objective – of factors which may challenge the development of ecological agriculture, this fact alone made organic agriculture an issue worthy of investigation.

4.7.2 Methodology

Researching this theme, as with the previous one, relied on a more ad-hoc methodology. Issues surrounding the use of organic inputs, and of differing intensities of technology use, had been built into the two previous research studies for the PPB Project. This field data contributed to theme 4. At farm level there was little ongoing certified organic production and therefore no opportunity for an in-depth case study on such. Nevertheless, the focus on banana enabled a more detailed investigation surrounding the potential for certified organic banana production, and other opportunities arose for enquiry into organic production and institutional support in Cuba. The Cuban organic movement was particularly helpful in accommodating this enquiry.

Methods

Interviews on the potential for organic banana production

Interviews were held with banana producers in the provinces of Havana, Pinar del Rio, Cienfuegos and Holguin; and also with relevant institutions: ACAO, ACTAF, INIVIT and MINAG. A checklist of questions additional to those already given in Appendix I, is provided in Box 4.8. Perspectives were also gathered on genetic modification and its potential role in Cuban agriculture.

International workshop on organic banana production

A workshop was attended in the Dominican Republic, organised by INIBAP/CTA, on Small-Holder Production of Organic Bananas in the Caribbean (Oct 31st – Nov 3rd 1999), and a post-workshop event in Cuba, through which the author visited sites of banana production and talked with key actors in the Cuban banana sector.

Box 4.8 Checklist of additional questions for organic banana production.

General questions

- Main technology changes in banana production since 1989
- Organic technologies and the main challenges to their widespread adoption and use.
- Current input recommendations for banana. (What do farmers actually do in practice?)
- Difference in breeding strategies for high input, low input or organic production
- Future possible directions under current conditions, and strategy when inputs become more widely available

For research and extension

- Current research on ecological production, and research articles
- Potential role for genetically engineered crops

For input supplies

- Issues surrounding the provision of organic inputs

For collection/marketing

- Differentiation over product quality
- National market for organic products

Policy level

- Existence of specific policy on organic production.
- What is the future strategy under:
  - current conditions
  - conditions of more input availability?

Postal survey

Figure 4.2 Postal survey questionnaire on organic agriculture

ENCUESTA : LA AGRICULTURA ORGANICA EN CUBA

Estimado delegado:

La encuesta forma parte de un estudio sobre agricultura sostenible en Cuba, y su cooperación resulta muy valiosa. Le garantizamos el anonimato.

1. ¿Desde qué fecha se interesa activamente por la agricultura orgánica? ....

2. ¿A través de qué vía le llegaron las primeras informaciónes sobre la agricultura orgánica? ....

3. ¿Cómo ves el futuro de la agricultura en Cuba?
   (a) Con predominio de técnicas orgánicas: Si[ ]
   (b) Con predominio de técnicas convencionales: Si[ ]
   (c)Otro: ....

4. ¿Cuáles son, desde tu punto de vista, tres fortalezas que apoyan la agricultura organíca en Cuba actualemente?
   1) ....
   2) ....
   3) ....

5. ¿Qué acciones serían necesarias para impulsar mas la agricultura orgánica en Cuba?
   1) ....
   2) ....
   3) ....

6. ¿Qué esperaba encontrar en este evento?
   ....

7. ¿Qué encontraste en este evento?
   ....

8. Diga por favor: (i) ¿A qué se dedicar? ....
   (ii) ¿En donde?.....................
   (iii) ¿Edad?.........................
   (iv) ¿Sexo?..........................
   (v) ¿Pais?..........................

Muchas gracias!

Further information gathering, on perceptions of ecological agriculture in Cuba, was planned for the Cuban National Conference on Organic Agriculture, due to be held in May 2000. When this conference was postponed, the author instead sent out a short postal questionnaire to the Cuban conference registrants.

This questionnaire comprised of six simple questions and was explicitly anonymous. The questions were largely open-ended, so as to elicit the maximum response. The questions addressed the following:

- reasons for interest in organic agriculture,
- relation between the organic movement and the Special Period in Cuba,
- the main knowledge and support institutes,
- whether the Cuban experience of the Special Period has led actors to further believe in or refute organic agriculture as a viable way forward,
- the factors necessary for support of such a system,

the challenges and hindrances to the development of organic agriculture.

Some basic details of the respondents were also asked for. The questionnaire is shown in Figure 4.2. The questionnaire was sent to 137 Cuban farmers, researchers, ministry staff and other professionals, all over the country. Stamped, addressed envelopes were enclosed for return to the host institute in Cuba. 73 questionnaires were returned during the period of May to July 2000, i.e. a response rate of 53%. The majority of respondents, 55%, were based in Villa Clara and Havana. However, of the 15 provinces in Cuba, 13 were represented by respondents; with 42% from the western, 33% from the central, and 26% from the eastern provinces.

4.8 OTHER OPPORTUNITIES AND SOURCES OF INFORMATION

4.8.1 Information gathering opportunities within Cuba

The complete range of institutions visited during field work is provided in Box 4.9. These institutes participated in the research or were visited for interviews, meetings, or use of libraries, at municipal, provincial and national levels.

Box 4.9. Main institutions visited for field data collection, at national, provincial and municipal levels, in Cuba during 1999-2001

Ministry of Agriculture and associated entities: Departments of Urban Agriculture (incl. Agricultural Services Shop), Science and Technology, Quality Control; National Institutes of Soils, Plant Health (INISAV); Provincial subdelegations; Enterprises of Mixed Crops, Livestock, Citrus, Seeds, Frutas Selectas; Seed Inspection and Certification Service; Centres for the Reproduction of Entomophages and Entomopathogens (CREE); Research institutes: Soils Research Institute, Plant Health Research Institute (Sanidad Vegetal), National Research Institute of Tropical Agriculture (INIFAT), National Research Institute of Tropical Roots and Tubers (INIVIT), Horticultural Research Institute 'Liliana Dimitrova' (IIHLD), Pastures and Forages Research Institute (IIPF), Institute of Agricultural Mechanisation (IIMA), Irrigation and Drainage Research Institute (IIID), Territorial Agricultural Research Station of Holguin (ETIAH); Acopio, National Association of Small Producers (ANAP), Cuban Association of Agricultural and Forestry Technicians (ACTAF), Cuban Association of Organic Agriculture (ACAO).

Ministry of Higher Education: National Agricultural University of Havana (UNAH) (including the Centre for Studies in Sustainable Agriculture (CEAS)), National Institute of Agricultural Sciences (INCA), Institute for Animal Sciences (ICA), National University of Havana (UNH) (Faculties of Geography and Sociology), Central University of Las Villas (UCLV), University of Holguin, University of Cienfuegos.

Ministry of Science, Technology and Environment (CITMA): Research Institute of Ecology and Systematics (IIES), Tropical Geography Institute (IGT), Centro de Informacion, Gestion y Educacion Ambiental (CIGEA), Foundation of Nature and Man (Fundación de la Naturaleza y el Hombre), Botanic Gardens of Cienfuegos, Institute of Plant Biotechnology, Genetics and Biotechnology Research Centre (CIGB).

Ministry of Food Industry: Institute of Nutrition and Food Hygiene (INHA)

National Statistics Office (ONE)

Regional offices of: Food and Agriculture Organisation (FAO), European Union (EU).

Other primary and secondary information was collected through smaller experiential opportunities. Table 4.4 lists the sources of this information and the methods by which the data was gathered. The vast majority of sources contributed information relevant to all of the research issues.

Table 4.4 Other opportunities for primary and secondary information gathering in Cuba, and the methods of collection in Cuba.

Opportunity	Event/method
Conferences and tours	I International Meeting on Urban Agriculture. INIFAT, Havana. 1995. (co-author of paper)
	Study tour of urban and organic agriculture in Cuba, 20-28 February 1999 Organised by Food First, California.
	Participatory Plant Breeding Workshop, Instituto Nacional de Ciencias Agricolas (INCA), Havana. April 1999 (Workshop facilitator)
	Conference on Co-operativisation, Universidad de las Villas, Santa Clara, October 1999.
	XII Scientific Seminar on Agriculture, Instituto Nacional de Ciencias Agricolas (INCA), Havana. 14-17 November 2000
	Conference on Gender. University of Havana, 2000
	IV Meeting of Organic Agriculture, Havana, May 2001 (Poster presentation)
Other field visits	Pinar del Rio Province, accompanying foreign researcher. Visiting UBPCs and MINAG extension workers (2 days, 1999)
	Farm work on mixed crop and livestock CPA farm, Villa Clara Province. Living with a farm family and working as work brigade member (mainly weeding cassava crop) (1 week, 1999)
Other opportunities	Collaboration with German research team (University of Marburg) to apply five key questions of the author into a CPA farm survey in Havana province.

4.8.2 Information gathering outside Cuba

Further sources of primary and secondary data, external to Cuba, were as follows.
Secondary literature:

- Internet resource centres, particularly of research institutes in the USA - Food First, University of Gainsville, Florida; LANIC, University of Texas.
- Resources centres in Europe, such as the International Service for National Agricultural Research (ISNAR), the Hague; Institute for Latin American Studies, London.

Primary information:

- Informal meetings with Cuban scholars attending courses at Wageningen University,
- Formal and chance meetings with research groups also involved in activities in Cuba, such as with CIRAD, Montpellier, France; School of Biological Sciences, Uppsala, Sweden; University of Marburg, Germany; BOKU, Austria; FiBL, Switzerland; University of Guadalupe, Caribbean.

4.9 OVERALL COMMENTS ON METHODOLOGY

4.9.1 Usefulness of the field tools and frameworks

The author stuck fairly closely to the field methods first developed, throughout. Whilst there were many adaptations of the tools, the same kit was used. This was because, in practice, the large number of variables in conducting the research allowed little attention for methodological inventiveness. Further, a consistent set of tools provided an anchor within the surrounding uncertainty. For the same reason, the grounded theory and exploratory research approach were also held as constants. The theoretical model was, however, expanded early on from a knowledge system to a more embracing livelihoods framework. This framework served to frame the different sets of actor groups and their interrelationships with each other as well as with the external influences of the period. It also helped to break down factors external to the individual or group, and those internal factors, which served to discuss the key issues of relevance to this thesis: the farm-level and institutional practices and coping strategies, cognitive and learning processes, and the impacts of external change.

4.9.2 Maintaining a focus whilst being open to emerging phenomena

At first, the approach selected only those people, institutes and events which appeared to have direct relevance to the research, turning down other opportunities to avoid being side-tracked or overwhelmed with information. Yet such an approach tended to conflict with the clear mandate of the research plan, which was to ascertain what was happening on the ground in Cuba. It also became obvious that the building of social capital was very important in Cuba for increased access to information. Overall, and although space had been made in the scheduling for an in-depth follow up of a previously unanticipated issue, the very act of keeping 'an open mind' for emergent issues was not conducive to putting value on one particular issue over another, and so in practice nothing emerged.

This conundrum may be partly explained through critique of the grounded theory approach, which, although claiming to be objective, requires some subjective input or perspective (Ilberry & Maye, 2004). If enquiry is not theme-based, but is instead left open for the unexpected, then nothing 'of value' is seen. This tended to be the case in Cuba for as long as the author attempted to take an unbiased perspective. Therefore, during the later stages of field work, advantage was taken of spontaneously emerging and possibly serendipitous opportunities. In this way, the final field theme - on the development of organic agriculture – was built up, not because it appeared as an emergent phenomena, but because of the supportive nature of the individuals involved in the organic movement relative to other subgroups encountered, i.e. for quite a subjective and pragmatic reason.

4.9.3 Practical challenges to carrying out field work

Throughout the periods of field work, certain challenges were encountered by the author in accessing data. The reasons for this included the following:

- Some topics were too sensitive to allow a direct line of enquiry, and/or enquiry was met with a zero or avoidance response (this sometimes related to the author being foreign).[78]
- The field opportunities made available were not wholly appropriate for gathering the relevant data, and the author and her project did not have sufficient status to access higher levels of information.
- The author was sometimes overly cautious in some lines of enquiry, and did not dig as deeply as might have been possible.
- The ambitions for data collection were sometimes rather highly set.
- The data was simply not available, such as economic analyses per farm, published research results, institutional annual reports, aerial photographs or land survey information.

4.9.4 Recommendations for undertaking research in Cuba

Given the sanctions and other actions of the United States against Cuba (see for example, Baker, 2004), the country is understandably cautious about working with foreign researchers on issues of domestic importance. During the course of the research period, many other foreigners interested in undertaking their own research there came and left empty-handed. When attempting research in

[78] On several occasions during interviews, stories would change, mainly as a result of discrete exchange between interviewees during the course of the interview. On one occasion, for example, the interviewee was explaining how organic banana production was impossible for the moment, and then, after receiving a scribbled message from a colleague, made a u-turn to explain how Cuba was already almost organic. On another occasion, a senior interviewee stood behind the author and made hand signals to her team change the conversation.

Cuba, the author encountered strict procedure and a lot of luck and chance. Parameters change radically according to the individual. Based on this, Box 4.10 identifies some recommendations for attempting to undertake research in Cuba, as suggested by the author.

Box 4.10 Recommendations for success in organising research in Cuba

Make a reconnaissance mission on a tourist visa, as a tour arranged by an institute or to a conference, to assess the opportunities, make contacts and ascertain the issues.
Negotiate directly and be clear of the information required from you.
Make your status clear e.g., student or professional (this may affect institutional costs).
Allow 3-6 months for a work/study visa to come through.
Expect to pay (though rates vary).
Keep proposals methodologically conservative and with technical relevance.
Seek assistance and advice from a range of sources, and try several approaches.
Especially for the social sciences, be adaptive and seek niche opportunities, including outside the agricultural research sector (e.g. try sociology or geography departments).
Identify a topic that is of relevance to Cuba today.

4.9.5 Concluding remarks and correspondence with subsequent empirical chapters

Substantiating causes for the descriptive analysis

In summary, the actual time spent on field work was approximately one and a half years, spread over 1999 to 2001. During that period, 329 interviews and meetings were made, and an additional 106 responses from two different surveys, almost all within Cuba. These figures include 86 Cuban farmers from 37 different farming units.

The field work comprised ongoing triangulation of both secondary and primary information. As discussed, sampling was purposeful, and because the author was unable to undertake a statistically representative quantitative survey nor to access sufficient representative secondary data, so analysis was made verging on the anthropological, the primary evidence built up of perspectives from individuals and groups and supplemented by secondary information where possible. Out of these perspectives, evidence of shared realities were taken as fact, and these generalised where appropriate. This evidence included, for example, nationwide regulations on market taxes, mechanisms for planning production, or sources of inputs or foodstuffs. Within the common reality shared by Cubans was also their struggle against external forces, and the ideological values which united them. Other primary evidence was taken as individual and group constructed reality, and because of the purposeful sampling approach, generalisations about these were avoided and, at most, trends were suggested for the regions studied. Many diverging realities emerged concerning the nature of and approach to agriculture in Cuba, and in order to preserve their individualised nature, so a more lengthy description was necessary over a more succinct synthesis. This attempt at preservation of meaning manifests in the somewhat conflicting opinions set out in the analyses. The more extreme realities were sifted out, but many others retained, in order to provide a flavour of the diversity encountered and also to avoid additional construction by the author. Another check on re-interpreting evidence by the author was the continual cross-checking with Cuban counterparts, not only during the field work process but also, where possible, during the analysis and write-up. This was particularly helpful in avoiding unrealistic generalisations.

The use of descriptive detail also served to build up evidence. Because policy documents and higher-level actors were less accessible to the author, so policy had to be inferred from the collection of various smaller pieces of evidence visible at field level, from the over 300 interviews undertaken and qualitatively interpreted. Notwithstanding the length of these descriptive analyses, they identify nuanced features which may otherwise have got lost with a more quantitative approach, and they provide a rich account of rural conditions in contemporary Cuba within an otherwise information-dearth situation.

Keys and currencies used in subsequent field analyses

Through this nonconformist approach, the field work took maximum advantage of the opportunities provided to give a rich picture of the issues selected for research. These field themes are dealt with consecutively from Chapters 6 to 10. Prior to these, Chapter 5 reviews the available secondary literature for an overview of the basic organisational structure and major changes in post-crisis Cuban agriculture up to 1998, which provides a back-drop for the field work findings.

Table 4.5 Coding categories for the field sources

Main category	Sub-category	Code
Farmer		F
	UBPC	F/U
	CPA	F/P
	CCS	F/C
	Independent	F/I
	Organoponico	F/O
MINAG		MA
	Research	MA/R
Ministry of Health		MH
	Research	MH/R
Ministry of Higher Education		MES
	Research	MES/R
Ministry of Science and Technology (CITMA)		MST
	Research	MST/R
Ministry of Food Industry		MIA
Key individual informants		KI

In all these chapters, and for the purpose of verification, specific primary data is often referenced back to the individual, human source. This is done largely to emphasise that information was of an individualised nature rather than a generalisation. It also helps to trace back the context of the individual, given the emphasis on constructed realities. Each source is coded rather than named. The coding system relates to the profession of the individual, commencing with the main category and followed, where appropriate, with a sub-category, and finally an individual number. The categories are shown in Table 4.5. So, for example, the eleventh CCS farmer interviewed has been coded as F/C/11. Similarly, the first researcher working for the Ministry of Agriculture is coded as MA/R/1. The author holds the full details of each source.

In addition, information on costs and prices, which was usually – but not always – provided to the author in Cuban pesos,[79] is converted into dollars, based on the contemporary conversion rate of 20:1.

[79] Cuban pesos refers to '*moneda nacional*', rather than the Cuban Convertible Pesos introduced in November 2004 to replace dollar circulation in the country.

5 MAJOR AGRICULTURAL STRUCTURES IN POST-CRISIS CUBA

5.1 INTRODUCTION: OVERALL POLICY REFORM

5.1.1 Introduction

This chapter describes the major post-crisis agricultural structures of the 1990s. In doing so it provides the link between Chapter Two's account of Cuba up to the crisis and the period when fieldwork commenced in 1999. In describing the institutional set up, it provides the backdrop for understanding and interpreting the field results of the subsequent empirical chapters.[80]

5.1.2 Overall policy reform

The demise of the Soviet bloc led to a drastic drop in the subsidies received by Cuba. As spending was readjusted, all sectors suffered. Certain aspects of agriculture were less affected, owing to the State prioritisation of spending on the production of export items and the replacement of imports, and measures were also taken to prioritise food production (Castro, 1996). In general, the State realised that Cuba had to become more self-sufficient, and this meant increasing efficiency in two ways: through streamlining and through providing incentives.

Out of these critical early years, Cuba has found ways to re-emerge, based largely on its own resourcefulness and resources. The basis for this re-emergence, as identified by Rosset & Benjamin (1994), Garfield (1999) and Funes (2002), was the well developed social infrastructure and human resource base in which the State had invested since the Revolution. Thus it maintained the ability for subsistence occupations, and in particular agriculture, to continue. In addition, Cuba was not completely isolated - other countries continued to trade with it. Another important factor was the absence of the corporate sector, landlords, and so on, to divert or dilute State efforts in fulfilling social objectives.

Major reforms to the agricultural sector have been identified by Miedema and Trinks (1998) and Windisch (1994) as follows:

- Production techniques and technologies: the introduction of biological pest and disease control, of biological soil fertility strategies, of draft power, and training;
- Farm organisation and incentives: restructuring of farm size and organisation (creation of UBPCs, reorganisation of other State farms and of CCSs), programme of 'linking man to the land', land made available in perpetuity, increasing rural wages, and creation of new agricultural markets; and
- Institutional organisation: decentralisation of agricultural institutions, and refocusing of agricultural research and extension strategies.

[80] Few socio-economic commentaries or evaluations of grassroots level exist for this period. One exception, which is used in this chapter, was the pioneering account by Miedema and Trinks (1998) of their eight months in rural Cuba in search of the elusive "Alternative Model of Agricultural Production".

The major institutional structures existing post-crisis are discussed in turn. First, however, comes a brief account of the major, post-crisis, agricultural success story; one that has inspired the perception of an organic Cuba: the rise of urban agriculture.

5.2 THE RISE OF URBAN PRODUCTION: THE VANGUARD FOR WIDESPREAD ECOLOGICAL AGRICULTURE?

5.2.1 Introduction

The success of urban agriculture in Cuba provides the basis for many foreign accounts of Cuba's transition towards an ecological agriculture. Cuba's urban agricultural movement undoubtedly encapsulates all the positive forces arising out of the ashes of the crisis. This section summarises its development, drawing on the relatively extensive international literature on this topic, supplemented by field interviews[81] conducted by the author.

5.2.2 Historical development of urban agriculture

Early grassroots development

Urban agriculture emerged spontaneously out of the hardships of the early 1990s. For urban dwellers who had migrated from the countryside, cultivating urban waste land and keeping small livestock was a natural coping strategy. Possibly the first co-ordinated effort was the Santa Fe project in the north-west of Havana City, initiated in 1991 by individuals who went on to become co-founders of the Cuban organic movement. Taking advantage of the available resources within the community, they reclaimed empty urban space for food production to help overcome irregular and inadequate food supplies, using the principles of ecological agriculture by default. Production tripled over the first three years to supply approximately 30% of local food needs (Windisch, 1994).

Successful State backing

According to Companioni et al. (2002), urban production was based on three principles: the use of ecological methods that do not contaminate the environment, the use of local resources, and the direct marketing of produce. The advantages of, and rationale for, urban agriculture quickly became clear. Urban centres had the highest demand for foodstuffs, especially perishables that were difficult to transport. Such produce – vegetables, fruit, flowers, spices and small livestock – required a high labour input that was readily available in the cities. Further, city wastelands and neglected areas were otherwise becoming breeding grounds for disease (Companioni et al., 2002). The State recognised the potential of urban agriculture in contributing to the National Food Action Plan and supported it by making land available for growers, providing them with appropriate extension services, and organising marketing (Murphy, 1999). In 1994 it set up the Department of Urban Agriculture that, in 1998, became part of the Ministry of Agriculture. Already by that time, urban production was well developed, and the new Department, and research groups allocated to work on urban systems, found themselves running to keep pace with urban producers. As one researcher described it "*Development was ahead of research due to the high demand for techniques, so it was participatory and spontaneous from the start – we had to give out technologies before we could even test them, and in fact the farmers tested them.*" (MA/R/23).

As such, the urban agricultural movement differed in its development from the top-down model usually employed in Cuba; in this case the grassroots was driving research and policy. This could be justified with pragmatic reasons. Urban agriculture was able to demonstrate its success fairly rapidly; production doubled or tripled every year since 1994 even whilst technologies were being

[81] Direct quotations from these field interviews are given coded references. The codes are explained in Chapter 4.

improved. This gave the State further incentive to continue with its support and facilitation (in terms of formalising land access and legalising the right to sell produce) rather than placing restrictions. In 1997, a Resolution (527/97) was passed which allowed each urban dweller in Cuba to be eligible for up to one third of an acre of land. By December 1999, more than 190,000 lots had been taken up (Sinclair & Thompson, 2001). Success could be measured not only in terms of production, but also by the satisfaction of city dwellers who were empowered to resolve their own food problems (Sinclair & Thompson, 2001). The 'hands off' facilitatory approach by the State encouraged a diverse range of responses to the heterogeneous local conditions (Companioni et al., 2002). As the Head of International Relations of the Department of Urban Agriculture put it "*Our objective is for producers to fulfil their production goals with as much ease as possible*." By 1999, urban production was supplying 5% of Cuba's total domestic production, and this mainly salad crops in the cities (MA/R/23).

Significant support was also permitted by the State from international sources; in the early days from foreign NGOs interested in supporting the Cuban cause, and later on from bilateral donors concerned with reducing urban poverty. This meant that Cuban researchers had comparatively good access to international materials. It also enabled international groups such as the permaculture and organic movements to make significant input into urban agriculture as a serious development option. Sociological studies were undertaken which may not have been possible in rural areas, such as the work of Murphy (1999) on agriculture and food security, and that of Carrasco et al. (2003) on the Agricultural Knowledge and Information System. Finally, this international interchange encouraged foreign reporting to focus on the urban situation.

5.2.3 Urban farming systems

There were three main types of urban farm: the State or co-operative owned *organoponicos*, privately owned intensive community or home gardens (*huertos intensivos*), and parcel or patio plots (*parceleros*).

***i) Organoponicos*:** These consisted of constructed beds filled with soil and stones for drainage and then with 40-50% organic material. The raised-bed design of *organoponicos* was necessary due to the poor quality of the urban terrain. Seeds were generally transplanted from nursery beds. In 1997 there were 400 *organoponicos* in Havana City alone. High performing *organoponicos* were selected for preferential access to inputs and credit which enabled them to install high-tech facilities such as cement pavements, microjet irrigation systems, water pumps and iron-and-mesh frames for protection of crops from the summer sun.

ii) Intensive home gardens: These were smaller, privately owned plots, more often worked with family labour and having soils of adequate quality for intensive production without the need for raised beds. Seeds could be planted directly into the soil. One family-run home garden in Havana, working seven days a week, claimed to earn more than the *organoponicos* (F/HG/1).

By the end of 1997, *organoponicos* and intensive home gardens occupied 1,008 ha with 15,000 full time employees nationwide, with the State aim to cover 3,300 ha by the end of 1998. These figures indicated that 1 ha could support 15 full time jobs.

iii) Parcel plots: *Parceleros* were independent from the State, farming on wasteland and sites of collapsed buildings. By the end of the decade there were over 100,000 parcel plots, producing more than *organoponicos* and intensive gardens combined. These *parceleros* were organised into 900 self-help gardening clubs, pooling resources and expertise and organising workshops and events (Chaplowe, 1996).

Three other types of urban agriculture were workplace self-provisioning, suburban farms, and patio cultivation. Many work and educational buildings organised agricultural production on adjacent, including 300 organisations in Havana (Companioni et al., 2002). Even the high-rise headquarters of the Ministry of Agriculture had an adjacent cabbage patch. Around the city of Havana were 2,000 private suburban farms and 285 State farms, typically 2-15 ha in size. Apartment or patio cultivation relied on ingenuity in terms of soil substrate, planting beds, small containers, balconies, and so on, with minimal use of soil, to create a growing space in a concrete environment.

5.2.4 Labour force and wages

Salaries depended on the organisational structure of each individual unit. To encourage responsibility, employees received dividends on a profit-share basis. Generally, salaries ranged from US$ 12 to 40 per month (245 to 800 pesos),[82] although this varied and the head of one *organoponico* claimed to earn $100/month (F/O/04). Many urban farmers were retired people, and only a minority had much previous experience in the agricultural sector – the others included labourers, masons, mechanics, housewives, and other professionals (Weaver, 1997; López, 2000). This lack of experience or training may, paradoxically have assisted with the take up of ecological approaches. As one researcher (MA/R/23) pointed out *"We believe that one reason for success of urban agriculture has been that the people involved have not been previously trained in agricultural techniques and so they have been able to take up ecological techniques more rapidly and efficiently. They are not prejudiced by conventional knowledge and so don't require convincing."* In the 1990s, the urban agriculture sector created 160,000 jobs (López, 2000).

5.2.5 Production

By the late 1990s, each of the main types of urban farm had to meet planting quotas for certain crops based on population numbers, in order for each person to have access to a target of 170g/day of fresh produce.[83] Above this quota, the producer was free to plant whatever he or she chose. Urban agriculture produced largely salad crops and other vegetables, with a smaller amount of medicinal herbs, ornamental plants and flowers. Lettuce covered the largest area, up to 60%, as demand was high, but the farmer had to remain diversified (F/O//01). By 1999, *organoponicos* and intensive home gardens were producing 215g/capita per day of fresh horticultural crops (MINAG, 1999).

5.2.6 The use of agrochemicals in urban agriculture

Many authors have stated or implied that it was forbidden in Cuba to use agrochemicals in urban agriculture, in order to protect the health of urban residents (INIFAT, 1995; ACAO, 1995; Weaver, 1997; Ritchie, 1998; Miedema & Trinks, 1998; Sinclair & Thompson, 2001; Companioni et al., 2002). One foreign information leaflet claimed, for example, that *" Havana is the first city in the world to declare its agriculture fully organic – by law!"* (HDRA, 1997). Roycroft-Boswell (2002, p.25) states that *"By 1996, by-laws in Havana allowed for only organic methods of food production."* Chaplowe (1996), reports that chemicals were used, albeit in very small quantities. One *organoponico* head (F/O/04) explained that he used agrochemicals when required and received financial assistance to purchase inputs which required dollar payments. Personal accounts note the use of low levels of Formulin, Carbaryl, Thiodan and others (Kerry, 2001; Taboulchanas, 2001). A researcher in the National Urban Agriculture Management and Technology Group provided more detail: *"In urban agriculture, our National Group, organised by MINAG and headed by INIFAT, makes unwritten recommendations and a list of standards. Whilst there is no fine to pay if these standards are not met, the producer may not receive continued support from the municipality. In the organoponicos, it is recommended not to use chemical fertilisers. Some producers still use them, but the best plots do not. Sanidad Vegetal, with support by CITMA, implements a national standard for urban agriculture which prohibits the use of agrochemical pesticides unless authorised by the local urban farm centre (granja). Checks are maintained by neighbours who may report anyone using such inputs, and the offending producer may have to pay a fine to Sanidad Vegetal."* Overall,

[82] This is high, compared, for example, to the average earnings of a university professor of 300 pesos/month.
[83] Through the urban markets rather than the ration system.

some types of urban agriculture were under tighter control than others, but none were certified organic.

5.2.7 Ecological production strategies

Good management and planning: According to urban producers, great emphasis was placed on the planning stages as these had proved to be the critical factor for efficiency and success; the beds were always full, and harvests were consecutive, with seedlings always ready to be planted out when a bed became empty.

Pest and disease control: Urban agriculture was highly suitable for ecological input use, because the system was already labour intensive so that micro-management and observation were possible, and both the urban environment and the surface of the raised beds (which were relatively dry and hot) discouraged pest habitats. *Organoponicos* received weekly visits by specialists from Sanidad Vegetal, and care was taken to prevent the spread of pests and diseases from rural areas. Miedema & Trinks (1998) found a range of eight control products being used in *organoponicos* in Havana City. Other control methods employed included: the use of repellent crops such as *Tagetes minutae* (*flor de muerto*), catch crops which attracted the pests away from the cash crop, selection of less vulnerable crops, clean planting materials, nematode-free organic matter, soil inversion for exposure of breeding grounds to sun, removal of crop residues, and rotation when possible. The planting of neem trees was encouraged (MA/R/23).

Soil fertility: One guiding principle for urban agriculture was to "*systematically apply organic matter by using all available local alternatives, and to systematically develop local programmes to assure adequate supplies of organic matter*." (Companioni et al., 2002). Organic wastes came from four main sources: animal wastes, plant residues, industrial wastes and residential wastes (Altieri et al., 1999). The main organic materials were *biotierra* - composted sugarcane residues, *gallinasa* - chicken manure and rice chaff, and cow manure, all supplied by State farms. Occasionally, *Azobacter* was applied as biofertiliser. In 2000, 69,400 tons of compost was applied, and 80,000 in 2001 (González Novo & Merzthal, 2002), at an average rate of 13.5t/m^3 (FAO, 2003).

Seeds: The timely availability of seeds was immensely important. Cuban varieties were used where possible as these were adapted to local conditions. Most urban farms were self sufficient in reproducing and saving seeds from certain crops. However, several salad crops did not produce seed in the climate and so new seed stocks had to be imported each year. The State Seed Enterprise was unable to meet urban agricultural demand, especially at peak periods (MA/R/22), so in 1998 a network of provincial seed farms was set up. Some field sources noted that high agrochemical input demanding varieties were successfully being used under ecological input conditions (e.g. MA/R/21).

5.2.8 Support for urban agriculture

The support system for urban agriculture, along with the production system it served, has been seen as the vanguard for a nationwide agricultural system. The National Urban Agriculture Group (GNAU) regulated and directed the sector, comprising of individuals from scientific and government institutions as well as urban farmers, and covering twenty six sub-programmes (GNAU, 2000). Objectives and targets for these sub-programmes are shown in Box 5.1.

In Havana Province, the Department of Urban Agriculture employed 292 workers, including 12-14 specialists within each of 13 municipalities. Each region had a Municipal Urban Farm Enterprise which co-ordinated production, research and extension activities and networks (Ojeda, 1999). Details of the achievements of urban agriculture were regularly published in the national newspaper – Granma – and used to encourage municipalities to do well. The Popular Councils of each municipality had a qualified extensionist who liaised with farmers to develop demand-driven research programmes.[84] Havana City had 67 such extensionists in 1998. The Popular Councils also assisted with services such as veterinary clinics, farmers' shops, nurseries, and CREEs (Companioni, 2002).

Box 5.1. Objectives from the National Programme, for implementation throughout the country, 2001

- to apply 10kg/m^2 of organic material per year to *organoponicos* and intensive gardens, and a minimum of 20t/ha on plots and patios
- to regularly update the existence of organic material sources in the municipality and at the level of popular councils
- to create optimal conditions for worms to breed
- to popularise and implement vermiculture at the level of each unit of agricultural production
- to improve the recycling and use of urban waste
- to link teaching of agriculture and animal husbandry at different levels with productive urban agriculture practices
- to achieve links with producers and each of the following: agricultural polytechnics and animal husbandry institutes, university faculties and scientific institutions
- to raise the agro-ecological awareness of the population in environmental education while maintaining high quality production.

Source: González Novo & Merzthal, 2002

All inputs, such as seeds and seedlings, biological pesticides, accessories and tools could be purchased in municipal service shops (e.g. the *Casa de Semillas* or House of Seeds), staffed by qualified technicians. These shops also provided free technical advice on the usage of organic inputs. Only those units which followed recommendations were eligible for municipal support for equipment. Specific advice on soil fertility was provided by provincial and municipal Organic Fertilisers Reference Centres. Twelve UBPCs in Havana collected and processed organic material and distributed it across the city (González Novo & Merzthal, 2002), and in 1998 a project was commenced to create worm compost production centres in each province, with the aim to eventually have one in each municipality (MA/R/23). A seed-savers' network was developed by a Cuban NGO 'The Foundation for Nature and Man', for the conservation and use of locally adapted varieties, using reliable producers to multiply seeds which were then distributed to other producers. The Foundation also produced a low-priced and widely available gardening booklet on permaculture methods entitled '*Se Puede*!' (It's Possible!) (Weaver, 1997; MST/2).

A substantial amount of retraining was undertaken, of departmental staff, heads of farm enterprises, and practical on-farm training. According to one researcher (MA/R/23), each urban producer was going on four training courses a year on average.[85] Urban agriculture was monitored through a set of indicators that enabled improvements in sustainability. Nevertheless, some limiting factors to production have been identified as a general lack of resources, technical production constraints, theft of produce, and insufficient training for non-specialist growers (Chaplowe, 1996; Wilson & Harris, 1996; Miedema & Trinks, 1998)

5.2.9 Markets

Parceleros could sell their produce in the street or from their plot. *Organoponicos*, although producing a minimum quantity for the State, were also allowed to sell at the farm gate. Prices were set by the manager of the *organoponico* but had to fall between those of the State and farmers' markets and to be 30-50% lower than the latter. By the end of 1999, 505 vegetable stands had emerged. Modest taxes were imposed on these sales. According to an Oxfam survey in 1997, customers tended to be elderly and the majority spent less than 2 pesos (5c) there.

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[84] Research included developing strategies for testing, evaluating and producing commercial quantities of bio-inputs (Wilson & Harris, 1996). INIFAT played a key role in co-ordinating research for urban agriculture.

[85] Although Wilson & Harris note in an evaluation report (1996) a shortfall in the application of knowledge being promoted due to a lack of understanding of the purposes behind the techniques.

5.2.10 Increasing food security

The State invested in and prioritised[86] urban agriculture for several reasons: the high food demand in the cities, the relatively high free market price of fresh vegetables, the need to nutritionally improve the basic Cuban diet, the possibility of selling direct to the consumer from the farm gate, thus overcoming postharvest losses and transport restrictions, and the potential for employment creation in urban areas (Wilson & Harris, 1996). The income from urban agriculture was crucial to supplementing the generally low state wages of the 1990s (Murphy, 1999). Ritchie (1998 p.1) recounts one urban apartment producer growing grapes on the roof of his building, along with vegetables and herbs in compost-filled tyres, which he sold to supplement his pension. He claimed, *"it is the duty of Cubans to find ways to support themselves, as their contribution to sustaining the gains of the revolution"*.

Urban agriculture played an important role in fulfilling dietary requirements. This could be interpreted in statistical terms, such as the extent to which it fulfilled FAO recommendations of 300g vegetables person/day (Pagés, 1998), or in lay terms, through ensuring that vegetables were available everywhere (MA/43). Urban gardens were able to supply vital vitamins, minerals, some starches, as well as medicines and spices (Chaplowe, 1996). Visitors to Havana were often taken to an old people's retirement home where the residents would relate that, *"our health has improved since we started working outside, our salad and fibre intake has increased, and the need for medicines has reduced."* (F/O/03). Wider awareness of social objectives was prevalent amongst producers. The head of one private *organoponico* (F/O/02) described their objectives as being *"to increase food supply for the local community, to increase fresh vegetable supply, and to improve the environment."*

5.3.11 Urban agriculture in this thesis

The experience of urban agriculture stands as an example of what Cuban society is capable of achieving. As one researcher stated in 1999, *"The organic approach will last, because even now more agrochemicals are available, yet urban agriculture is still organic. Rural farmers need to be organised to achieve the same – whole families need retraining."* (MA/R/23). Notwithstanding this success, urban production contributes only 5% of the national food supply (although a higher percentage of macro- and micro-nutrients). The following three sections review the changes in the rural agricultural sector: changes in production techniques and technologies, in farm organisation and incentives, and in institutional organisation, up to 1998.

5.3 REFORMS IN PRODUCTION TECHNIQUES AND TECHNOLOGIES

5.3.1 Status of imported inputs in the 1990s

Sinclair & Thompson (2001) estimate that even by the end of the decade, Cuba was importing only one-sixth of the fertilisers previously consumed, and fewer herbicides and pesticides. Other figures provide a less extreme picture (CNSV, 1998; FAO stats website). Sugar and potato remained two 'favoured' crops, prioritised for receipt of inputs. For other, 'unfavoured' crops, only 18% of the total area sown received chemical fertilisers in 1998.

In the mid 1990s, world crude oil prices rose, and this, coupled with disputes with Russia over sugar deliveries, contributed to ongoing supply fluctuations in the agricultural sector and continued serious fuel shortages (Mesa-Lago, 1998). One consequence of the fuel shortage was that the area of irrigated land fell by 22,000 ha between 1989-91 and 1998 (FAO stats website), although

[86] The governing council of Havana, which included representatives from the Urban Agriculture Department, had, for example, refused a joint-venture building planned for an agricultural site in Havana (MA/43).

irrigation was concentrated on a very limited number (40 or so) of farming units (Paneque Brizuelas, 1997).

5.3.2 Substitution by ecological production techniques

A national programme for biological pest control had been established in the late 1980s, following on from a national IPM strategy introduced some years previously. Both stemmed from concerns about the negative impacts of agrochemical use (Pérez, 2002). Within this, two main approaches were developed to control insect pests: the release of beneficial insects (entomophagens) which act as parasites on the eggs of pest species; and the use of natural bacteria and pathogens of certain pest species (endemopathogens). Using these two strategies, scientists developed techniques to combat the main pests of major crops, including rice, sweetpotato, sugar cane, cabbage, tobacco, coffee, and citrus (Sinclair & Thompson, 2001). Although production figures of the major controls - *Bacillus thuringiensis* and *Trichoderma* spp - show a significant increase between 1994 and 1997 (Díaz, 1995; CNSV, 2000) figures on the actual usage of biological pest controls were scarce. The 1990s saw large-scale efforts to recycle nutrients and use available sources of organic materials (FAO, 2003). The main organic soil amendments being promoted in the 1990s were manure, compost, worm compost, sugarcane wastes, green manures and biofertilisers. However, and similar to pest control, figures on actual usage were scarce.

In 1992, the Ministries of Agriculture and Sugar established programmes to encourage the use of draft animals. To enable this it became obligatory to deliver all fit bulls to co-operative and State farms. This provided 100,000 bulls, and from there a breeding programme built up numbers to 376,000, from whereon almost 30,000 oxen were being trained annually. Early challenges included a lack of farm infrastructure to support animal traction, of relevant knowledge by the agricultural workforce, of pasture and on-farm fodder supplies (compounded by problems of feed transportation), and insufficient veterinary services (Ríos, 2002). Training was also crucial. Total numbers of oxen had doubled between 1990 and 1997. By 1998, the private CCS and individual farmers, farming 15% of the land, were using 78% of draft animals, whilst State farms, UBPCs and CPAs were using only 22% of draft animals (Ríos & Aguerreberre, 1998).

Rosset (1998) notes that, whilst the use of ecological inputs as a replacement for agrochemicals has been important in maintaining production levels, two other factors had contributed to increasing the complexity and diversity of agricultural systems: intercropping, and the integration of crop with animal production in rotational systems. Diversification was also a key feature: all farms that were previously dedicated to a few cash crops were now obliged to become self-sufficient or diversify for the market.

5.4 REFORMS IN FARM ORGANISATION

Changes in farm organisation were considered necessary to address the longstanding problems of labour shortages (notwithstanding mechanisation), low productivity and inefficiencies of central planning in the State farm sector.

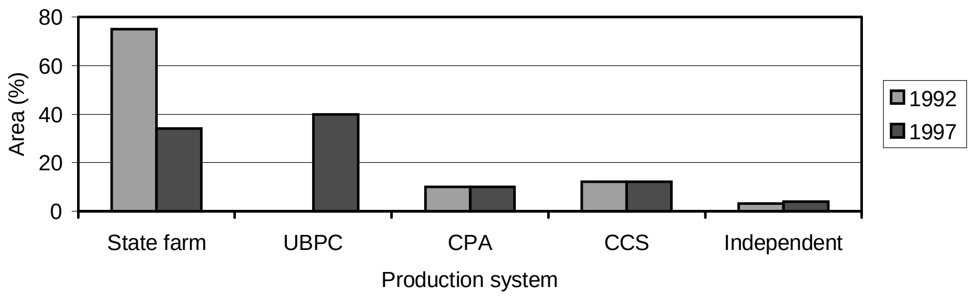
5.4.1 Changes toward co-operativisation

The dismantling of large-scale farms

Overall, since the crisis, there has been a dramatic reorganisation and redistribution of State land favouring the growth of co-operatives, as experience had shown co-operatives to be more productive and especially in a low-input situation (Deere et al., 1994; Deere, 1996, 1997). Even Castro admitted "*The state has not had success in large farm business*." (Granma, 2003). Rosset (1996) expands on this theme "*Once considered a national embarrassment, a remnant of a backward past, peasant farmers are emerging from this crisis with their image revamped by their* *agile response*.” Farms were broken up into smaller production units, and producers were given more responsibility for management (Rosset & Moore, 1997). Compared to the previous structure, there was more heterogeneity at local level in both policy implementation and experimentation (Deere et al., 1994).

Since 1993, two completely new types of production system have emerged: urban production systems (as discussed in the previous section), and Basic Units for Cooperative Production (UBPC). At the same time, some other State farms and CCSs have been structurally reorganised or strengthened. This change in farming structures can be seen in Figure 5.1. In 1992, 75% if cultivable land was under State control, but by 1997 this figure had dropped to only 34% (Fernández, 1998).

Figure 5.1 Area occupied by each type of production system, 1992 compared with 1997 (% of total farm land)



Source, Fernández, 1998

Changes in State farm structures

New Type State Farms

Known as GENTs (Granjas Estatales de Nuevos Tipos), these result from the reorganisation of State farms in 1993, during which process some farms were identified as currently unsuitable for conversion to UBPCs and so continued to produce on a large-scale and industrialised basis by the State. However, several changes were made in their organisation; they were granted more decision-making power, more economic responsibility and better representation of the personal interests of their workers. As with State farms, 50% of profits were distributed amongst the workers, including management staff, 25% went to investment and capital growth, social development and contingency reserves, and 25% to the State budget. Additional labour incentives could be made through bonuses to the fixed salary for the production of surpluses that could be sold through farmers’ markets. Average monthly income was 254 pesos ($0.5/day) (AGROINFOR, 1998).

Basic Units of Co-operative Production

Known as UBPCs (Unidades Basicas de Producción Cooperativa), these co-operatives were formed in 1993 in an attempt by the State to emulate the long-existing CPA co-operatives. Land was handed over in rent-free perpetuity (*en usufruct*) to the farm workers, with the aim of stimulating production. In this transfer, the workers become associates and had to purchase the farm's capital infrastructure. Members had long-term credit arrangements, owned the produce and received an equal share of profits, and could elect their own management teams (Deere, 1997). Decision-making on production was decentralised, yet centralised planning was retained for overall resource management and food distribution (Sinclair & Thompson, 2001).[87]

[87] Herrera (1999) identifies an important difference between co-operatives in other countries and those in Cuba. The former have focused on developing secondary activities such as processing and marketing whereas in Cuba the focus remains on primary production. This may partly explain why Cuba’s co-ops have not yet become economically efficient.

By 1995 there were 1,353 UBPCs covering 37% of Cuba's agricultural area (Everleny & Marquetti, 1995) and incorporating 400,000 ex-State agricultural workers (Lage, 1995). Most State sugarcane farms were converted in the hope of raising sugar yields. Their members were mainly agricultural labourers (95%) and a few had been farmers. There were signs that the UBPCs were more productive than the old State farms, but they were still considered to be economically inefficient and had not yet achieved the results hoped for by the State. Many of these disappointing early results could be attributed to the continued maintenance of old forms of power and administrative structures (EIU, 1997).

Changes in non-State farming structures

Strengthened Credit and Service Co-operatives

Known as CCS-*fortalecida*, the move to strengthen certain CCS co-operatives came about in 1997 in order to further improve their productive potential. (Their productivity was already higher than that of State farms and CPAs even though they received far less State investment (Sinclair & Thompson, 2001).) Strengthening meant fusing two normal CCSs to co-operate over services. They could then draw upon a better range of professional services, and could also make a production plan with Acopio as an entity rather than with each individual farmer member. According to Miedema and Trinks (1998), many CCS members felt that these changes were pushing them closer to the CPA model. In 1997 there were 2,770 CCSs and CCS-*fortalecidas*, covering 912,400 ha and containing 153,640 households (ANAP, 1997).

Increased diversity of farming types

By 1997 there were 1,500 UBPCs occupying 21% of agricultural land, 1,150 CPAs (9.4%), and 2,700 CCSs (12%) (ONE; 1997). In addition, 71,000 individual workers were holding 103,334ha of land in perpetuity (3% - mainly for coffee, cocoa and self provisioning), as well as *organoponicos* and intensive gardens (MINAG, 1998).[88] In addition were 62 New Type State Farms, 75 Granjas operated by the Youth Work Service (Ejercicio Juvenil de Trabajo, EJT), and 19 operated by MININT and MINFAR. Non-State farms became responsible for 90% of sugarcane land and 42% of non-sugar cropping land (Wroe, 1996). Of note here that although non-State farms comprised of the UBPCs, CPAs, CCSs and individual producers, within this, the CPAs, CCSs and individuals were classified as private producers or campesinos, although some definitions did not count CPAs as private.

5.4.2 Incentivising production

'Linking man to the land' (*Vinculación del hombre al area*)

In 1990, a ‘Technical, Organisational and Payment System According to Final Production Results’[89] was introduced, first on State farms in Havana province and then extended, albeit unevenly and non-obligatory, to all MINAG farms around the country including UBPCs and CPAs. Under this system, an individual or group within the farm was responsible for a piece of land and its production – typically 4 people to 13.4ha (Enríquez, 2000) - and received a share of any surplus to the production plan. Conversely, a share might be deducted from the wage packet if production costs were too high and targets not met. (This system was in contrast to the previous one whereby individuals or gangs of workers would be rotated around the farm unit and paid on the basis of days worked.) This new system was designed to increase labour productivity and efficiency, to redress a situation where, according to Rosset (1996) “*The bond had been cut between the farm worker and the land. In crisis, state farms’ unwieldy management units could not adapt to life without high inputs of technology*.” The effects of this on productivity were difficult to assess early on, as it

[88] Field source KI/16 (1999) gives a figure of 42,000 individual *parceleros* nationwide in the same year.
[89] Sistema Tecnólogico, Organizativo, y de Pago por los Resultado Finales de la Producción.

coincided with a decline in inputs and was difficult to implement for short cycle crops or where voluntary workers were involved (Deere et al., 1994). As one Cuban economist explained (Férnandez, 1998) "*The first thing we want to do is to turn workers into farmers, to make them feel like owners and then to produce as the campesinos do, and this along with special education programmes for them.*"

Provision of land in perpetuity

In September 1993, MINAG decreed that small farmers and CPAs were allowed to receive more land in perpetuity if they used it for the production of coffee or tobacco. This specifically applied to old State land, which had fallen fallow during the early crisis years. Distribution would be given based on contract and quota, and as long as this was met it could be used for other commercial activities. Unproductive land could be claimed back by the State (SN/1). In addition, land not exceeding 0.24 ha was also made available 'in perpetuity' to individuals unable to work full-time in agriculture and to pensioners, in order to increase family self-provisioning. 'In perpetuity' meant rent-free leasing, with the State holding the property rights (Rosset, 2002). Deere et al. (1994) note that this move demonstrated a greater flexibility on the part of the State, discarding some long-held principles of opposition to land held in perpetuity.

Change in farm-gate prices

Chapter 2 had described how the State traditionally collected an agreed quantity of produce from each farm or co-operative, at an agreed, low price. In the 1990s, changes were introduced whereby basic prices for produce were still determined at the time of planning, but any surplus production received a slightly higher price from the State (sugar was an exception to this), if the farmer decided not to sell this through other channels. For export crops such as sugarcane and tobacco, part of the purchase price would be paid in US dollars. Individual farmers received this in cash, though in the case of co-operative members it was maintained in a State account which they could access to purchase tools, inputs, clothing, and more.

Opening new markets

Marketing arrangements were diversified in several ways; two changes were specifically to incentive farmers. One was the enabling of direct sales through an agreement between a farm and local sales centre. This was known in Havana as *tiro directo* (literally 'direct throw'). The other change was the opening, in 1994, of over 120 farmers' markets throughout the country, where farmers could sell directly to consumers at prices controlled by supply and demand. Prices here were higher than the sales points of urban agriculture but much lower than on the black market. More detail on these changes, and their impacts, is discussed in Chapter 9.

5.5 KEY INSTITUTIONAL STRUCTURES AND STRATEGIES

"Rural life in Cuba is not the litany of misery it is for campesinos in so many Latin American countries. Cuban farmers can count on rural institutions designed to support them, free, widely accessible social services, an impressive physical infrastructure, access to land, some inputs and a stable market and strong national cohesion in terms of social values."

Sinclair & Thompson, 2001

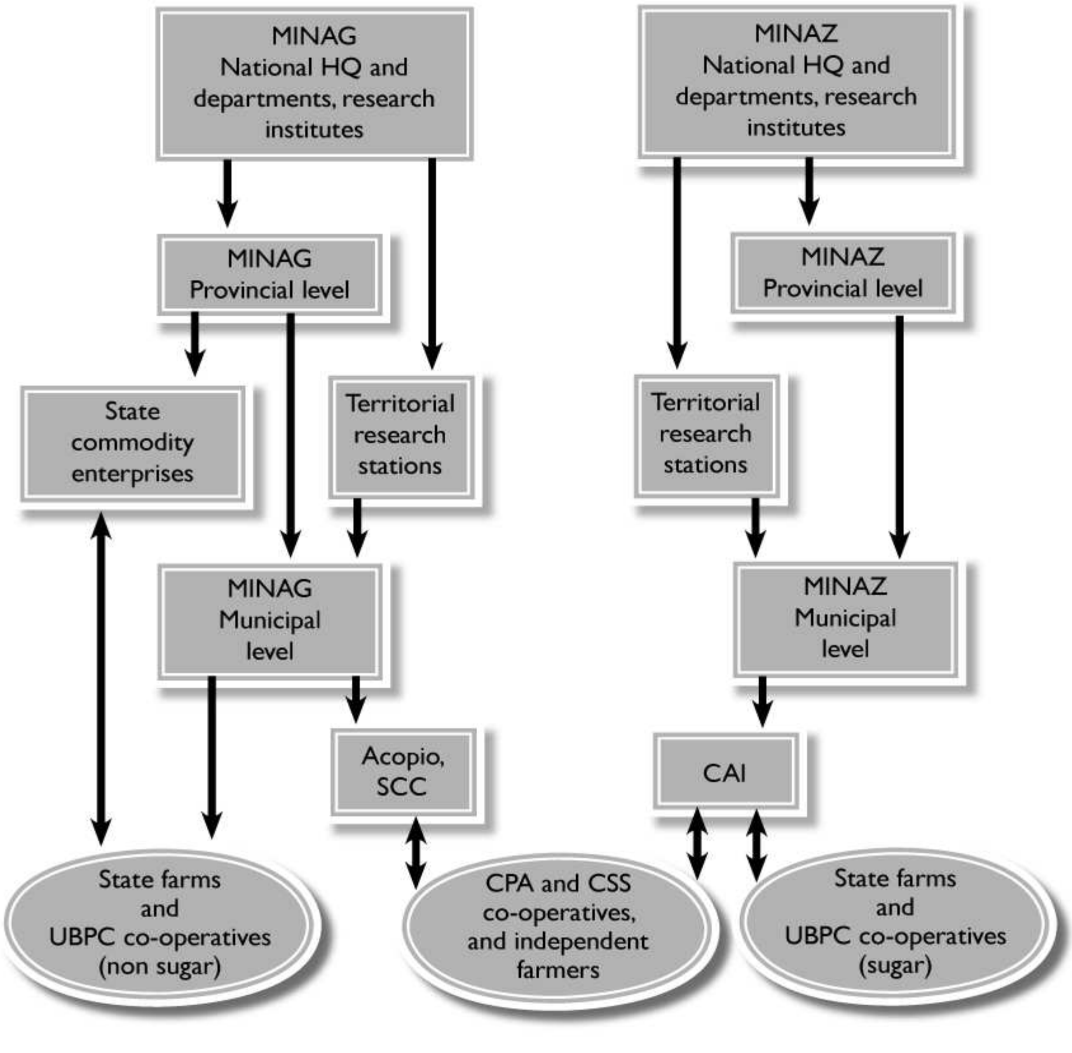
5.5.1 The organisation of agricultural institutions

This section describes the basic structure of agricultural institutions in Cuba. Administratively, the country is organised into 14 provinces containing 169 municipalities and many more Peoples'

Councils (*consejos populares*) at the lowest administrative level. Given Cuba's planned economy and infrastructure, the agricultural support system has a clear structure within this.

Two Ministries were concerned with agricultural production: the Ministry of Agriculture (MINAG) and the Ministry of Sugar (MINAZ). Although institutionally separate, some non-State farms produced for both. A basic organogram of the Ministerial organisational structure is shown in Figure 5.2 and is accompanied by a brief description.

Figure 5.2 Organogram of the institutional structure of the Ministry of Agriculture and the Ministry of Sugar (from Miedema & Trinks, 1998)



(Note that the arrows indicate flows of one or more of policy direction, technology, information or market support)

The Ministry of Agriculture (MINAG) and its entities

The Ministry of Agriculture contained 24 departments and 19 national level research and support institutions that comprised the National Institute of Plant Protection (Sanidad Vegetal), the Soils Institute (Instituto de Suelos), and 17 largely commodity-focused agricultural research centres. For production support and marketing, MINAG operated a nationwide network of institutional entities: production enterprises, the Sector Campesino Co-operativa (SCC), and Acopio, as described later on, as well as running 222 State farms (MINAG 1999). The Credit and Commerce Bank (BANDEC) provided credit to the State farms and co-operatives.

In terms of change, 1994 brought a process of decentralisation, resulting in a dramatic downsizing of MINAG, as shown for its Havana-based head office in Table 5.1. This decentralisation led to many ministerial functions being taken up by the co-operatives themselves

(Sinclair & Thompson, 2001). It also facilitated the emergence of more enterprises and producers involved in distribution and marketing. MINAG continued to maintain control over food production plans, the National Food Plan becoming subsidiarised to provincial to municipal level offices where it was then allocated amongst producers.

Table 5.1 Changes in staffing and structure of MINAG HQ, comparing 1990 with 1998

HQ staffing and structures	Nos. in 1990	Nos. in 1998
Minister	1	1
Vice-minister	10	8
Directorates	38	25
Departments	104	24
Sections	12	0
Employees	1,350	252

Source: Miedema & Trinks, from MINAG, 1998

State Enterprises (*Emprezas*): State production was co-ordinated by various provincial Enterprises, each one specialised in a specific production component or commodity, such as mixed crops, livestock or seeds. There were 487 throughout the country (MINAG, 1999).

Campesino Co-operative Sector (SCC): This organisation worked closely with non-State producers, to sell seeds, work clothes and small tools, and other inputs.

Acopio[90]: The State food collection and distribution enterprise, Acopio, was responsible for making production/delivery plans with farmers, and for the collection, transport and distribution/marketing of produce for the ration and to other outlets. It worked with both State and non-State producers. Almost 100% of State production and about 50-80% of non-State production was moved through Acopio (Oliveros Blet et al., 1998).

National Institute of Plant Protection (Sanidad Vegetal): This family of institutes were dedicated to plant health, embracing pest and disease control; policy, legislation and control of compliance on phytosanitary issues; assistance and control on production of biological pest control products; research on plant protection; and information diffusion to government and producers. It had 257 staff, of whom 84% were researchers, and its research operations were headed by the National Research Institute of Plant Protection (INISAV).

In terms of management of pest and disease controls, recommended chemical dosages for different crops were decided at national level and disseminated in the form of provincial guidelines. Territorial Stations of Plant Protection (ETPP)[91] liased with farmers (specifically on-farm counterparts or '*activistas*') to check on pests and diseases, provide advice and assistance, and ensure that phytosanitary laws were obeyed. Farmers were obliged to adhere to these laws and had to inform Sanidad Vegetal of any pest or disease outbreaks (from Decree Law no.153, 31/8/94). Phytosanitary specialists from the ETPPs had sole entitlement for "prescribing" chemical inputs, and with such authorisation farmers then accessed these from the agrochemical warehouse.

CREEs and Bio-preparation Plants: Officially within Sanidad Vegetal, the Centres for the Reproduction of Entomophages and Entomopathogens (CREE) produced biological control products, mainly *Beauvaria, Bacillus, Metarhizium, Trichoderma, Trichogramma* and *Verticillium*. Established in 1992, there were 192 CREEs by the following year, and by 1998 there were 222 (Miedema & Trinks, 1998). The CREEs were situated on farms, as stand-alone establishments, or in higher education establishments. Depending on location they might be staffed by technicians and/or

[90] Derived from '*acopiar*' meaning 'to store or collect'

[91] The initial function of the ETPP was to provide an early warning system of pest and disease outbreak through analysis of meteorological conditions.

high school graduates. Cuba also had three larger factories dedicated to the production of the bacteria *Bacillus thuringiensis*, the most widely used biological control. For both, product prices were lower than those of chemical pest and disease control products and were sold in Cuban pesos.

Soils Institute (Instituto de Suelos): Originally the 'Research Institute for Soils and Agrochemicals', this was established in 1977 to undertake research and service provision, and carry out State functions. As well as provincial offices, the Institute had three regional experimental stations. Little information was available on the institutional mechanisms for management and distribution of agrochemical fertilisers. Ecological soil fertility inputs included bacteria such as *Azospirillum*, *Azotobacter* and *Rhizobium*, and fungi such as mycorrhiza. Their uses were recommended for a wide range of crops including sugar cane, cassava, onion, citrus, and maize (Miedema & Trinks, 1998). Also falling under the Soils Institute were Basic Units of Worm Culture (UBL).

Other Ministries relevant to agriculture

Ministry of Sugar (MINAZ): The existence of a Ministry of Sugar highlights the importance of sugar in the Cuban economy. It was responsible for an area of over 1.5 million ha of productive land, dealing with both State and non-State producers. It operated Agro-Industrial Centres (CAI, Centro Agro-Industrial) (which fulfilled similar functions as MINAG's Acopio and the production enterprises), and ran sugarcane processing factories. As an important national export product, sugar received State priority for petrol, fertilisers and herbicides; more sustainable sugar production had not achieved development priority (Miedema & Trinks, 1998).[92]

Ministry of Higher Education (MES): Several important agricultural research institutes fell under the Ministry of Higher Education. These included the National Agricultural University of Havana, UNAH (previously known as ISCAH), which housed the Centre for Studies on Sustainable Agriculture (CEAS), and the National Institute of Agricultural Sciences (INCA) which hosted the author's research project. INCA and UNAH jointly published, since 1967, the *Revista Cubana de Ciencia Agrícola*, which contained agricultural articles of national and international interest.

Ministry of Science, Technology and the Environment (CITMA): This Ministry emerged in 1994 out of the Cuban National Academy of Sciences. Amongst other roles, it was responsible for environmental education, and for environmental laws some of which affected the agricultural sector.

Major non-State agricultural institutions

National Association of Small Farmers (ANAP): Formed in 1961, ANAP's main initial task was "*To inform farmers about ideological goals of the Revolution, and to prepare them against an imperialist attack and counter-revolutionaries.*" (SN/01). Though officially independent from the State, it followed the line of the Cuban Communist Party (PCC) and was seen as the political organisation of non-State producer co-operatives – the CPAs, CCSs and individual farmer members. It was well represented on Cuba's National Assembly, with 14 members among the 490 representatives. ANAP's main tasks were to oversee production plans, represent the social and economic interests of the farmers and provide practical assistance.

Cuban Association of Organic Agriculture (ACAO): This association was founded in 1994 by a group of largely applied researchers. It had no juridical status and was dependent on donor funding

[92] Long past this period, during the author's most recent visit to Cuba in November 2004, the State had accepted that sugar would never regain its importance, and plans were underway to plough up vast tracts of sugarcane land and plant with mixed forests, livestock pastures, and horticultural crops. Sugar had been the agri-cultural and economic backbone of Cuba for over a century; therefore not surprising that this decision had taken over a decade to make.

and on the voluntary input of its members, comprising both scientists and producers. At 1998 it was actively involved in the research and promotion of ecological agriculture.

5.5.2 The organisation and refocusing of agricultural research

Toward the end of the decade, Cuba continued to have a well developed research capacity and scientific skills base, with 221 research and development centres and 46 centres of higher education, and employed over 60,000 workers (CITMA, 2000).

Institutional re-organisation and re-focusing

Prior to the 1990s, agricultural research was highly disciplinary, with each institute specialising in particular crops and commodities. There was little integration, structured planning or evaluation (Bode et al., 1998). Toward the end of 1995, MINAG, CITMA and MES started a process of inter-institutional consolidation to revise the aims, objectives, and strategies of the 19 research institutes. This led to the establishment of a model network: the National System of Agricultural Science and Technological Innovation (SINCITA),[93] within an international programme, the New Paradigms Initiative. SINCITA's mission was *"To contribute to national food security, through the development of sustainable agriculture and the international competitiveness of the agricultural sector for the benefit of Cuban society"* (Mato et al., 1999). It soon became evident that the model needed adapting to Cuba's economic conditions, and five criteria were established to guide this process: integration and rationalisation, regionality,[94] specialisation, interdisciplinarity, and stewardship and management of natural agricultural resources.

These changes led to the introduction of formal tendering for research funding administered by the three Ministries. Research projects were of four types: national, branch (based on topic), regional, or local (at the request of producers – largely State). Inter-institutional collaboration, multi-disciplinarity and a focus on problem-solving became important criteria for acceptance of proposals. Also implemented by MINAG was the 'enforcement of economic responsibility' by which institutes had to become partly economically independent.

The SINCITA programme also institutionalised an Integrated System for Planning, Monitoring and Evaluation (SIPSyE), although at 1998, no results were available on the degree or effectiveness of SINCITA as regards change in institutional structures and approaches, nor on improvements in reaching and facilitating farm production.

5.5.3 The organisation of extension and education

Early changes in formal and informal agricultural education

Formal agricultural education remained a priority and to some extent was strengthened over the decade. Schools in the Countryside (*'escuelas en el campo'*), in operation since the 1970s, had helped encourage a general understanding of agriculture that proved vital during the Special Period (Rosset & Benjamin, 1994). These co-educational boarding schools competed against each other for the highest yields and production improvements (Lane, 1999). From 1995, basic agriculture was an option on the syllabus of most primary school courses in Cuba. ANAP started a programme to teach children within CPA and CCS co-operatives; the majority were situated in rural areas and pupils worked in the fields for half of each day.

At higher educational levels, the State created agricultural polytechnics in every municipality at the start of the Special Period, each affiliated to a Mixed-Crops Enterprise. Ecological agriculture was included as part of the syllabus, and this necessitated a retraining of teachers in this subject

[93] This was undertaken as part of a programme of the International Service for National Agricultural Research (ISNAR).
[94] The criteria of regionality, for example, allowed for "*improved response to the demands of different zones of the country (agroclimatic, agroproductivity and economic) as well as operationalising the State policy of management decentralisation to the regions and opening possibilities for other sources of funding*." (Mato et al., 1999 p. xiii).

(Crespo & Alvarez, 1999). Every university contained a department of agriculture, although it was the lower-performing students who were sent there (students often not being free to choose their own discipline), and there was little specialisation at undergraduate level. Overall, of the 600,000 college graduates in Cuba, 27% held agricultural degrees (Lane, 1999). This meant widespread technical support for the agricultural sector, with 24,000 qualified agronomists nationwide in 1996 (Ramirez, 1997, quoted by Lane, 1999).

The Agricultural University of Havana (UNAH) in particular had over 10,000 part- and full-time diploma, degree and higher-degree agricultural students at any one time. All graduates were guaranteed employment afterwards, as university acceptance was based on the needs of the agricultural sector. UNAH also provided free education for 300 foreign students from developing countries.[95] In 1994, the University opened the Centre for Studies in Sustainable Agriculture (CEAS), which offered part- and full-time, and long distance diploma and MSc courses in ecological agriculture. Course development was assisted by ACAO. Commencing in March 1997, the long-distance course aimed at farmers, teachers, scientists and agronomists (Rosset & Moore, 1997).

Agricultural education and training also came through non-academic routes. For farmers, the Niceto Pérez[96] National Training Centre of ANAP, in Havana Province, trained non-State farmers on a variety of issues. Farmer training was also undertaken with the Council of Churches of Cuba (DECAP), the Cuban Association of Small Livestock Producers (ACPA), ACAO and the Foundation for Nature and Man (FNH). All of these groups included agroecology as one part of their training curriculum. Lane (1999) identified several other non-formal agricultural education and extension mechanisms: ‘circles of interest’ which encouraged integration of schooling with productive work life, eco-youth camps which promoted agricultural and environmental education, and education through the urban agriculture movement.

In the early part of the 1990s, an interest developed in the potential of traditional knowledge as a way of helping Cuba out its crisis. Rosset (1996) describes how a new national programme by MINAG encouraged farmers to share their knowledge with researchers and officials at mobile workshops throughout the country. Exchange of traditional knowledge between farmers was also encouraged by ANAP. This interest appeared to have reduced by the end of the decade. Finally, in terms of ecological education, ACAO diffused information and supported education through the above-mentioned channels, and also through its regular publication, *Agricultura Orgánica*. It also operated a mobile library around the country, and organised other community education projects.

Little change in main extension institutions and structures

Farmer support by the State was historically paternalistic, more than simply providing information and services. Support in the 1990s came mainly through the municipal offices of MINAG which, for historical reasons, tended to focus on the State farms and UBPCs. Private farmers were catered for by the Campesino Co-operative Sector (SCC), which, for example, distributed work clothes and tools provided by MINAG, and which liaised between the farmer and Sanidad Vegetal at the appearance of a pest or disease. ANAP, with offices in every municipality, also guided the private co-operatives, with one ANAP representative responsible for 8-12 co-operatives.

Up to 1998 – far into the Special Period – relatively little change had been made toward adapting the formal extension structure in Cuba, which instead continued to rely on the traditional transfer of technology (TOT) approach from research to production unit. Significant research results would first be sent to the national Scientific Council (*Consejo Cientifico*) that checked for scientific

[95] In 1999, the author met a Nigerian student, who had arrived in Cuba 15 years previously to undertake his final years of schooling and then a degree. After completing this, and then a masters’ degree and PhD, he found himself stuck in Cuba. The Special Period meant that there was no funding to pay for his ticket back home, and he was unable to earn dollars to purchase the ticket himself. He was often spotted roaming the university campus, talking to strangers, caught in a financial time warp.

[96] Niceto Perez had been a leading campesino who was assassinated in 1946 in events leading up to the Revolution (SN/1)

validity and then, if approved, passed to an Expert Group. If this Group approved, the result was then sent to the Vice-Minister of the appropriate MINAG department, who in turn send it to the provincial delegations for implementation in their production plans. Research institutes worked with reference farms, usually the most high-performing State or UBPC farms. This approach assumed that by working with the best producers, other farmers would follow suit, but there was little monitoring of the uptake of innovations. This method did lead to higher yields in specific crops and regions. However, most technologies had only a short life span; the researchers complained that the farmers were mis-applying the technology and the farmers that the technology did not work in the first place.[97] Technologies were often disseminated before the researchers themselves had full confidence in them (Rosset, 1996).

The Ministry used a wide range of other channels to disseminate information. These included through ANAP, the Popular Councils, the Federation of Cuban Women, the Young Communist Union, and the State-run media: television, radio and newspapers. MINAG maintained a press and public relations group that was responsible for obtaining an overview of public opinion. There was a high level of public awareness on agricultural issues, and continuous dissemination of news on the state of national production, such as on the sugarcane harvest, the quality of cigars, and any prevalent pest or disease outbreak. In 1998, national television was broadcasting a weekly agricultural programme (*De Sol a Sol*), and a daily television show (*Hoy Misma*) that included agricultural issues. Local radio broadcasted agricultural programmes around midday when farmers were more likely to be listening, the information for these being supplied by MINAG.[98]

5.6 CONCLUSIONS AND IMPLICATIONS FOR FIELD WORK

5.6.1 Some emerging paradoxes

This brief review of secondary data for the period after the crisis indicates the dramatic adaptations and changes that Cuba has made in its agricultural sector. Some changes, such as the use of bio-inputs, were enforced or by default, while others, such as incentivising production, were to some extent planned. Aside from the example of urban agriculture, the reforms were State-led coping strategies. There was little documentation on farmer response to these, nor on farmers' own survival and coping mechanisms. Similarly, there was little information available on the spread and impact of organisational and methodological changes at institutional level. The example of urban agriculture provides a very strong case for a transformation to a more ecological agriculture. Yet there was little evidence on the spread of such practices in rural areas, and meanwhile the importation of agrochemical inputs continued.

In fact, shortages of imported resources had affected all aspects of Cuban life. The lack of resources encouraged major recycling and energy efficient programmes: the use of bicycles and larger public buses[99] ('*camelos*'), a national school campaign to collect recyclable materials in exchange for schools supplies, active neighbourhood recycling centres, new factories to produce domestic items from recycled materials, and a nationwide environmental education campaign. There has been a tendency to interpret this phenomenon as a proactive choice by Cuban authorities to 'go green'. Weaver (1997) suggests that increases in sustainability may have to be balanced with the drive to increase domestic yields. In October 1998, a visiting Cuban economist from MINAG gave a seminar at Wageningen University where he described the first stage of what he termed 'the current Third Agrarian Reform' in Cuba. According to him, the two main challenges facing Cuba were those of achieving food security and protecting the natural resource base. At the same time, he emphasised their most important goal as being to increase production per unit area through the

[97] Research findings were evaluated and approved on their scientific validity, with less regard for their relevance or applicability.
[98] Although some producers in the central and eastern regions of the country still did not have electricity and therefore were not reached by such media (Miedema & Trinks, 1998).
[99] The number of buses in Havana had dropped from 2,500 to just 500 during the Special Period (KI/9).

transformation of technology and of market relations (Fernández, 1998). As Weaver suggests, the greater challenge may be of marrying the challenges with the goal.

5.6.2 Subsequent accounts from the field

Based on this review of basic agricultural structures and processes, the following chapters provide an account from the field. They attempt to verify and fill the knowledge gaps around the current changes and coping strategies in agricultural production and the institutional support system in rural Cuba. They then go on to analyse the relationship between agriculture and food security, and the extent of development of ecological agriculture.

6 FIRST FIELD FORAY: MAIZE SEED AND CROPPING SYSTEMS IN HAVANA PROVINCE

6.1 LOW-INPUT MAIZE PRODUCTION AS A SNAPSHOT OF CONTEMPORARY PRODUCTION SYSTEMS

6.1.1 Working within a participatory plant breeding project

In this first phase of field work, the main issue of concern was to ascertain the type of mainstream production system operating in Cuba, in terms of production technologies and techniques. Surrounding this was the aim to obtain a first snapshot of the rural agricultural sector. The first available opportunity for achieving this came through involvement in a Participatory Plant Breeding (PPB) Project in Havana Province, which was itself assessing the use of maize varieties adapted to the prevailing low-input conditions. This project was pioneering in its rationale, which surrounded the need for varieties suitable for low-input or ecological conditions, the empowerment of small farmers, decentralised and local systems, and the participatory approach in general. Involving a wide range of stakeholders, it was focused on three CPA co-operatives in Havana Province, with some collection missions to the neighbouring province of Pinar del Rio. Current plant breeding and maize cropping systems could be used as indicators of the type and extent of (ecological) practices and institutional support in the region, and the PPB Project presented two opportunities for looking at this: 1) the direct participation in its early activities; and 2) undertaking a baseline study for the project on low-input maize cropping systems. Field work was conducted between April and June 1999. Further explanation of the opportunistic-type of field methodology is provided in Chapter 4.

This chapter summarises the context and rationale of the Participatory Plant Breeding Project. It describes some experiences in the start-up phase of the project which attempted to pioneer a participatory approach. To support this project, the author undertook a baseline study of maize cropping systems and support for this, the results of which are discussed in the context of the extent of ecological approaches being practised in the study region. This discussion leads to a re-evaluation of the research process and of subsequent field work strategies.

6.1.2 Participatory versus conventional plant breeding

Participatory plant breeding entails a range of approaches through which the end users – farmers - are more closely involved in the development of the crop or seed supply. It has been found to have great potential in situations where formal breeding and seed systems are unable to fulfil the needs of the producers, especially in marginal areas where conditions are variable. It us of particular value in situations of change or crisis, where formal systems do not function properly, if at all (McGuire et al., 1999). It gives more control over the seed supply and breeding choices to resource-poor farmers and this has significance for food security (Lipton, 1989; Shiva et al., 1995). In many ways, participatory plant breeding is congruent with ecological plant breeding (see Box 6.1 for an overview of ecological plant breeding approaches), in that both seek to encourage farmer responsibility for breeding as the main source of seed supply, encourage local adaptation, and rely on local knowledge. This does not mean that all local landraces and traditional varieties are necessarily the most resilient during times of hardship, and much depends on whether farmers can manage their wider farming system (Morin,1999).

Box 6.1 An ecological approach to plant breeding research and development

Specifically with regard to seed varieties, ecological plant breeding requires a different approach to that of industrialised agriculture. From the agronomic aspect, Howell (1985) identified the process by which the plant genetic resource base has been weakened; firstly by cultivating plants in enzyme-deficient soils, and then having to support the survival of these weakened plants through the use of pest and disease controls.Genetic selection criteria for an ecological system might include mineral uptake efficiency, rootage, weed suppressive ability, and polygenetic resistance to pests and diseases, while attempting to maintain a wide genetic diversity within and between varieties under local conditions (Lammerts van Bueren et al., 1999). From the social aspect, and to support these agronomic criteria, ecological plant breeding requires being directed by local knowledge, with close interaction both between farmers and researchers and between farmers themselves. In order to ensure compatibility with local conditions, the management of plant genetic resources is largely in the hands of the farmers, and this means that they have good knowledge of, and facilities for, on-farm selection, breeding, conservation and storage, and hygiene.

6.2 DEVELOPMENT AND ACHIEVEMENTS OF THE PARTICIPATORY PLANT BREEDING PROJECT IN CUBA

6.2.1 Cuba's formal and informal seed sectors

Cuba's conventional (industrialised) seed system had operated on a centralised planning basis, breeding predominantly for yield attributes in conditions of medium to high external inputs and homogeneous environments. According to Ríos Labrada et al. (1998), there were two major drawbacks of this approach. Firstly, the varieties developed did not perform well with under the resource-scarce conditions of the Special Period, scarce not only in terms of agrochemical inputs but also of institutional (financial and managerial) resources to multiply and extend sufficient quality seed to meet rural demand. All the functions of the formal seed system had been concentrated in the State sector. For example, prior to 1989, seed multiplication had been undertaken mainly on State seed farms, and since then, due to the financial restrictions, largely by specialised farmers. Secondly, this approach failed to account for the high degree of agro-ecological heterogeneity that exists in Cuba, which became more evident as inputs became more scarce (Almekinders et al., 1995). For example, varieties from the conventional plant breeding system proved to be vulnerable to pest and disease attack, and the centralised structure of the conventional system did not provide many opportunities to develop materials suitable for more diverse circumstances (Ríos Labrada et al., 1998). The biggest obstacles to the formal seed sector were the lack of resources (fuel, agrochemicals, machinery and spare parts), and the accompanying lack of perception that varietal management might provide an alternative to alleviate this input deficit.

An informal seed system, operated by and for farmers, has always existed in Cuba, although weakened up to 1989 by the dominance of the formal system. The composition, ethnicity and process of cross breeding in these informal systems was related to the mixture of plant genetic resources originating from the early native cultures from Central America and the Caribbean, and then from Spain, Africa and Asia (Esquivel & Hammer, 1992). The maintenance of a wide variability and adaptation was traditionally carried out in '*conucos*'[100] or home garden plots where the farmers in effect conserved *in vivo* those varieties considered useful. This system showed to be resilient in that the production of seeds of the basic staples of the Cuban diet is still found in many regions of the country.[101] Further, these plant genetic resources selected and maintained by Cuban small farmers had been a basic source for selection by formal plant breeders. However, according to Ríos Labrada et al. (1998), up till that time, little attention had been paid to this informal seed management system in Cuba, and while it held great potential for fulfilling the demands of the farmers, much of the genetic variability was being eroded.

[100] According to Esquivel & Hammer (1992), the first *conucus* were created by the Tainos, and the word, derived from Arawak and Caribe, means 'a plantation in a forest'.

[101] Rural home gardens in Cuba, containing a high diversity of cultivated species, are an important contribution to food intake (Wezel & Bender, 2002).

6.2.2 Behind the rationale: the experience of plant breeders in the early 1990s

The interest of a small group of Cuban plant breeders in participatory plant breeding and in the potential of traditional landraces was sparked by early experience with pumpkin breeding (Ríos et al., 2001). Pumpkin production levels decreased from an average of 2-3 t/ha[102] in the late 1980s to 0.2-0.4 t/ha in 1993. Pumpkin almost completely disappeared from the market and became a luxury item. A government committee identified two causes of the decreased yield: a lack of pesticides and irrigation fuel, and varietal degeneration. They instituted a plant breeding programme aimed at identifying varieties of pumpkin tolerant to low-input conditions.

The programme tested both foreign varieties and local landraces; results showed that the foreign varieties required high inputs and displayed poor culinary quality, whereas the landraces performed better under low-input conditions. The research institute in charge of the programme did not have sufficient resources (fertilisers, pesticides and fuel) on its own experimental station, and the plant breeders saw that these could be accessed if the experiments were held on farmers' fields. Once on farm, it became clear that the farmers had more knowledge of selection criteria than the researchers, and so a participatory process was developed. The researchers found advantages in this approach; they were able to harness the capacity of the farmers to identify varieties resistant to drought and pest and disease attack. At the same time, farmers taught the researchers about the importance of earliness as a varietal characteristic, crucial for the farms' rotation schemes.

The results of the research programme showed that total energy expenditure – an important factor given the wider circumstances - was lower for what was termed 'low-input' or ‘low-income’ production than in the industrialised approach and that with similar yields the cost-benefit ratio was higher for the low-input production (see Table 6.1 below). Further, researchers learned the importance of selecting appropriate varieties for specific target areas.

Table 6.1 Comparison of pumpkin breeding strategies amongst farmers in Havana province

Indicators	Pumpkin strategies	
	Pumpkin bred under high-input conditions	Pumpkin bred under low-input conditions
Mineral fertilisation	N: 42 kg/ha P: 39 kg/ha K: 62 kg/ha	0
Artificial irrigation (no.) (200m^3/ha)	9-11	2-4
No. varieties released	1	2
Use of organic manure	Negligible	6-7 t/ha
Varietal multiplication and maintenance	Isolation	Cross pollination
Pest and disease control	Chemical	Biological
Use of bees in pollination	Sporadic	Frequent
Fruit yield	6-10 t/ha	6-10 t/ha
Farmer participation	Seed multiplication selected by breeders	Family selection on-farm, high level of experimentation.
Research participation	Screening germplasm and varietal selection	Screening germplasm, facilitating new germplasm, evaluation with farmers.
Energy expenditure (Kcal) (based on fertiliser, irrigation and pesticide applications for Havana province)	17,000,000	3,800,000

Source: Ríos et al., 2001

[102] The most popular commercial pumpkin variety, distributed over more than 70% of the island, had been renowned for yielding up to 18-20 t/ha under high input conditions.

6.2.3 The approach of the new Plant Breeding Project at INCA

The Participatory Plant Breeding (PPB) Project started in 1999 within the Department of Plant Breeding of the National Institute of Agricultural Sciences (INCA), as part of a Meso-American Collaborative Breeding Programme. Its aim was to diversify and improve the varietal structure of maize and common bean crops for low-input conditions, through a diagnosis of small farmer needs, participatory selection of appropriate materials collected from regions of high genetic diversity, the generation and dissemination of these materials by the farmers themselves and the dissemination of methodologies to other plant breeding programmes (Ríos Labrada et al., 1998).

The basic hypothesis of the Project was that achieving high and stable yields necessitated a high genetic diversity within crop. Seed flows, particularly from regions of high genetic resource variability to those of low availability, helped encourage this diversity. The isolated nature of these high-resource regions in Cuba had protected them from the extension programmes of the formal seed sector, yet also hindered the informal seed flow networks between communities. The building of linkages to stimulate seed flow between these regions would contribute to maintaining and improving yields and enhancing the Cuban diet, and this would entail the strengthening of the informal seed system. A major aspect of the Project was on interdisciplinary teamwork. The Project had pre-identified three main limitations to research and development work in Cuba as being: lack of methodologies for multidisciplinary team work in the research and development sector; lack of skills to formulate proposals with a sustainable focus; and predominance of top-down technology transfer approaches which was limiting farmer innovation and adoption of technologies.

The PPB Project commenced on three CPA farm co-operatives in Havana Province. These co-operatives were already involved in a research and demonstration programme on the development of ecological production strategies. Within each co-operative, one farm unit or *finca* was being run on ecological principles as what was termed an 'Agroecological Lighthouse' (*Faro Agroecologico*). These Lighthouse *fincas* acted as model farms both within and between co-operatives.

6.2.4 Maize as an appropriate focus crop

The PPB Project had selected maize as its main focus crop. Maize, although not the preferred national staple, was produced for home consumption by almost all farmers, and indigenous varieties were important for developing commercial hybrids.[103] Not being a State-prioritised crop, it did not qualify for receiving agrochemicals.

Maize production appeared to be little affected by the crisis of the 1990s. Production had more than tripled between 1970 and 1989, with the highest rates of increase in the non-State sector (ONE, 1984; ONE 1989). Production figures continued to show significant increases through the Special Period, doubling between 1989 and 1994 and again between 1994 and 1998 (see Table 6.2), and even more by the non-State producers. Maize yields, which had been stable prior to the 1990s, also saw a steady increase through the early to mid 1990s, rising between 1990 and 1996 from 0.69 t/ha to 1.13 t/ha in the non-State sector, and 1.05 t/ha to 1.29 t/ha in the State sector (ONE 1984, 1989, 1998).

Rios et al. (GFP, 2001) suggest that these increases in production were due to the general exponential increase in performance by the co-operative and private sector[104] which were operating on a low-input basis. During this period, commercial varieties of maize were able to satisfy only 30% of national seed demand, so it followed that these production increases were being supported by a burgeoning informal seed sector.

[103] Maize was introduced to Cuba in the 3rd century onwards by the Taino, who came from the Orinoco area of South America. When Columbus arrived in Cuba, he came across maize for the first time. According to popular legend, Columbus landed at the easternmost tip of Guantanemo Province, a place called Maisí Point.

[104] This may partly be driven by the decline in maize imports (used for livestock feed) which fell from more than half a million tonnes in 1990 to under 40,000 by 1994, recuperating slightly to just over 150,000 by 1996 (ONE, 1998).

Table 6.2 National maize production, 1994-1998

Crop	Production (t)				
	1994	1995	1996[a]	1997	1998
Maize	98,500	103,800	143,900	202,500	176,600

[a] 1996 figures were broken down into the following:

	State	Non-State	Other[*]
Maize	29.1	75.2	39.6

[*]Other – estimate of production for self-provisioning and for CCS and individual producers.

Source: ONE, 1998

6.2.5 Preliminary activities of the PPB Project: seed collection, seed fair and varietal experimentation

The first stage of the PPB Project was planned to run for 20 months, from April 1999 to December 2000. Its objectives were firstly to appraise the selection, management, varietal needs, and quality of local seeds and local and regional seed flows; and secondly, to implement plant breeding trials on the CPA farms, with genetic material of maize (and common bean) coming from the zones of greatest diversity as well as genotypes from the community itself. Farmer leaders who would participate in a network for community selection and evaluation.

Thus, the preparation for the Project involved undertaking seed identification and collection in the neighbouring, high-diversity, Province of Pinar del Rio. After this, a seed fair and workshop would be held in Havana Province to introduce the new varieties and the concepts of the project to the stakeholders. Then the farmer experimentation would commence. The author participated in the second activity, and all provided interesting early insights for this field study.

Seed collection in a community of ‘high genetic diversity’ in Pinar del Rio Province

Twenty eight CCS farming families from the community of La Palma, in the Province of Pinar del Rio - considered one of the most isolated and undeveloped provinces of Cuba (Ríos Labrada et al., 2000[a]) - were involved in this seed collection activity. Farms here averaged 20ha in size, but most of this was forest or very infertile land. The only commercial crop was tobacco, which received agrochemical inputs. On all other crops, farmers applied ecological inputs such as tobacco crop waste (*palo de tobacco*). Farmers regularly 'refreshed' their seed by introducing desired characteristics from informal seed exchanges. Their small plot sizes also encouraged natural cross-pollination.

These farmers were asked to identify desired characteristics of maize varieties. They placed highest importance on the degree of cob husk cover, as, according to them, this provided protection against insect attack during storage. Other preferences were for plants with one good cob rather than with two poor ones, and for cobs with a good grain set. Cob size itself was only preferred after these previous criteria had been satisfied. Ríos Labrada et al. (2000[a]) point out that full husk cover was a fairly rare characteristic and negatively correlated to cob size, as both husk and cob competed for the same nutrients.

In project trials of 36 local landraces identified by the farmers, 90% of cobs emerged with both full husk cover and full grain. Under low-ecological-input management conditions, 70% of the population showed yields ranging between 2.5 to 4.5 t/ha. Adjacent to the trial plot, a State experimental research station was achieving yields of less than 2 t/ha of maize despite using chemical fertilisers and maintaining isolated populations. On the face of it, the main difference was that the co-operative farmers were using landraces which they had maintained and were continually adapting to their conditions, whereas the experimental station was using formal varieties which had been bred in isolation.

Seed fair and workshop in Havana Province

As a next step in the Project, a two-day maize seed workshop and fair was organised on-research station in Havana Province. The researchers hoped to identify the varietal needs of a pre-identified group of small farmers, introduce them to a diversity of varieties, encourage the selection of locally appropriate varieties and distribute these for farmer experimentation and multiplication. In contrast to Pinar del Rio where much of the maize varieties had been collected, Havana Province was characterised by relatively higher economic levels and ecological homogeneity, low genetic diversity, and farmer dependence on the formal State seed and input sectors (GFP, 2001).

In preparation for the fair, the researchers had sown a total of 72 varieties, selected for hardiness under low-input conditions. These comprised 68 landraces from La Palma and Havana, and 4 commercial varieties. Owing to a lack of resources, the on-station demonstration plot received one irrigation treatment and no other inputs. Eighteen farmers attended the workshop, together with maize breeders, soil specialists, social scientists and representatives from ANAP and ACAO. As an introduction to the fair, the farmers were asked to identify five crops for which seed management posed the most difficulties. This exercise showed that for these farmers, seed quality (germination rate and vigour) was the most important problem, followed by incidence of pest and disease attack and access to planting materials. Training and extension issues, and seed exchange, were considered only moderate problems, and input availability relatively no problem (Ríos Labrada & Wright, 1999).

The farmers then were asked to judge the *in situ* stands of the 72 maize lines. There was some disbelief that the maize could perform so well without inputs, and several farmers reasoned that the soils on the experimental plot must be in better condition than on their own farms. Notwithstanding the traditional extension methods that the farmers were used to, they confidently and easily selected between the many varieties on offer, ranking their selection criteria as shown in Table 6.3. During the selection, 80% of farmers assigned different preference criteria for each of the five lines they selected.

Table 6.3 Farmers' selection criteria for maize varieties.

Criteria	% farmer acceptation as important	Criteria	% farmer acceptation as important
Plant yield	87.5	Cob size	42.5
Plant height	87.5	Leaf size	41.3
Stalk width	76.3	Ear size	40.0
Leaf positioning	62.5	Cob height	40.0
Number of leaves	60.0	Cob fullness	40.0
Number of cobs	57.5	Cob diameter	37.5
Cob husk cover	55.0	Insect damage	35.0
Cob shape	55.0	Ear colour	32.5
Cob weight	50.0	Susceptibility to lodging	31.3
Leaf colour	45.5	Husk colour	28.5
Cob length	45.0		

Source: Ríos Labrada & Wright, 1999

Farmers showed a strong preference for those lines planted in mixed stands - these displaying better crop response to the low-input conditions than the mono-varietal stands. Generally, cob yield was not considered a top priority; number of cobs ranked 6th, and cob weight 9th. One farmer, for example, selected the criteria of plant height, cob fullness, husk cover, and stalk width, explaining that he did not select for yield because "*the other attributes would provide that*".[105] The most

[105] On a separate occasion, another farmer (F/P/2) explained the reasons for some of these choices. Plant height was the most important criteria because the taller the plant, the more leaves below the cob which would be taking precious nutrients, and the risk of lodging meant that only one side of the cob might get pollinated. A dark, tough leaf was more resistant to plagues as insects preferred tender leaves; and a thick stem was better for the cob. Further, in terms of leaf

popular line overall was a landrace from Pinar del Rio Province, which with others performed better than those from Havana. In contrast, when researchers were asked to select their top varieties they mainly chose those with the largest and most numerous cobs, and tended to avoid the mixed stands.

Farmer experimentation in Havana Province

The participating farmers were made responsible for selecting varieties, designing their on-farm experiment, assessing the experimental outcomes, and exchanging (and possibly marketing) seeds within their communities. In the design of their experiments, these farmers reacted in three different ways in terms of chemical application:

i) those farmers who had training in ecological agriculture but because of fear of losing these seeds decided to apply chemicals during the trial;[106]

ii) those farmers who usually applied chemicals and had little knowledge of ecological techniques, but who lacked access to agrochemicals and were curious to see how the varieties reacted under low input conditions, so did not apply chemicals;

iii) those farmers who had received training in ecological agriculture and believed in the efficacy of its approach, who did not apply chemicals.

In the farmers' experimental designs, there was no attempt to isolate each variety, and some farmers stated that mixing varieties would help to avoid deterioration. Each farmer successfully maintained a logbook of cultivation techniques and of the experimentation process. The researchers organising the Project were convinced that the farmers had the capacity to manage selection, multiplication, conservation and marketing of improved seeds through their own informal system.

6.2.6 Emerging conclusions by the PPB Project

Interdisciplinarity and facilitation

In drawing conclusions from the first phase of the PPB Project, a new type of development agent in Cuba was proposed, one with the ability to work in interdisciplinary groups, facilitate actor participation and integration, formulate, propose, execute and evaluate development projects, and manage continuous learning (Ríos Labrada et al., 2000[b]). The PPB Project noted that research institutes were well placed to act as facilitators of knowledge exchange between the formal and informal seed systems. They were, however, less well placed for multiplying seeds to support the development of local seed systems (GFP, 2001).

Acceptability of the Project concepts within the formal agricultural research sector

The participatory seed fair and workshop was felt by the PPB Project team to have been a useful method of drawing on board all the stakeholders and especially the farmers, and of introducing the project concepts. Several institutional impacts also occurred. As a consequence of the workshop, new bottom-up research approaches had been stimulated within INCA, on biotechnology, biofertilisers, and participatory breeding of other crops. Within its Plant Breeding Department, the scientific strategy shifted toward a more participatory and appropriate focus and this strategy had been accepted at management level. The PPB Project itself acquired some degree of autonomy within INCA, through self-management of funds and control over its activities, and became an organisation platform for integrating farmers and other actors into local-level decision-making

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size, the width was more important than the length. The size of the tassel on the end of the cob (*espiga*) was important: the longer it was, the more nutrients were used for its growth. A closure of the husk cover, neat and tight, meant that there would be less pest attack of the cob and also less effect of humidity.

[106] Participating in some of the follow-up visits, the author observed farmers experimenting with dosages of urea, all-purpose pesticides, manure and NPK (farmer refs. F/C/5, F/P/11, F/P/4).

processes. The participatory methodology was also adopted by other research institutes within the Ministry of Agriculture, specifically to multiply material from its maize seed banks.

6.2.7 Relevance for this field study

The development and outcomes of the first stage of the PPB Project at INCA provide a first glimpse of contemporary rural agriculture. The seed collection and experimentation activities reveal rural conditions in two contrasting provinces, indicating that even with a centralised planning system such as Cuba’s, regional differences exist in terms of resource access and use as well as of knowledge. The lack of resources has hit the whole sector, yet agrochemicals appear to be still available and used by farmers, and of greater concern to them appears to be access to good quality plant genetic resources. Farmers appear to have held on to a degree of latent capacity for decision-making over management of their productive resources, and small farmer, low-input systems to have played a significant role in helping the country through critical years in terms of domestic food supply for at least certain crops. Given that the PPB project is pioneering, and emerging only at the end of the decade, implies that the support system has been slower to react to its external circumstances, and especially in terms of understanding and facilitating its farmer client group. The acceptability of the PPB project within the institutional framework suggests a general acceptance of adaptation to the low-input conditions of the period.

6.3 BASELINE STUDY OF MAIZE CROPPING SYSTEMS IN 3 CPA CO-OPERATIVES, AND THEIR SUPPORT SYSTEMS, IN HAVANA PROVINCE

6.3.1 Background: the focus co-operatives in Havana Province and their 'Agro-Ecological Lighthouses'

This study as a first impression

This baseline study, undertaken in the midst of these early experiences of the PPB Project, provides a first impression of the main production approach being practised as well as the types of institutional support. The study also provides an insight into the contemporary conditions of co-operatives in the area: CPAs Gilberto León and Jorgé Dimitrov in the municipality of San Antonio de los Baños, and CPA 28 de Septiembre in the municipality of Batabanó. This baseline study was undertaken under the umbrella of the existing PPB Project; therefore the field sites and farms were pre-selected, and (as explained in chapter 4), the survey respondents (25) and interviewees (18 on-farm and 32 within institutions) were not randomised. Therefore, statistical methods were not used and there was no attempt to generalise for a larger population. Instead, the study provides a first impression or understanding. Chapter 4 describes the field research methods used, suffice to remind that each interviewee and respondent was given a code, and that prices were converted from pesos to US$ at a rate of 20:1.

The study region

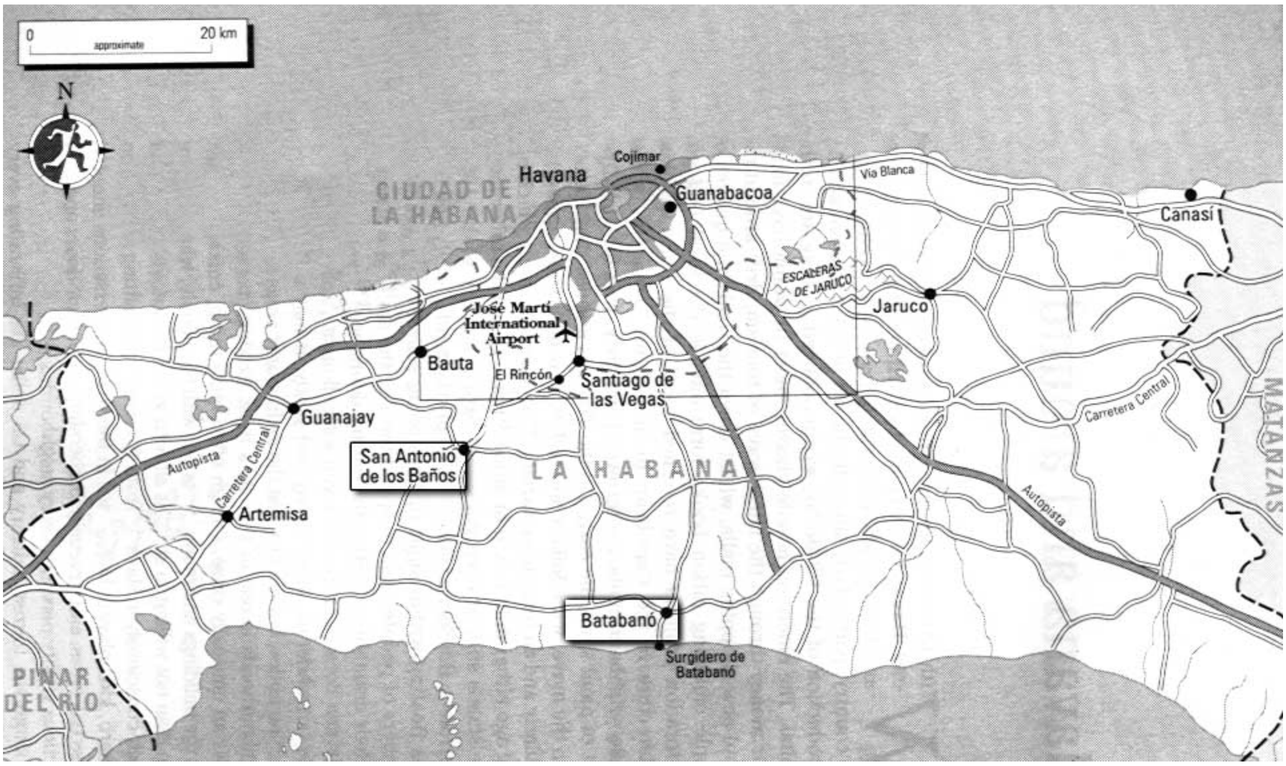
Surrounding the city of Havana, the Province of Havana is the most highly populated,[107] the most highly industrialised, and historically has the highest agricultural production in terms of both yields and volumes.[108] In terms of agricultural tenancy, the Province contains 14% of the total CPA and CCS co-operatives of the country, which supply 40% of the national production of root, tuber and horticultural crops. The highest investments for production are made here because of demands of

[107] The Provinces of Havana and City of Havana have a combined population of 2,881 million, approximately one-quarter of the national population.
[108] According to Zequeira Sanchez (1980), it was an agrarian policy of the province to leave no land fallow or resting, so 75% of cultivable land was continually in use, compared to a national average of 59%.

the capital. Ninety-five percent of the national agricultural research institutes are found in Havana, and because of transport and other logistical limitations during the Special Period, their work is mainly focused within the same province.

The three CPA co-operatives of the study lie in the municipalities of San Antonio de los Baños and Batabanó, as shown in Figure 6.1. San Antonio de los Baños is one of the most prosperous and the second most productive out of the nineteen provincial municipalities; being close to the capital and with 91% of its land area cultivable. In comparison, the low-lying municipality of Batabanó, on the southern coast of the Province, is less prosperous, being vulnerable to inundations during periods of heavy rains and hurricanes. Because population is relatively low and production high, so about 70% of products are distributed outside the region and mainly to Havana City.

Figure 6.1. Map of Havana province showing municipalities of San Antonio de los Baños and Batabanó



The three co-operatives and their "Agro-ecological Lighthouses"

This baseline study covered the whole farm of each co-operative, including the 'Lighthouse' areas. In terms of functioning, production was undertaken according to a planting plan (*Plan de Siembra*), this plan being renewed every three months. Chemicals were regulated and electricity intermittent, and inputs, including veterinary medicines, had to be paid for in dollars. At the daily planning meetings of CPA 28 de Septiembre, for example, petroleum use was the major concern as the co-operative struggled to make do with just a fraction of its needs - petroleum consumption during the first quarter of that year had been just over 14,000 litres/month, whilst estimated needs were 10,000 litres/day.

On Gilberto León and 28 de Septiembre, the farm workers were linked (vinculated) to specific *fincas*, while on Jorgé Dimitrov they were rotated around the whole co-operative according to discipline (livestock, management, irrigation, manual labour, etc), and these different styles affected profit share and incentives. In each co-operative, careful records were displayed of annual and monthly production figures, costs and incomes, and human resources. Figures for CPA Jorgé Dimitrov, provided in Table 6.4, show the drop in production and yields around 1992-95, and an increase in members and salaries over the 1990s. They also give an indication of the financial incentives received for good production performance. On CPA 28 de Septiembre, average income was $0.4-0.45/day, but including the profit share scheme and self-provisioning of food, amounted to $0.75/day. The CPAs had renounced their State rations in lieu of self-provisioning, although they still received certain items from the State such as sugar, oil[109] and soap.

Table 6.4. Summary of economic balances for the CPA Jorge Dimitrov, from 1983 to 1998, showing production changes over time and income of farmer members

Item	Year				
	1983	1988	1993	1997	1998
Total production t	2,520	2,632	3,001	2,226	2,383
Yield t/ha	16.3	16.3	18.6	14.4	15.4
Average no. members	30	44	52	66	62
Annual basic salary (average, $)	112	127	135	152	153
Daily basic salary (average $)	0.39	0.46	0.49	0.58	0.60
Member's profit/day[a] $	0.39	0.39	0.68	0.41	0.38

Currency converted from pesos to $ at a rate of 20:1

[a] Cooperative members obtain a basic daily rate and on top of this they share the profit from the area of land or crop they are linked to through their work assignments. Incomes must be evaluated in the light of the members having virtually free accommodation, healthcare and schooling, and of obtaining a large proportion of their food needs from on-farm self provisioning.

Source: F/P/2

Produce surplus to the plan could be sold on the farmers' market. On CPA Gilberto León, for example, the previous year had resulted in a 720t surplus,[110] and other of its produce passed through its own processing plant to be sold to ISLAZUL - the State tourist product enterprise. As an overall picture, Figure 6.2 details the seed and input flows, institutional support and markets, for the CPA 28 de Septiembre, Batabanó.

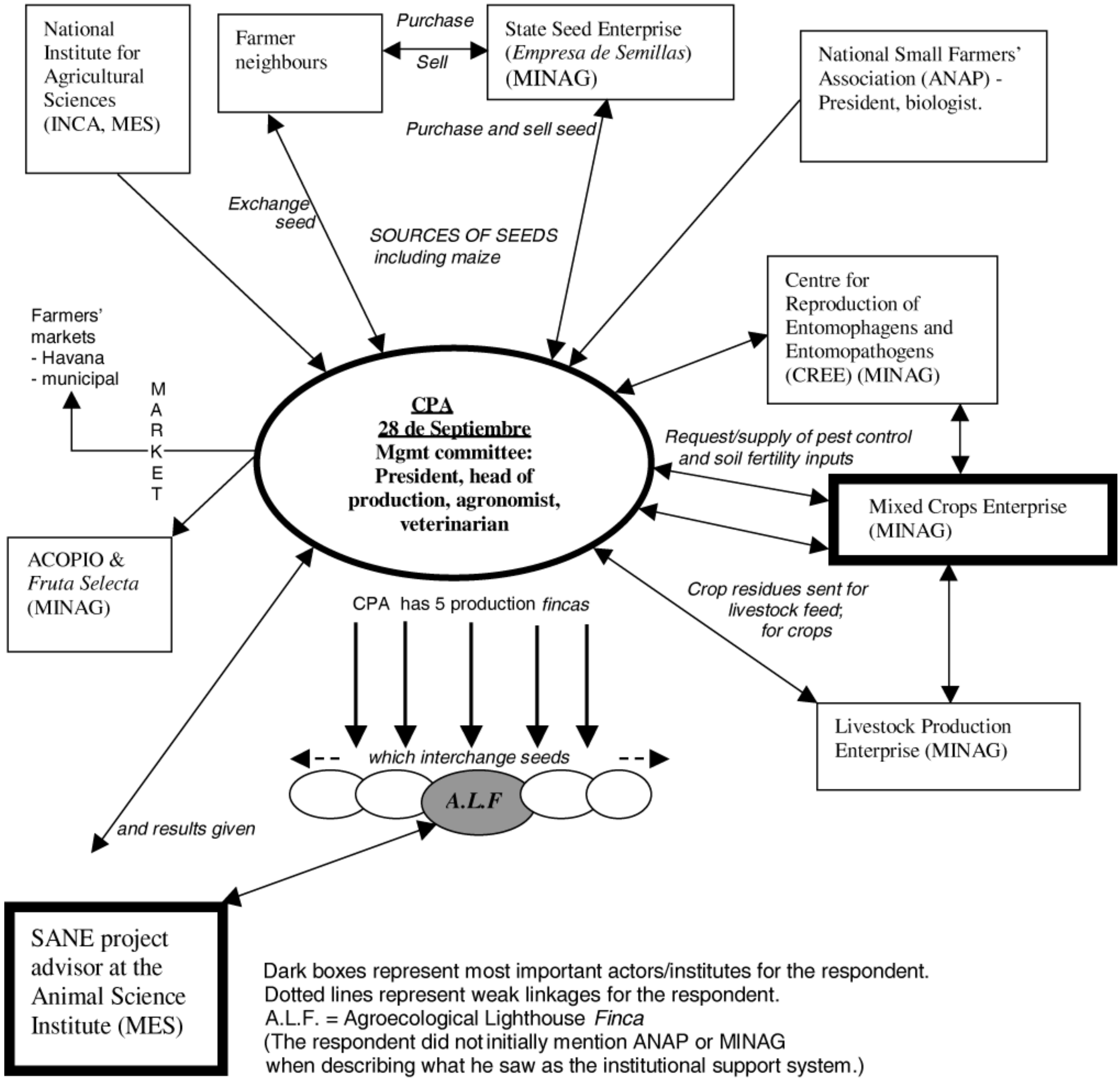
At the end of 1994, the Cuban Association for Organic Agriculture (ACAO) developed ecological experimental/demonstration farm units termed "Agro-ecological Lighthouses" on the three CPA production co-operatives. Funded by a UNDP Programme, the principle objective was to develop ecologically-based production systems through appropriate soil management, the reduction of chemical inputs, and improved environmental relations (ACAO, 1999). One farm unit or *finca* from each co-operative was chosen for conversion in the experiment, and a research programme designed in participation with co-operative members. On CPAs Gilberto León and 28 de Septiembre, the Lighthouse *fincas* occupied 7.6% of total farm area, on Jorgé Dimitrov 3.5% (ACAO, 1999; GFP, 2001).

Research results were promising for the potential of ecological agriculture in the region. A final project evaluation showed that, over the three years of the project, ecological techniques had increased total productivity by 7-14 t/ha, whilst eliminating the need for agrochemicals and increasing crop diversity 4-fold. Soil organic matter had risen significantly. Team learning was heightened if the work teams were allocated by *finca* rather than rotating them around the co-operative, and teams holding more traditional agricultural knowledge also fared better. Maize was featured as a traditional staple. Box 6.2 describes maize production on the Lighthouse *finca* of CPA 28 de Septiembre, Batabanó. The Lighthouse sites were also used as demonstration training areas for students, and at an international level were held as an example of ecological research and development in Cuba.

[109] Cooking oil was otherwise available at dollar stores for $2 per litre (F/P/5).

[110] Hard data on actual yields was a slightly sensitive issue, not least perhaps because if the farms declared their real figures to Acopio they would have less surplus for sale on the higher-priced farmers' market.

Figure 6.2 Systems diagram of the basic seed and input flows, institutional support and markets, for the Lighthouse finca and CPA 28 de Septiembre, Batabanó (F/9/6)



The Lighthouse *fincas* differed from and influenced the rest of the co-operatives in various ways. On Gilberto León, the Lighthouse *finca* received higher levels of organic inputs, practiced more polycropping, and used only oxen for traction. Over 90% of pest and disease control was currently biological over the whole co-operative. On Jorgé Dimitrov, the Lighthouse *finca* received no inputs – neither chemical nor ecological. Where results were seen to be sufficiently positive, certain techniques such as intercropping were spread to the rest of the CPA. On 28 de Septiembre, benefits to the whole co-operative were seen to include the new project computer, work clothes and better electricity connection which came with the Lighthouse project.

Box 6.2 Case example: maize production and ecological agriculture on the Lighthouse finca of CPA 28 de Septiembre, Batabanó, as described by the head of finca (F/P/6)

The new head of this *finca* joined the co-operative one year ago. In charge of a team of 4 workers, and working two pairs of oxen, he followed instructions on production activities from a member of the Lighthouse research team who made frequent visits to the site. The *finca* was also profitable, playing its role in meeting the production plan of the CPA. Surplus produce went for sale at the farmers' market or for self-provisioning of the CPA.

Maize cropping techniques. In the previous year, maize had been intercropped with pumpkin, and also sown with forage king grass and a green manure (mucuna) understory. This March, maize was sown together with cassava. Spot applications of organic manure were made at planting time, and the area was irrigated weekly. Hand weeding was undertaken twice. The head of the *finca* predicted a yield of 220 *vegas*[111] of maize. Harvesting would also be undertaken by hand to avoid damage to the cassava intercrop, and after the maize was removed, soya would be sown. If the maize were bought by Acopio, they would receive a price of $4.4/t, whereas on the farmers' market it commanded a price of $66/t. A windbreak barrier of banana trees shielded one side of maize stand from the flat open fields of the rest of the CPA.

The same variety of maize was used on this *finca* as for the rest of the co-operative, and seed came from three sources: the Seed Enterprise, external exchange with farmer neighbours, and internal exchange between the *fincas* of the CPA. Generally there was very little variety available, and sometimes no seed at all from the formal sector. The traditional *criollo* maize had, according to the interviewee, a better flavour than modern varieties, but it was smaller and lower yielding. Even with the higher yields of the modern varieties, the CPA was interested to acquire better ones. Seed saving was not practised; the CPA would need a refrigerated storage unit if it wanted to avoid the use of postharvest chemicals. However, saving seed would be financially worthwhile, as the Seed Enterprise sold at $275/t and purchased at $110/t. Further, it was not known from where the purchased seed originated.

Perceptions on ecological production. The most important source of information and advice for the ecological Lighthouse *finca* came from the project adviser at the Animal Science Institute. The task of this head of *finca* was to log the results of the experimental trials. He has not received any training but had acquired his knowledge through growing up in the countryside and through practice. The decrease in agrochemicals since 1989 had been gradual rather than sudden. He believed that the whole CPA could not convert to an ecological system for several reasons: there was a need for agrochemicals in some situations, such as to combat insect attacks; the CPA did not have sufficient land available for any to be left fallow; and there might be a limitation to the amount of manure they could obtain, especially given the risk of livestock theft. Once more agrochemical inputs become available, they would be used to improve yields. However, he did not personally approve of agrochemicals because of the damage they caused to human health, and in this respect he referred to his two young children. He explained "*those who work in fumigation can only work for five years maximum in that job and then have to change, because of illness - vomit, nausea and lack of energy.*"

6.3.2 General knowledge and experience of the farmer respondents from the 3 CPA co-operatives

Primary data from farms came through 25 respondents of the farm survey, and another 18 farmers who were separately interviewed. Of the survey respondents, the majority were between 46-65 years old, and all were male and came from farming families. Only 12% had received training in agriculture, and one had studied in the USSR. One of the more elderly respondents who had been working in agriculture for 50 years and used to run his own farm before pooling it into the CPA, commented that he did not have a strong decision-making role because he was '*only a campesino*' and so was '*still learning*', both about the new methods of chemical control and even newer ones of biological control; still '*trying to align the new approaches with what I already know*' (F/P/4). Two farmers had received training in ecological agriculture from ISCAH, and had in turn attempted to disseminate what they had learned to the rest of their co-operatives. These two farmers were also the main driving forces in the promotion of alternatives on their CPAs.

[111] 1 vega = 1000 cobs

6.3.3 Seed management on the co-operatives

Almost all respondents knew how to select varieties of maize, and had learned this from experience or family rather than formal training. Selection criteria were: *health, freshness, size, more production per area, most desired cobs, grains at centre of cob, vigorous plants*. Although virtually none knew how to cross-pollinate, almost all (94%) agreed that it would be useful to improve varieties on-farm, mainly to improve quality and increase yields. Farmers could identify specific research institutes involved in improving seed supply, but not those working on plant breeding issues. Just one respondent had received training on seed management.

Often the only available seed from the Seed Enterprise was a *criollo* maize variety with poor germination rate, and it was recognised that varietal diversity had been eroded during the period of industrialised agriculture (F/P/2). Almost all respondents favoured traditional maize for their qualities of resistance to drought, poor soils, and pests and diseases, and for flavour and cooking quality. Farmers identified eleven important selection characteristics for maize, the most popular being pest and disease resistance (61%), drought resistance (58%), cob size (30%) and '*criollo*-type' 24%). Although increased yields was the main reason, others included appropriateness, less pollution, better consumption quality, and more economical. The head of one *finca* explained how varieties with lower water requirements would mean petrol savings on for irrigation.

Almost all survey respondents knew how to save their own seed, and the majority of these, 79%, used traditional storage methods such as: *"the hanging-up of maize in old sacks under a tree", or "maize cobs and husks piled up on a raised palmwood table under a thatch of dry palm leaves"*. A small minority mentioned the use of chemical fumigants or refrigeration as preferred storage methods. Knowledge on seed saving came largely from family or practice, and the majority felt this to be a useful practice for their co-operative, largely to avoid dependency on the State but also for reasons of economics, appropriateness and quality. At least 20% of purchased seed did not germinate.

Challenges to seed saving and storing were identified as the risk of reducing quality through in-breeding, and poor storage facilities. The CPAs had storehouses where seed could be safely kept, though capacity varied and these stores may be reserved for specific produce. Seed could also be stored at the State Enterprises or on neighbouring UBPC co-operatives, though there was some risk involved in this.[112] The strategy of one co-operative was to store just a small quantity of maize seed for livestock feed and as a security measure. Another co-operative self-saved maize seed for self-provisioning, and bought in commercial lines for their cash crop.

In terms of sourcing seed, almost all farmers obtained some seed from the Seed Enterprise, and almost half also self-saved. A small number exchanged with neighbours, obtained seed from family or research projects, or purchased from the local farmers' shop. Although prior to the Revolution around 40% of farmers had exchanged seeds, this had changed and there appeared to have been little change in sourcing seeds over the preceding decade, although one farmer observed that many varieties became lost as more farmers were contracted to growing seed for the Seed Enterprise (which had previously had its own seed multiplication areas).[113]

6.3.4 Varieties and cultivation practices

Traditional knowledge on cultivation could be found on the co-operatives. The head of one *finca* described the traditional process of maize production, from seed selection through to harvest, given in Box 6.3.

[112]One CPA president described their experience of storing 360kg bean at the Seed Enterprise and receiving only 225kg back on collection, partly because of an attack by *Thrips palmi* but also because they had not made a proper contract with the Enterprise.

[113] One CCS co-operative farmer living adjacent to the CPA in Batabanó (F/C/5) described how he used to exchange seed with his neighbours from other co-operatives, but with the introduction of the State Seed Plan (*Plan de Semillas*) this was not necessary any more.

Box 6.3 Traditional knowledge on maize production (as recalled by a head one finca, F/P/4)

In the past, seed maize was selected for the fullest cobs which had the closest husk wrapping with no hole at the end for insects to penetrate. On a night when the moon was full but about to wane, the seed was harvested and bagged in jute sacks. Weevils would not eat the grain when the moon was waning (*menguante*). The jute sacks had been used for sugar and kept the cobs better than nylon. 50 cobs were put into each sack, and these then strung up in a dry, well-ventilated place. There they would keep fresh for 5-6 months. Only the seed from the middle of each cob would be sown, because at the cob-ends the seed was considered too weak. Sowing periods were planned to take advantage of the rains[a], and germination rates were almost 100%. The seeds would be sown in an open row with about 18 inches spacing between plants, and 2-3 grains per hole. Then the row would be closed by foot. When the maize was tall, the plot would be weeded and the rows hilled-up. All cultivation was done using oxen.

Farmers used to have mixed farms and would rotate crop fields with grazing pasture. The soil was fertile and did not need fertilising directly, but prior to the maize they would grow sweetpotato or cassava and leave the residues in the field. This was called '*vegetal al terrano*'. After ploughing, the soil would be left to rest for 40 days before sowing. During this time, the weed residues would break down and fertilise the soil, and because of the heat it was said that the broken soil had 'fever'. If crops were sown before the end of this period they would turn yellow. The maize in those days was *criollo* - locally interbred and adapted. The cobs were yellow and bottle-shaped. Maize harvested at 3 months was tender (*tierna*) while that harvested at 4 months would be dried, ground and made into a dish of steamed maize (*tamales*).

[a] According to the father of one old farmer, the rainy months - and thus the sowing periods - could be forecasted the previous year. On the 21st September of that year, 12 piles of salt would be laid out and observed to see which would absorb the most water. Further, on the same day, at 2pm, the direction of the wind would indicate the predominant wind direction for the coming year (F/P/13).

In terms of cultivation practices, equal numbers of farmer respondents favoured mono-cropping maize, intercropping or both. Intercropping was favoured to make best use of land, reduce pest and disease levels, and protect soils. One head of production (F/P/12) explained that intercropping also resulted in higher yields, and trials undertaken by an ex-CPA agronomist had shown the intercropping of maize to be cost effective, higher yielding, with lower labour costs and appropriate on a large scale. Head of *finca* F/P/13 put the increased prevalence of insect pests over the years down to the widespread practice of monocropping. Monocropping, on the other hand, was supported by others as it avoided crop competition, facilitated mechanisation, and allowed better ventilation. In addition, intercropping was seen by some as being too labour intensive and only appropriate on small plots of land. Those in favour of both methods argued that it depended which was most economical. It was necessary to monocrop maize destined for the Seed Enterprise because the State would send in a harvester.

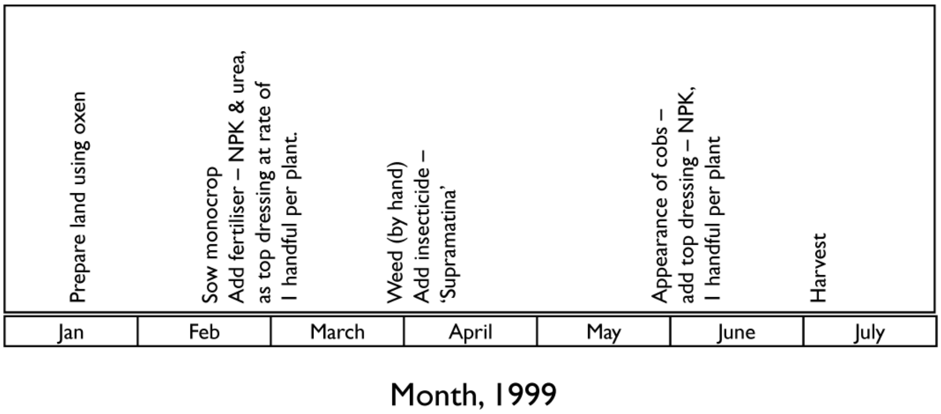
6.3.5 Use of chemical and ecological fertiliser and pest control inputs and strategies

Over a third of the farmer respondents were applying NPK formula on their maize crop as basal and top dressings, and a quarter were using urea usually about one month after the sowing date. Rates varied between 200-400kg/ha urea and 100-800kg/ha NPK. Several farmers, and especially those from San Antonio, affirmed that they would apply more if available. The calendar of activities of a typical farmer, (F/P/7) for the cultivation of maize, is displayed in Figure 6.3.

Some respondents used of one or more ecological soil fertility management strategies for maize. Approximately 40% were using rotations, and 30% were applying organic matter/manure. A very small number were using green manures, intercropping, and/or the integration of livestock. Rotations and intercropping were more popular when the crop was destined for self-provisioning.

In terms of pest control, almost half the farmers were using a duel formula pesticide (Parathion and Carbonil) on maize, at rates between 24-600kg/ha. Timings of applications varied from *"when the plague is detected", "at the time of a visit by the State Enterprise", or "at two months"*. A range of six other chemical pest and disease control products were being used. Some of the respondents identified using at least one ecological pest and disease control strategy with maize. One third were applying biopesticides (*Bacillus thuringiensis* at 5 litres/ha, and/or *Verticillium lecanii*), and an equal number manual techniques of sprinkling ash, chalk, soil or sand onto the leaf nodes. One farmer explained that frequent applications of Bt should, with good rainfall, be sufficient to control maize leaf borer. Small numbers were using plant associations, periodic irrigation, and seasonal timeliness. Biological controls complemented intercropping systems as they could be applicable, and were certainly not damaging, to both field crops.

Figure 6.3 Seasonal calendar of maize production using agrochemical inputs on one CPA finca (F/P/7)



Equal numbers of farmers preferred to use either just organic inputs or a combined approach of organic with chemical. Only a small number preferred to only use chemical inputs. Common reasons for choosing only organic inputs included: "*this is more appropriate", "the use of seeds with alternatives means less costs, less pollution and less external dependency", "this will result in resistant plants with low input use"*. One farmer (F/P/7) described how biocontrols such as *Trichograma* were cheaper than chemicals because they were produced in Cuba. Reasons for the combined use were given as: *"the use of chemicals delays the onset of pest attack", "germination rates would otherwise be lower", "often the seed is not of good quality and soils are poor", "use of both has shown better yields and also conserves the seed better", "maize needs nitrogen as it has a short growing period"*. CPA president F/P/11 explained that biocontrols required more knowledge and management than chemical inputs. In terms of integrated control, farmer F/P/12 noted that the more expensive chemical pesticide should only be used in periods of light rainfall, when the rainwater could not sufficiently collect in the leaf nodes to deter the maize leaf borer.

6.3.6 Sources of inputs, knowledge and technical assistance

Agrochemical fertilisers and pesticides came from MINAG. Biological controls came from the local CREE, organic soil inputs (e.g. *Rhizobium*) from the Soils Institute and ICA, and manure from the local State livestock farms. Farmer F/P/7 explained that their high level of use of organic inputs was because of encouragement by their President. Those using biofertilisers and green manures explained that these were only available through specific research programmes.

Some organic inputs were produced on-farm. Half the respondents identified on-farm production of organic material, including manure, and almost the same quantity green manures. Other on-farm organic soil inputs included mulch, incorporated harvest residues, and decomposed chicken manure, although these were usually earmarked for specific crops such as banana or pumpkin. Chrysanthemum (*flor de muerto*) was identified as an on-farm pest control input for nematode control. The majority of respondents (82%) attained the benefits of producing more inputs on-farm, and green manures were particularly desirable - *terciopelo*, *canavalia* and sorghum - because of their multi-purpose benefits of improving soil fertility, eliminating weeds and increasing yields. Other desired on-farm strategies were to increase the level of natural predators and for vermiculture. Farmers were able to name three institutes working on soil fertility issues, and ten on pest and disease control. Very few farmers had received training on either of these topics. Four institutes were identified as working on issues of ecological agriculture: INCA, ICA, ANAP and Sanidad Vegetal. The majority of respondents had learned about ecological approaches through family or practice. One CPA had developed its ecological knowledge through the personal interest and commitment of one member who had undergone several training courses and then extended this knowledge to the rest of the co-operative. Other sources of both ecological information and appropriate seeds were the contacts made through the Agroecological Lighthouse project. ANAP and its training school also played a significant role, and CPA president F/P/11 felt that he had received more assistance from ANAP and from the research centres than from MINAG which was, he commented, “*still itself learning about sustainable agriculture*”.

6.3.7 Awareness and perceptions on ecological agriculture

When put before them, over half the farmer respondents were aware of (but not necessarily using) ecological soil fertility techniques (of crop rotation, intercropping, use of manures, plant wastes, green manures, incorporation of plant residues, and legumes), and for pest control, (crop rotations, polycultures, crop associations, pheromone traps, resistant varieties, biological insect control, and the use of Bt). There was a lower awareness – less than half of respondents - of the potential for techniques such as compost, *Rhizobium*, minimum tillage, or use of plant extracts. The only techniques known by more than half the farmers from both municipalities were intercropping, addition of manure, and use of green manures. Appendix III displays a table of these results in full detail. Generally there was far higher awareness in San Antonio than Batabanó. Sowing in the correct season had been overlooked from the table but was a widespread traditional practice.

Agrochemical use was associated with some risks and side effects for the majority (76%) of farmers, and largely relating to human health and toxicity, and harm to the environment. The build up of biological resistance was mentioned, as was the resulting poor flavour and plant development. Strategies suggested to reduce toxicity risks were to ensure a time gap between chemical application and harvest/consumption, and for farmers to wear protective masks. The decrease in availability and use of agrochemicals during the Special Period was seen overall as having a positive impact on specific factors, and especially on issues of pest and disease levels, soil quality, farmer health, the role of the female farmer, the natural environment, and economy. A negative impact was felt for issues of crop yield, product quality and labour requirements. These results are shown in Table 6.5, and the reasons for these choices in Table 6.6.

Table 6.5 Impact of decrease in use of agrochemicals for specific factors, amongst survey respondents in San Antonio de los Baños and Batabanó

Factor	Positive impact (% respondents)	Negative impact (% respondents)
Health of farmer	67	0
Natural environment within co-operative	55	0
Economic	55	6
Level of pest and disease	52	12
Role of female farmer	52	0
Soil quality	48	6
Level of knowledge required by farmer	48	3
Livestock health	42	3
Product quality	27	36
Labour requirements	24	33
Crop yields	21	42
TOTAL FREQUENCY of responses	164	47

Several farmers pointed out that with the decrease in input availability, the main limitation to production was not the lack of agrochemicals but of petrol to drive irrigation systems and farm machinery, and specifically for land preparation and weeding. Farm organisation was also an important consideration, and the optimum size for a CPA was considered to be approximately 160-

200ha with a labour force of 50. In this respect, all three co-operatives were too large to be managed most efficiently.[114]

Table 6.6 Reasons for the positive or negative impacts of the decrease in use of agrochemicals, amongst survey respondents

Factor	Reason for **positive** impact of lack of agrochemicals	Reason for **negative** impact of lack of agrochemicals
Crop yields [a]	- improved attention to the crop and sowing at optimum planting date, - good seeds.	- decreased production, - increase in pests, - "*at this moment we are working with crops bred for artificial environments*".
Product quality	- good attention paid to the crop, - crops are more healthy, - better flavour and less toxicity, - less pests and diseases.	- increase in plagues.
Level of pest and disease	- improved biological equilibrium, - less pest attacks and plagues, - use of more natural controls, - maintenance of weed control and keeping areas clean.	- lack of petroleum, irrigation and inputs.
Soil quality	- less use of chemicals so less labour required, - more ground cover - value placed on manure [b]	- problems with land preparation - lack of petrol means poorer soil drainage, and thus increased topsoil loss through surface runoff.
Health of farmer	- less intoxications and injuries, - less accidents.	
Health of livestock	- fewer fatal poisonings of animals.	
Level of knowledge required by farmer	- more knowledge is required, - there is a need to study and learn more.	- lack of knowledge.
Labour requirements	- less use of chemicals so less labour required.	- less labour required - more labour required.
Role of female farmer[c]	- increased female employment, - more possibilities for employment.	
Natural environment within co-operative	- less environmental damage - improved ecosystem [d].	
Economic	- lower costs with equal or higher yields.	- little production, - decrease in economy.

[a]In terms of crop yields, several farmers depended on the crop and the year, and on whether ecological alternatives had been found. Contrary to other respondents, one felt that pest levels were affecting yields. One noted a yield drop of 40%, and a few were aware of the temporary drop in yields during an ecological transition process. [b]Farmer F/P/11 noted that that the value of manure became defined in monetary terms during the Special Period, when it was seen that the grazing lands and pastures were able to maintain production whilst the crop lands were not. [c]One farmer explained that "*Female workers have a tendency to be better at delicate handling activities such as working with organic inputs, yet men are still required to undertake the heavy back-pack spraying.*" [d]Farmers explained that at the height of chemical usage in the 1980s, there were no bees.

Maize was already being produced ecologically on self-provisioning *fincas*. For a more widespread ecological approach to maize production, the most important factor to maintain high yields would be, according to the farmer respondents, the use of appropriate varieties, and then, in descending order of importance, improved seed quality, the use of organic fertilisers, learning from the experiences of other farmers, and the use of biological pest and disease control. Issues of labour, irrigation, land area, prices and training, were seen as of lesser importance. The perspective of one veteran farmer who had been using ecological approaches all his life is given in Box 6.4.

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[114]Generally, CPAs were being increased in size by merging two or more together (F/C/30).

Box 6.4 Perceptions and practices of ecological agriculture by a veteran farmer on one Lighthouse finca (F/P/2)

Interest in ecological agriculture. Back in 1992, this CPA farmer had participated in an exchange of experiences on ecological agriculture as a way through the crisis period. From this meeting, the Cuban organic movement, ACAO was born. Yet the approach was not new to him; it was similar to traditional agriculture, whereas for only 4½ decades had they been encouraged to farm industrially. So he went about farming the Lighthouse *finca* – of which he was head - using traditional knowledge coupled with advice from the research institutes. For this farmer, ecological agriculture meant timely planting, field rotations, soil improvement, minimal labour, crop associations, polycultures, and biodiversity enhancement. For him also, industrialised agriculture did not make good economic sense in the reality he saw around him. He explained why he had had enough of industrialised agriculture thus: "*When the camel is in the desert with a long walk and a heavy load he asks the flea to get off his back*." Why did he have this belief in ecological agriculture whilst other farmers didn't? He felt that "*those who should and can believe are those with the most education and knowledge*", and also that "*people change when things start to go against their reality of what they see as being true*."

Use of inputs. He had found that biofertilisers were useful for the transition period, but that in general they were not necessary as part of a good ecological system - they were costly, and an alternative strategy during the low-yield conversion period was to grow higher-value crops. In 1993-94, when the *finca* was being developed, soil organic matter content was 0.5, whereas its current level was between 5-6 (which he felt was similar to the pre-industrialised period). This was due to the use of green manures. Banana was considered a good crop for the transition period: it could be intercropped in the first year, fed itself naturally over a 5-7 year cycle, cleaned the soil from lingering residues, and produced a good crop throughout. Current soil fertility practices included minimum tillage where possible, and leaving stones in the fields to supply calcium.

He did not believe that agrochemicals were completely redundant, but that they focused on the wrong target. He gave the examples of the *Thrips palmi* pest where the focus for control should, he felt, be on breaking the cycle at the egg-nymph-lava stage rather than the adult stage which was the target of chemical and biological toxins. Toxins ran the risk of a build-up of resistance, whereas he proposed breaking the lifecycle through other means. Quantities of biocontrols being used on the CPA were increasing slightly from 42 l/ha in 1994 to 53l/ha in 1996, yet the CPA was currently (at 1999) reducing its level of biocontol use as it was now not needed. Levels of biocide had dropped to 6.6 kg/ha in 1995 and since then had increased slightly. In terms of land area treated, 56 ha received bioinputs, and 3 ha chemical inputs. For this farmer, biopesticides were advantageous in that they were non-polluting, non-toxic to humans, could be produced nationally, were cheaper, did not induce insect resistance and did not interfere with the biological cycle. According to him, yields in this transition phase were starting to increase as were biodiversity levels. With the increase in birds there are fewer pest outbreaks.

Labour force, training and knowledge More labour was necessary at an early stage of the conversion, but once the ecological basis had been established after 5-6 years, then labour needs decreased. By rotating the workforce so that each has a long work period on this *finca, so* the whole farm could be converted in the future. He stressed the importance of the learning process, and that it would have been too strong a metamorphosis for the conversion to happen all at once, for example it could take 4-5 years to recover the soil and what could be grown in the meantime? He thought that the workers were interested because they had seen the residual effects of chemicals in their foods, and could observe the difference in quality as regards flavour and colour, as well as the cost savings of the Lighthouse *finca*.

He himself ran a training course on agro-ecology for small farmers in the municipality, although he had never formally studied but instead he read, listened, and looked. As he explained "*Agronomists especially have to start learning everything through observation: mixing plants of different colours and smells to regulate insects, noticing air currents at different times of the year and wind direction, and the influence of the sun and the moon.*" For him, there was a continual learning process between the grower and nature, and between farmers.

Overall production State production plans were considered somewhat incompatible with ecological approaches; better suited to the industrialised approach. Total yield on the whole CPA co-operative was averaging 14.3 t/ha in 1994-95, and 16.9 t/ha in 1995-96. However, the farmer explained that there was a 4-year cyclical agroclimatic pattern to production which necessitated a long-term view of fluctuations. The years 1988, 1992 and 1996 had been particularly good ones, and this information could be used to direct planting programmes so that, for instance, more resistant crops such as sweetpotato and cassava could be planted during bad years.

The future for ecological agriculture This farmer felt that integration was the key to sustainable agriculture in Cuba, with health as the most important consideration, so preoccupation with export markets, including organic, was unnecessary. He acknowledged that one outlet could be the export and tourist market, but he stressed again that the first priority of the country was to feed its people, and that there was no point in importing a product which it could produce itself. He felt that Cuba had achieved a lot over the last few years in terms of developing ecological agriculture, especially in urban agriculture, and he suspected that they were almost through the most difficult part of the transition phase – the last major pest plague had broken out in 1994-95, but since then they have been able to encourage more ecological balance and control. Rural areas still required more training and better crop varieties, and more research was required to regain the traditional knowledge that has been lost over the years. Also required, he felt, was a balanced production-consumption chain and a balanced diet. Overall, he felt that Cuba was creating its own way through experience and knowledge, a way that could not be planned as per the industrialised model. However, "*this requires a slow, step-by-step approach, and the country would be wrong to hope otherwise*."
[a] This observation was corroborated by the Head of Production F/P/12 on another CPA.

Over half the farmer respondents, 58%, believed that their co-operatives could perform well without recourse to agrochemical products. Common reasons given were: "T*he reality of the 1990s has demonstrated that it is possible to increase production without agrochemicals.", "If it is managed to protect from erosion and to have organic fertiliser and good seeds, then yields will not be affected.", "It is possible to do everything well and carefully, increasing soil fertility, to achieve good yields in a stable manner"*, and *"We can do this through following a logical rotation and using alternatives*." However, one quarter of respondents firmly believed that they could not perform without agrochemicals, because: "*This technology is necessary to develop the country.", "Every day there appears a new, stronger and unknown pest.", "It is these inputs which resolve the problems of the co-operative.", "The lack of agrochemicals has decreased production in general.",* and *"There exists a lot of plagues and bacteria in the atmosphere*."

In terms of the future, there was a certain common agreement that they would be careful with the use of agrochemicals as they became more available, using "*only the necessary*", as they now knew of their negative effects and the positive effects of ecological alternatives. Still, as and when chemical inputs became cheaper, some agreed that they would use more, and others felt that Cuba would return to high levels of use because it was associated with past affluent times. The biggest obstacles to developing ecological agriculture in the future were, according to CPA president F/P/11, the low level of farmer awareness coupled with the time lag in seeing the benefits of ecological production, while the biggest incentives were the high costs, and lack of availability of, chemicals.

6.3.8 Institutional capacity and perspectives on maize crop management

In terms of ascertaining the type of institutional support for these CPA co-operatives in their maize production activities, 25 institutions were visited in the province and city of Havana, and 32 interviews undertaken. The institutional focus was on plant breeding support, and seed provision and regulation entities (a more detailed list is provided in Chapter 4).

Plant breeding institutes, strategies and recommendations

Institutional functioning and impacts of the Special Period

Scientific research on plant genetic resources was co-ordinated through the Biotechnology of Agricultural Crops programme of CITMA, and the National System of Plant Genetic Resources, established in 1992, was responsible for the preservation of genetic resources.[115] The agricultural research institutes most closely involved in maize breeding, and which held maize germplasm banks, were INIFAT, IIHLD, and INCA.

Plant breeding departments collaborated with a range of actors in the sector: with MINAG over resources, with CITMA on methods and project approval, with the State Seed Enterprise, ANAP,

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[115] A more detailed description of this national network is provided by Rodríguez et al. (1994).

and with producers. This collaboration, and more applied research, was being encouraged in recent years, as was economic (but not sociological) evaluation of the research impacts (MA/R/21). Resource shortages had constrained the activities of the research institutes, and particularly their capacity to maintain their seed banks, reproduce and distribute seed, and conduct field trials[116]. Researchers at INIFAT described how they had lost a lot of their seed collection due to both the lack of fuel to reproduce the seedbank *in vivo*, and the outbreak of *Thrips palmi* three years previously (MA/R/18). Research funding sources were also going to change, from the current sources - MINAG, ANAP and the Seed Enterprise – to a future situation where farmers would have to finance their own research. According to researcher MA/R/5, this would increase the credibility and trustworthiness of research.

The conventional research process

The traditional research process of breeding programmes lasted for 3 to 7 years, comprising of three basic stages:

i) Investigation on the management of populations and lines, lasting 2-3 years. This was undertaken by researchers, with problems defined by MINAG or through talking directly with farmers.
ii) Yield performance trials, lasting 1-2 years. This was undertaken with farmer participation, and at a regional level 15-20 farmers were usually selected near to the research institute, based on criteria of appropriate soils, irrigation facilities, knowledge of the crop, and farmer capability. The farmers followed recommended input levels for fertilisers[117] and pesticide application, and retained the crop at the end of the trial. Farmers were asked to evaluate varietal performance using a questionnaire.
iii) Validation/extension, lasting 1-2 years. This was undertaken by farmers and consumers.

Farmer groups selected for on-farm or on-station trials were those with the best natural and technical resources and therefore were not representative of the farmers of the region. These farmers were instructed as to how to proceed with the trials and researchers were in control of the whole process, with farmers' opinions sought in year 5 in the form of a questionnaire.

After the successful completion of this procedure, the final step was to pass the selected varieties to the Seed Enterprise for multiplication and distribution. Research results were distributed through municipal, provincial and national meetings, events and training courses, to which farmers were invited. Within this process was some concept of regionality. The research institutes had field stations in other provinces, and regional projects bred for the local eco-region. If a variety appeared to be stable at regional level, only then would it be tested, and disseminated, at national level. Prior to 1989, in contrast, there were national recommendations only. The institutes also interacted with regional universities and research centres working on the same crops.

Breeders held mixed but generally cautious reactions to the concept of participatory plant breeding. One researcher pointed out that farmers would find it difficult to cross varieties in practice, because of the 7 fields needed to reproduce parents and offspring. Farmers might face difficulties in making their own selection, and there was concern that characteristics may be lost if more than one variety were planted together. There was negligible awareness on increasing their interaction with, and the interest of, farmers.

Changes in maize breeding strategies

The plant breeding departments served both State and non-State farms. Although breeders acknowledged that farmers demanded '*criollo*' types, they felt that these types were often less resistant and developed too much biomass at the expense of the grain. Both hybrids and varieties were developed. Hybrids had higher input requirements and were more expensive to produce.

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[116] Rodríguez (2000) points out that although the main function of the National System of Plant Genetic Resources is to stop genetic erosion, such erosion has occurred within the institutes themselves because of the lack of regeneration programmes. For example, 36% of pasture, 24% of citrus and fruit, and 14% of rice material has been lost.

[117] An average being 130 kg/ha N, 90kg/ha P and 80 kg/ha K.

Because of this, and rather than limit their production, breeders worked on the calculation that yield requirements had to be 30-50% higher than that of varieties, in order to be cost-effective.

Prior to 1989, the main breeding objective had been to directly increase yields, which for maize were at that time around 6-8 t/ha when supported by a high level of inputs. Input recommendations then were approximately: N:150kg, P:120kg, K:180kg. Although Green Revolution varieties were not widely introduced into the country, the accompanying technologies were taken up during that period. By contrast, the current breeding projects of one research institute focused on a range of characteristics including: length of cropping period, resistance to lodging, plant density, low fertiliser inputs, proliferability, pest resistance, altitude variation, high temperatures, and drought resistance. Another institute explained that, since 1993, they had been looking for rustic varieties, although they felt that this approach could change again within a few years (MA/R/21).

At this current time, a 10-year plan for maize production was being developed by MINAG and the research institutes. The main objective of this plan was to obtain a national average yield of 3 t/ha (current yields were below 1 t/ha) so as to supply the population with the national demand of 50kg/capita/year, plus an additional 300,000t dry grain for livestock feed. This plan provided a good example of future agricultural policy, envisaging a three-pronged mixture of production approaches as detailed below:

i) "Intensive production": 29% of total maize area under high input conditions using 100% hybrids to achieve yields of 4.5 t/ha and a production of 390,000t, for human and animal consumption;

ii) "Sustainable production": 47% of total maize area under 'sustainable' conditions using 70% hybrids and improved varieties, to achieve yields of 3 t/ha and a production of 470,000t, about half of which was tender maize (premature) and largely for human consumption;

iii) "Self-provisioning consumption": 22% of total maize area under low-input conditions using 20-30% improved varieties for yields of 1.5 t/ha. The latter category entailed the use of biological inputs only and with no mechanisation or irrigation, and largely on marginal soils.

Because this plan intended for domestic self-sufficiency in maize production, it would require the tripling of maize cropping area from 100,000 ha to 300,000 ha, and this would need the approval of MINAG in order to utilise the land currently being taken out of sugar production.

Research input recommendations for maize

Although input recommendations were not necessarily reflected in farming practise, they demonstrate the extent to which the research sector was in tune with current field conditions. The form of input recommendations had changed over the years. In the late 1960s, for example, optimum input levels were disseminated in the form of a ' technical menu' (*carta tecnologica*), a set of instructions specifically aimed at campesino farmers, given that State farms were implementing these *de facto*.

Current technical leaflets published by the breeding departments of 2 research institutes provided recommendations for maize varieties and hybrids as shown in Table 6.7. They assumed that specific varieties and inputs could be obtained, and that farm machinery could be worked. The use of ecological inputs was not mentioned. Separately, INISAV had produced technical recommendation leaflets on biological control. These leaflets followed a similar style to those of industrialised inputs, describing application methods and dosages, and compatibility with chemical and other biological inputs, as in Table 6.8. The leaflets also described how the product affected the pest. Information on management strategies for low-input and ecological production were either non-existent or not easily available.

There was little other evidence of any emphasis on ecological techniques, save one technical bulletin of Sanidad Vegetal, entitled "Leaf Borer in Maize", (INISAV, 1997[b]), which was dedicated to integrated management of the pest. This bulletin advised reduced use of chemicals in the future and only in cases where biological methods had not proven successful or possible. The burning of maize stubble had recently been prohibited, although MINAG itself still continued this practice, and the Seed Enterprise in particular.

Table 6.7 Input recommendations for some current commercial maize varieties and hybrids

Type	Potential yield	Input recommendations		
		Fertilisation	Pest control	Weed control
Variety X	5.4-6.0 t/ha For large-scale production with high or low inputs.	N – 135 kg/ha P – 80 kg/ha K – 90 kg/ha	Follow recommendations of Sanidad Vegetal	Apply one herbicide only if soil is compacted, and another after the cultivator has hilled-up.
Variety Y	6 t/ha	N – 150 kg/ha P – 70 kg/ha K – 90 kg/ha	None	None
Double hybrid Z	10.5 t/ha	N – 150 kg/ha P – 90 kg/ha K – 80 kg/ha Depending on soil type. Apply when soil is humid and may cover.	If Leaf-hopper: Dimicron 1 l/ha Bi 58 1 l/ha If Leaf-borer: Tamaron 1 l/ha If Leaf borer: Thiodan Parathion 30kg/ha Dipterex 30 kg/ha	3-4 kg/ha Gesaprim. Where this is not possible, weeds can be controlled by mechanical and manual means.

Source: Technical leaflets of agricultural research institutes (IIHLD, 1997; INIFAT, various)

Table 6.8. Recommendations for use of bio-pesticides on maize

Biological product	Pests controlled	Dosage	Application
Bacillus thuringiensis	*Spodoptera frugiperda* (Maize leaf borer)	2-5 l/ha	As preventative: when low level of larva, apply every 5-10 days. As control: more frequent appications.
Verticillium lecanii	*Bemisia tabaci* (whitefly)	1kg/ha	In afternoon or evening, in liquid form on leaves.

Source: Technical leaflets, INISAV 1997[a]

Breeders' perceptions on the potential for ecological maize cropping

To avoid competition for nutrients, intercropping, if practised, should be undertaken at no more than 20% of the secondary crop. Breeders also felt that organic manure did not release nutrients sufficiently quickly in the short growth cycle of maize. This opinion was supported by results of trials by the Soils Institute which showed that organic manures were unable to achieve the same maximum yield levels as chemical fertilisers. Several breeders also felt that maize production required the use of chemical pesticides, because varieties had only partial pest resistance and were readily affected by climate. Further, biological pesticides required careful management in terms of timely application, storage and transport, whereas chemicals did not. Farmer confidence was also identified as an important factor against the use of biocontrols: in a previous experiment, 7 bioproducts for maize were tested but none performed well and this affected the interest of the farmers.[118]

Researchers' opinions of the viability of a more ecological agriculture varied, with some being in favour whilst others feeling that farmers would use more agrochemicals when they become available. One plant breeder (MA/R/4) felt that "*organic agriculture is confronted with too many difficulties*." For this researcher, sustainability meant "*Resistance - that production is capable of covering needs and produce for sale. Equilibrium - to invest with what you receive*." Another seed

[118] Compared to plant breeders, researchers from other research disciplines were more holistic, with one agronomist (who had undertaken an MSc on sustainable agriculture at CEAS) commenting "*If you don't add fertiliser then you won't get the yield, but it depends on what you planted previously – such as a legume rotation, and the 2 best ways to achieve good maize yields in Cuba under current conditions are with good seeds and correct timing – planting after April. I recently met a group of farmers who were getting very high yields through spraying a preparation of cachasa, manure and water, and I would also recommend minimum tillage and 12-30 t/ha manure*." (MA/R/21).

specialist felt that different regions had different needs and constraints, and agreed that one should not risk the food supply (MA/R/22).

Strategic changes of seed production and quality control institutes

The Seed Enterprise produced, improved and commercialised seed, whilst quality control was provided by the Seed Inspection and Certification Service, run by INIFAT. Prior to 1999, the Seed Enterprise was responsible for supplying seeds to farmers, but recently this had decentralised to become the responsibility of municipal delegations of MINAG and their associated Enterprises. According to MINAG representative (MA/15), farmers preferred to purchase seed because it was of a high, certified quality.

Seed production and multiplication

The Seed Enterprise worked with about 12 varieties of maize nationally, although in Havana province it focussed on 6 maize hybrids: 3 doubles and 3 triples which varied in price according to yield. For urban agriculture, the Enterprise imported whatever seed could not be produced in-country. Based on advice by the research institutes on which varieties to reproduce, the Enterprise and MINAG made a programme of production needs. Contracts were made with farmers to reproduce this basic seed, which was then registered and certified by MINAG. In Havana Province, approximately 400 farmers – largely the more efficient CCS producers - were producing seed for the Enterprise. These farmers received the necessary inputs: NPK, urea, insect controls, and petrol for irrigation, and if their cropping area was large enough the Enterprise brought in its own machinery for cultivation/harvest. The Enterprise had a centre in every province, and could produce regional varieties if requested by the research institutes. Since 1998, the territorial stations of Sanidad Vegetal had also become an important player in seed production, in charge of certifying seed, authorising certificates for the free transfer of seed (to control the spread of disease between regions), and imposing fines. Yet owing to resource shortages it was unable to make the required technical visits to each production co-operative (GFP, 2001).

Production levels were greatly influenced by the Special Period. Prior to 1989, the Enterprise was relying on specialised State farms to produce seed under high-input conditions. By the early 1990s it was producing approximately 50% of previous levels (Ríos & Wright, 1999) and largely on UBPC co-operatives (MH/R/4). More recently, however, seed production had surpassed the levels of the late 1980s, because of the introduction of hybrids. In 1996, for example, maize production reached 684t maize seed, compared to 90t in 1985[119] (GFP, 2001).

Seed inspection and certification

The Seed Inspection Service set minimum standards for germination, micro-organism presence and so on, and a body of inspectors provided orientation and levied fines where necessary. Every seed-producing farm must be declared and inspected, and if seeds were being produced for consumption, then the usage could not change to seed production. Whilst any institute could develop varieties and undertake eco-regional trials, commercialisation must be preceded by registration in the Register of National Varieties (MA/R/22).

The Province of Havana supplied 50% of all nationally produced seed, so there was a heavy workload of inspection the whole process taking about 15 days. The Inspection Service was also aware that farmers saved their own seed, and acknowledged that this may be because of a lack of confidence in the Seed Service as regards quality and quantity. Equally, they pointed out that farmers' own saved seed also lacked quality. The Service was operating under the limitations imposed by the Special Period, and this was affecting seed storage capacity and ability to identify farmers capable of reproducing seed of good quality. According to them, low inputs equated with low yields. One staff member (MA/R/22) attempted to define 'low input': "*Low input can be*

[119] By 2000, State maize seed production had dropped again to 470 t/pa and was predicted as lower still for 2001. The reason for this was partly an intentional drop owing to the large quantity of seed already in the cold stores, and partly because of a decrease in financial resources (GFP, 2001).

without any or with low amounts of inputs. Low inputs means low yields, it is substitutions and adding manure, and also means being more precise – to measure exactly what the plant's needs are."

Varietal improvement and participatory plant breeding

The Seed Enterprise also undertook varietal trials with MINAG, and these included on maize varieties suitable for self-provisioning. A typical maize cropping calendar, according to provincial level Enterprise staff MA/17, would be to sow winter maize at the end of December with about 0.3 t/ha of NPK, and then after 30 days apply 0.2–0.3 t/ha of pesticide – Parathion and Carbonil. According to him, the Seed Enterprise did not work with low-input varieties because this would lead to drops in yields.

The Seed Enterprise was aware that farmers were involved in maintaining and interchanging their own local '*criollo*' types, yet it had no involvement in this. Staff admitted "*We have not been interested in low input seeds, and anyway, quality is the most important aspect, such as germination and phytosanitary conditions.*" The Seed Enterprise staff felt that farmers were not necessarily capable of maintaining a good seed quality and were better off going to the Enterprise. They also had their doubts about farmer seed networks and quality control: "*The producer always mixes varieties anyway, and may harvest when it is humid and do other things which lower seed quality. Also, would it be economic to produce seed in this way*?" Staff at the Seed Enterprise expressed interest to assist in a participatory plant breeding project by, for example, providing storage for low-input seeds, as long as there were large enough volumes (minimum 4-5t). One staff researcher explained that the need for farmers to self-save seed was diminishing. While in the past there might have been shortfalls in production, "*the situation is now stabilising and producers do not need to save their own seed any more*." (MA/R/22).

In terms of farmer development of commercial lines, as was being looked into by the PPB Project, Seed Law 175 (Decreto Ley de Semillas 175) prohibited seed being distributed without official certification, in order to prevent the spread of disease. This had legal implications for farmers attempting to commercialise or exchange seed without authorisation. However, it was common knowledge that farmers exchanged small quantities of locally-adapted varieties, and as this was a benefit for agricultural production, so it was not prevented. Inspection Service staff felt that participatory plant breeding could make a positive contribution to this informal exchange process as long as everyone were consulted - particularly the Seed Enterprise, themselves and Sanidad Vegetal.

Future strategies for seed production

Representatives from the Seed Enterprise felt that small farmers were unable to produce sufficient maize quantities to feed the urban populations or meet national demand. One staff member, MA/14, explained "*Although I know that Europe feeds itself through small farm enterprises, I cannot imagine that possibility in Cuba*". Because of problems faced in the State sector, some staff saw the way forward as being through joint investment schemes, with large-scale production and high technology "*such as using aeroplanes to spread the herbicide*" (MA/14). The Seed Enterprise was currently involved in on such scheme, PROGRAN, a collaborative venture with French support, with the objective to demonstrate the cost-effectiveness of producing maize, soya and bean within the country rather than importing these crops. They would be sold at a low dollar price to the State, and some production would go back to the investors who had put up $600,000 for the development of 309ha of land. The project was expecting high yields with low production costs, and a fairly intensive production system.

6.4 DISCUSSION OF RESULTS

6.4.1 Degree of representativeness of the field study

The three CPAs hosting the Agro-ecological Lighthouse Project were located in Havana Province, in areas relatively well endowed in terms of both natural resources (soil fertility, water) and institutional support (proximity to centralised State institutions in Havana City) compared with the rest of the country. Both pre- and post-crisis, they were in receipt of more agrochemical inputs and industrialised technologies and would therefore probably have been harder hit by the crisis in real terms. Yet at the same time they were likely to have had greater access to knowledge on ecological agriculture, given their involvement in the Agro-ecological Lighthouse Project.

To test the representativeness of this sample farm group, a small-scale test survey was undertaken of a number other farms, using the resources of a German-Cuban agro-geographical research project.[120] The characteristics of these farms indicate a reasonable level of similarity and overlap in conditions and perceptions of these farms and those used in this field study (see Appendix IV for a summary of results of this survey). Specific similarities with the three focus CPAs were the low level of training on ecological agriculture, the lack of fuel as being the major constraint to production, the desire for more appropriate crop varieties, and the importance of irrigation and traction. A major difference was that the co-operatives in Quivican held more negative perceptions of the impact of the Special Period than the three focus CPAs.

6.4.2 Identifying the predominant production approach

Agrochemicals were being used on all the co-operatives (including the CCS co-operatives in Pinar del Rio), and especially for seed production and priority crops, where the majority of farmers were also using inappropriate seed varieties. On the basis of this limited sample, at least half the farmers were using agrochemicals for their maize crops, with fertiliser rates as high 0.8t/ha NPK, and pesticide dosages up to 0.6t/ha, and this for maize which was unprioritised in terms of receipt of agrochemicals. At the same time, up to half were rotating their crops and about one third were applying organic manure and using biopesticides or physical pest control methods. Paradoxically, there was a high latent desire both to use more agrochemicals if available and to use more of the ecological techniques which were known about but not currently practised. In terms of farmers' seed systems, although they held relatively good levels of knowledge about seed management, in practice they held very little control over seed selection and production, genetic diversity was low, and poor storage conditions encouraged the use of fumigants.

Rather than one production approach over the whole farm, each CPA contained certain *fincas* which were more industrialised – those which were growing priority crops, and others which were less-industrialised or ecological – the obvious one being the Lighthouse *finca* but there were others too. Therefore, even for these CPAs which were housing ecological demonstration farms, the overall production approach was not ecological in terms of intent or knowledge base. Certain ecological techniques were being practised to a wide extent, but given that the delineation between industrialised and ecological agriculture goes wider than practices (as discussed in Chapter 3), with many husbandry practices common to both, therefore the practice of ecological techniques was not taken as sufficient evidence of a widespread ecological agriculture.

In terms of transition, the CPA co-operatives appeared to be at a stage of reducing industrialised inputs and starting to apply ecological inputs and more localised strategies. Within this were the wide intra-farm differences between crop treatments. The Agro-ecological Lighthouse *fincas* were further ahead, in that they were decreasing applications of ecological inputs and were showing signs of self-regulation and an upturn in productivity. This variety was also seen at individual level, with some farmers – multipliers of seed - in receipt of technology packages from the Seed Enterprise, whilst others, such as the head of a Lighthouse *finca* F/P/2, making use of natural processes and

[120] This project distributed questionnaires to ten farms (5 CPAs and 5 CCSs) in another municipality of Havana Province (Quivican).

dynamics to maintain his production system. Box 6.4 showed evidence of this farmer's underlying sense making, a process of observation and comparison, and a reluctance to accept mainstream ideas if they did not fit with the observed reality. There was a visible correlation between the stage of transition of the *finca* and that of the farmer in charge, and similarly where ecological strategies were more visible on-farm they could be traced back to specific individual 'pioneers' who were specifically promoting this farming approach.

6.4.3 Changes and coping strategies in the institutional support system

The seed support system had been strongly affected by the crisis, as described in the rationale of the PPB Project which itself emerged as a coping strategy to the lack of on-station experimental resources. In terms of achievements, the formal seed sector had been successful in serving large-scale production units; it had been able to continue to provide at least one variety of most major crops even throughout the crisis years, and it had raised awareness on quality issues as far as it understood them.

However, the degree to which the whole sector had made proactive changes to cope with the situation was variable. As a whole, the Cuban seed sector appeared to be continuing to operate along industrialised lines as far as it was able, and in this respect the PPB Project represented a major departure in approach. The emergence of the PPB Project highlighted the limitations of the mainstream research sector in its capacity to undertake systems research due to a lack of methodologies for multidisciplinary teamwork, a lack of awareness on how to incorporate sustainability objectives into research programmes, and the continued predominance of a technology transfer approach. At 1999, there was an almost complete absence of social science within the agricultural research sector, according to the focus of research departments within the research institutes visited and in the institutional libraries.

The national seed system demonstrated the limitations of centralised control. The State could not maintain a quality supply of seeds throughout the crisis period – meeting only 30% of national demand. Germination rates of its seeds were considered low, and State storage units suffered from pest and disease attack. The State seed plan had discouraged farmer interchange of seeds with neighbours yet the new varieties from breeders were not satisfying farmer needs. The State seed system had, to a large extent, suppressed or even destroyed the informal seed network and farmer to farmer exchange, although there was sufficient residual traditional knowledge to reinstate this network. However, the dominant role of the State Seed Enterprise in seed distribution and in decision making about which varieties to sow, continued to hamper the development and use of locally appropriate varieties. A further hindrance to the growth of an informal and localised seed sector was the Seed Law 175 which prevented the transport or sale of uncertified seed (although State officials were well aware that this law was regularly being flouted and appeared to tolerate this).

Even though decentralisation had officially taken place, institutional change seems to have been slow. The responsibility for seed certification has passed, in 1998, from the Seed Enterprise to Sanidad Vegetal, and responsibility for supplying seed to farmers to the Mixed Crops Enterprise in 1999. Moreover, in the 1990s, seed production, which had previously occurred on State farms was contracted out to the private sector. Despite this, the Participatory Plant Breeding Project was the first major attempt since the crisis to encourage the growth of alternative pathways to compensate for an underperforming State seed system. Notably this project was instigated not by the national seed system but by a small number of entrepreneurial individuals within the Ministry of Higher Education. As the project was using ideas developed in other countries - linked to the empowerment of farmers and other actors, and aimed to create a network that would compensate for some of the shortcomings of the existing system, its relationship with the State seed system was a delicate one. Seed specialists within the State sector had not given much consideration to the development of varieties appropriate to low input conditions. Paradoxically, the decrease in agrochemical availability was also encouraging research into high-input, higher yielding varieties, generated by the logic that, given the high cost of chemical inputs, so hybrids were required which would yield more in order to be cost effective. Overall, the seed sector appeared to have been slower to adapt to the Special Period than other sectors (e.g. for soil fertility or pest control). In particular, it had not taken advantage of the possibility that better varietal management might mitigate the negative consequences of the lack of inputs. It also held little awareness of contemporary international advances in developing farmer capacity to manage their own resources.[121] Although the Seed Enterprise claimed to be producing regionally-appropriate seed, the province of Havana was still supplying 50% of all seed used nationally in the formal sector, and only 50% was being produced in the rest of the country, thus limiting possibilities for regionally appropriate seeds.

Much of the rationale of the seed sector ran contrary to an ecological approach. For example, the Seed Enterprise promoted monoculture of maize in order to maintain lineage and for ease of cropping with machines. Farmers, by contrast, preferred mixed varietal stands and especially as these displayed better response to ecological or no-chemical conditions. The State Seed Enterprise provided agrochemical fertilisers and pesticides to contracted seed producers, and this was a major incentive for farmers to become involved in producing seed. Enterprise representatives described the average farmer cropping strategy as being with the use of NPK and pesticides and with no mention of biological inputs. Rather than changing their approach to become, for example, more participatory or more appropriate to the existing field conditions, the State Seed sector appeared more concerned, or fixated with, quality control, as if this provided an anchor of familiarity that they could cling to in a sea of chaos that surrounded them. In short, the seed sector appeared relatively industrialised at least in intent if not with the full resources to practice.

Breeders were able to acknowledge farmers' needs on certain issues even though they did not operate a participatory approach or follow up such needs. There were several major discrepancies between researchers’ and farmers’ opinions surrounding field conditions and needs. Although researchers' identified similar basic breeding criteria for maize as that of farmers' main criteria, the farmers had a much wider range of important indirect criteria - 18 in total - which would result in an implicit outcome of higher yields. Maize breeders perceived *criollo* types as producing too much biomass at the expense of the grain. Yet increased plant biomass would correlate to husk cover, stem width and leaf thickness - all important criteria for the farmers and especially husk cover as this prevented insect attack and humidity and so was more important than, say, cob size, as an indicator of good yields. Conversely, researchers explained that taller maize plants would obtain more sunlight for growth, whereas a farmer explained that the taller the plant, the more leaves would be syphoning off precious nutrients. Researchers were also not fully aware of the potential interaction of farmer selection x genetics, saying that full husk cover meant poor cob growth due to competition for nutrients, whereas in practice farmers in Pinar del Rio had successfully bred for good growth of both characteristics. Further, researchers were more concerned with direct resistance - to pests and diseases, low fertility, and drought, whilst farmers were more concerned about plant physiology as a sign of such resistance. In this respect, farmers had a greater intrinsic understanding of the link between plant health and resistance. Finally, research recommendations were not appropriate for crops which were not State prioritised.

Some ecological techniques were being disseminated through this top-down approach, such as of biological pest controls, and at least one Lighthouse *finca* was being facilitated in a partially top-down way. It was unclear whether the individual 'pioneers' of ecological agriculture were receiving explicit State backing, or if the potential of these individuals in spreading or upscaling small islands of success was being recognised. Farmers themselves identified NGOs such as ACAO and ANAP as promoting ecological agriculture, rather than MINAG. More clear was the situation of the institutional pioneers – of the PPB and Lighthouse Projects, which were by their very existence being accepted within the institutional framework. These groups and individuals had to take personal initiative and make substantial personal effort to get such projects off the ground in the face of the mainstream agenda; often with few available financial resources. Exposure to knowledge and/or experience from abroad - either through communications or travel, was an important common factor amongst such groups and individuals.

[121] Certain of these attitudes had also been found in the urban seed sector (MA/42).

ACAO appeared to have been a key “behind-the-scenes” player, having been instrumental in setting up the Agro-ecological Lighthouse Project and having provided an institutional link between individuals promoting ecological concepts. The Lighthouse project in particular had a far wider influence than its direct impact on production approaches within the CPA co-operatives. It also facilitated the exchange of information and experiences between Cuban and foreign NGOs even during the most difficult years of the crisis, acting as a conduit for new and possibly useful ideas to help cope in the crisis.

Notwithstanding the degree of institutional decentralisation that had occurred, for example in contracting out farmers to multiply seeds, or in the regional development of varieties, there had been little change in overall co-ordination approach from the traditional one of regulation. There were some signs of change: that farmers may in the future have to pay for research services, and that the PPB Project was looking into the possibility of small-farmer marketing of seeds. Certain regulations currently stood in the way of this taking effect. There appeared to be less official objection to farmers taking more control of their resources and inputs: of their own seeds and of production of their own biofertiliser inputs, when quality was not an issue.

Social negotiation occurred within the system, from the weekly, inclusive CPA meetings on planning and allocation of farm resources and formulation of production plans[122], to the high degree of formal interaction with institutions over production plans and technical support. These flows of contact helped the support sector to keep in touch with field conditions, and this was compounded by the institutes, including MINAG, having to manage land for their own self-provisioning. Yet formal decisions on the use of chemical inputs were taken by the State, and as fines may be imposed if recommendations on input use were violated, so this, and the production plans did not encourage farmer experimentation and learning.

Several farmers had noted that the other form of private farmer co-operative – the CCSs – were more attractive in terms of motivation, finances and productivity, because the CCS farmer was more in control of the productive cycle and had to make less commitment to the State. The tendency of CCS co-operatives to be more efficient and better performing was also recognised by the State Seed Sector which selected these farmers for seed multiplication. Less commitment to the State also meant that CCS co-operatives were in receipt of fewer agrochemical inputs for production of priority crops, but selling on the farmers' markets enabled them to purchase inputs on the black market.

6.4.4 Support for, and challenges to, ecological production

Pulls and pushes for ecological production

Although there was no evidence of direct policy on ecological agriculture, specific institutional strategies and plans provided an indication of State objective. These included the 10-year maize breeding plan, which aimed for 80% of production under integrated or high-input approaches; research recommendations which focused on agrochemical input use, and the aims of research institutions to achieve a balance of chemical and ecological approaches. Yet there were other forces in operation, and the CPA farms and farmers were subject to specific pulls and pushes to adopting an ecological approach. Figure 6.4 depicts these factors, using the AKS categorisation as developed in Chapter 3.[123] It shows apparently contradictory forces, indicating that the agricultural sector was not operating a conscious or joined-up agricultural strategy. Some factors worked both for and against an ecological approach, such as the situation of scarcity.

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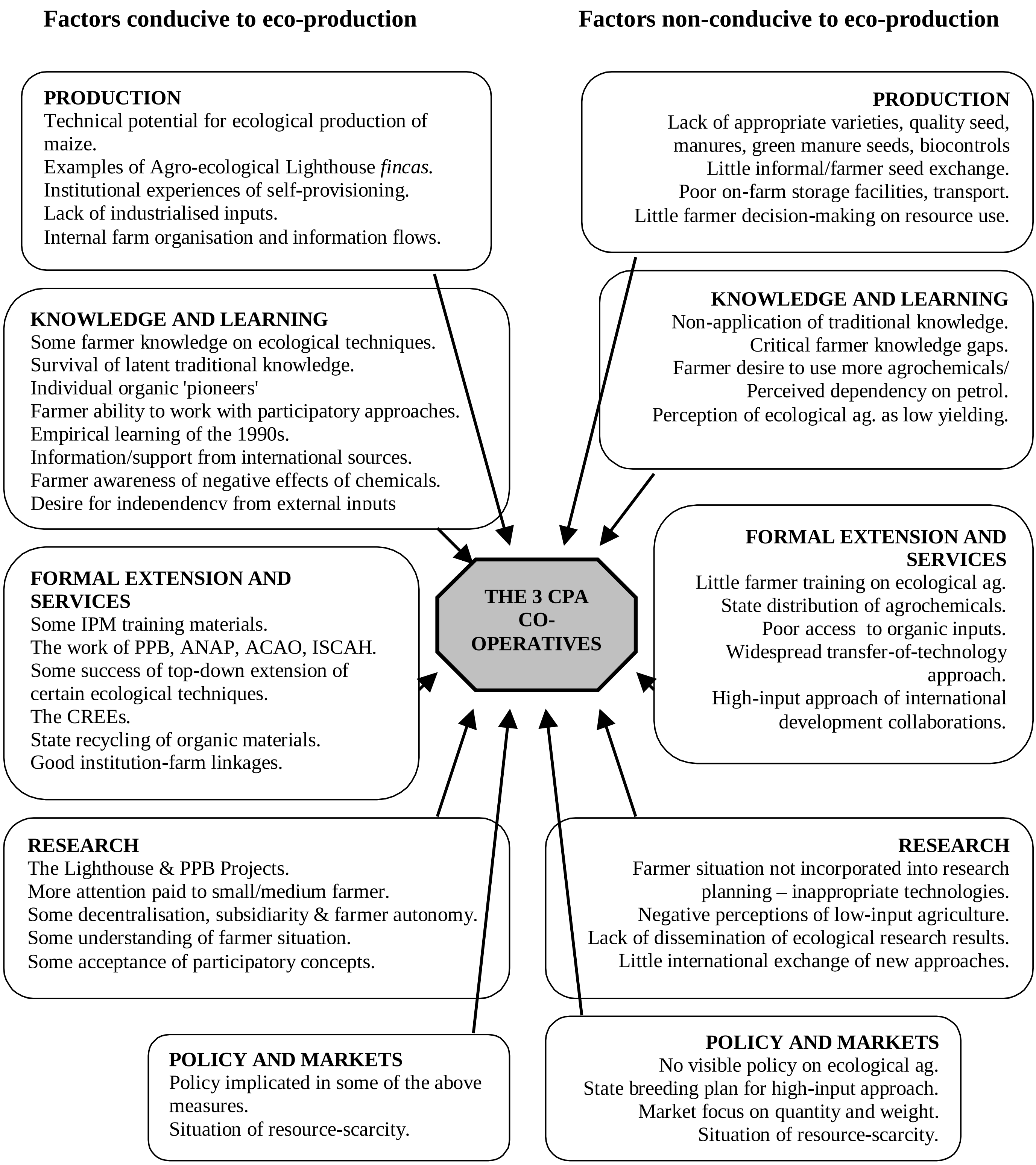
[122] Although women appeared to play a minor role on the CPA cooperatives, in both productive activities and direct decision making.

[123] The classification was modified to the field work findings to emphasise the importance of services and externalities. Policy issues were inherent within all factors, given the centralised planning system. In addition, certain empirical evidence did not fit with the conceptual factors, specifically attitudes, resource provision, internal farm processes, and the wider external context. This will be discussed further in section 6.5.

Figure 6.4 Factors conducive or non-conducive to ecological production on the CPA co-operatives



Overall, the main driving forces conducive for ecological production came from the desire for independence from external inputs and the poor access to inputs. Constraining forces included political uncertainty, the dominance of petrol, negative perceptions about low-input agriculture, and the lack of organic inputs. If this study were one of the agricultural fact-finding missions – which had previously come to, and reported on, organic agriculture in Cuba - it would find what it was looking for in terms of a strong ecological orientation. Yet there was a dominant, other side of the coin.

Knowledge and perceptions on the potential for ecological agriculture

There was evidence of the technical potential for ecological agriculture, through both on-farm experiences and scientific findings. The results of the Agro-ecological Lighthouse Project, the Participatory Plant Breeding Project, and responses to the field survey, suggested that ecological production of certain crops appeared to be technically feasible and even compared favourably to industrialised approaches. For example, the PPB Project in Pinar del Rio was already achieving maize yields of 4.5t/ha under ecological conditions, this figure being the average target of the State ten year plan for maize under high-input conditions. Because of the stocks and reserves which tided over the early 1990s, wider awareness of ecological approaches only started to take off around 1995, when farmers were forced to turn to organic inputs. Thus at 1999 it was too early to draw definitive conclusions on the results of production performance under ecological approaches.

In relation to this, farmer knowledge levels varied. It was difficult to assess the ability of the co-operatives to synthesise and combine traditional knowledge with the advice from external and on-farm technical experts. Older farmers were humble about their knowledge from the past, seeing it as outdated compared to both the newer industrialised approach and to the contemporary use of biological inputs. Knowledge levels on ecological agriculture varied widely and were influenced by the degree of involvement in the Lighthouse Project. Although farmers may not know about ecological agriculture in its generic form, they did know about the use of specific practices such as of organic material and non-use of chemicals. There were also clear knowledge gaps, even on the Agro-ecological Lighthouse Project and its *fincas:* such as soil preparation, soil cover, beneficial crops, on-farm breeding, and biodiversity reservoirs. The data also hinted at a similar lack of knowledge on water conservation and labour saving methods. Apart from the few individual organic pioneers, there was little understanding of the philosophy behind ecological agriculture.[124]

At farm level, the conditions of the Special Period were to some extent conducive to learning from empirical evidence - that biological controls could be used in intercropping without negative effects, that timely planting and the use of clean seeds was critical to a good crop, that green manures improved soil fertility and also eliminated weeds, that pests could be kept at bay through maintaining weed control and cleanliness, and so on. Farmers had also noted the benefits of the decrease in agrochemical use, to the health of the soil, farmer and livestock, to managing pests and diseases, and to the natural environment. They had also learned to use chemical inputs more efficiently, for example, through spot application. Two factors had facilitated this learning: the presence of traditional knowledge within the work brigades, and the 'linking' of work teams to one specific CPA *finca*.

Yet a major feature emerging from the field work was the disparity in perceptions of ecological agriculture. Each individual held differing perceptions which could be grouped into common themes, and within these themes were conflicting viewpoints. These also contrasted with research results. The plant breeding and seed research sector generally held certain negative perceptions of ecological approaches. These were, for example, that intercropping maize would negatively affect yields; that low-input varieties were not useful because of their lower yields; or that small-farmer production could not satisfy a national demand. In contrast, farmers were less negative, and a large minority felt that, given the right conditions, their co-operatives could perform under an ecological approach.

Certain viewpoints were explicitly incongruent. For example, research results from the National Institute for Agricultural Sciences demonstrated that low-input varieties of both pumpkin and maize equalled or out-yielded those of high-input varieties; whereas staff from the Seed Enterprise held the view that low-input varieties were not useful, based on the rationale that as inputs drop so do yields. Similarly, some farmers were convinced that yields under ecological conditions fell, whereas others stated that yields had increased. Over 70 differing viewpoints were identified from

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[124] The concept of ecological agriculture is fairly recent in Cuba. As Treto et al. (2002, p.184) state "*Although the term agroecology has only recently entered widespread use in Cuba, agroecological practices are known empirically by many campesinos… Other farmers and some agricultural professionals still subscribe to the agricultural paradigm of the so-called Green Revolution.*"

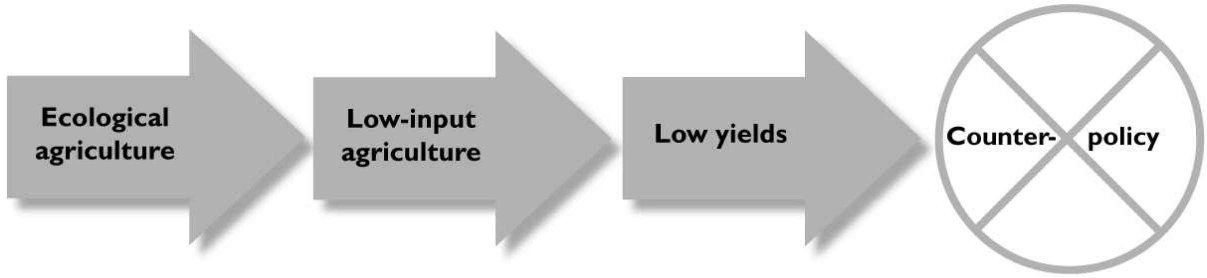
the interviews held, relating to specific production issues. These viewpoints can be categorised as deriving from one or more of: research results, personal experience, or secondary evidence, this dependent on context in which the statement was made to the author. A selection of these contrasting viewpoints is provided in Appendix V. Identifying the reasons for these viewpoints may help somewhat to understanding the possible limits to ecological production, the reasons for the current agricultural production system in Cuba, and issues that need to be dealt with if ecological production was to be more widespread. Possible reasons for these differing viewpoints are suggested as follows:

- At a certain time and place, an industrialised approach may be most appropriate;
- Research results which support ecological agriculture have not been sufficiently disseminated, or not accepted by the mainstream;
- Research results which support ecological agriculture require multiplying and upscaling for further verification;
- More knowledge generation on suitable ecological approaches is required;
- Ecological management strategies and indicators (including approaches to problem solving) are being compared directly to industrialised rather than seeing the former as having a different scientific basis or *modus operandi*;
- Tendency to hold unsubstantiated views on ecological or industrialised agriculture;
- The potential capacity and capabilities of farmers and/or nature is not recognised.

In some cases, the reasons for such incongruencies are obvious - protagonists are identifying positive aspects of ecological agriculture and those against are identifying potential weaknesses. Yet underlying, and mixed up in this is mis-information, mis-understanding, lack of information dissemination, and so on, much of which can be addressed. In certain cases, the background education and experience of the individual correlates to their opinions such as agronomist MA/R/21 who favours a more ecological agriculture and has studied sustainable agriculture to MSc level. Many plant breeders, on the other hand, had a more negative opinion of ecological approaches, possibly derived from their sectoral background and training.

One of the most outstanding features was the perception that ecological meant low-input, and that low-input meant low-yield, as illustrated in Figure 6.5 below. With State policy being to increase yields, ecological production was in danger of running counter to political mandate, and at least two researchers noted that it would not be right to experiment with staple food crops of the population in this uncertain way.

Figure 6.5 Train of thought concerning low input agriculture



6.4.5 Relationship between seed systems and food security

Official statistics indicated that maize production significantly increased from 1989 onwards. However, this does not necessarily mean that yields increased under low-input conditions (and individual accounts suggest that yields fell dramatically and especially of the hybrids under high-input conditions); rather, it was largely due to the increase in land dedicated to maize production, and also to the inclusion in official statistics of figures for production by independent farmers and of self provisioning. Yield figures for maize indicated that the non-State sector maintained and even raised maize yields over this period, whereas the State sector was not able to do so. This may be partly because of the greater State sector dependence on inputs, but also because of the organisational restructuring of State farms in the 1990s and their refocusing on other crops and activities. The State plan for maize was to triple average productivity and area in order to achieve national food security in maize within the next decade. It is worth reiterating that yield and production figures were subject to many influences over and above the type of production approach, and farmers identified a four year cyclical pattern of production, with figures for 1992 and 1996 being at the peak of the cycle.

On the face of it, local seed systems in the Cuban context were not so important for achieving food security relative to other countries, given that the State ran a rationed food distribution system and was been able to maintain, even during the worst years of the crisis, a skeleton seed distribution system. Nevertheless, this centralised, formal seed system was severely restricted in its operations, and during this period, near-dormant informal systems for maize seed exchange re-emerged, particularly in more peripheral areas. The approach of the PPB Project in encouraging more autonomy and control to farmers to improve local food security, would appear politically compatible with the State drive for local self-reliance.

6.5 REASSESSMENT OF THE RESEARCH PROCESS AND SUBSEQUENT FIELD WORK

6.5.1 The case study in relation to the research issues

This field study acted as a first step and provided a sounding board for subsequent steps through the progressive, exploratory approach to primary data collection. Therefore, here a brief respite provides a sense of orientation for the subsequent empirical chapters.

Working within the Participatory Plant Breeding Project provided a unique opportunity in two respects. Firstly, it enabled the author a first solid exposure to the agricultural dynamics of rural Cuba seen through the perspective of plant breeding and seed systems. From this an attempt could be made to address the basic research questions on the type of production system in operation in Cuba, and the institutional factors affecting this. Because maize was a traditional, small farmer crop, without State priority for investment with research, resources or inputs, its study revealed the coping strategies which farmers and the support sector undertook – or did not undertake - to maintain production during the Special Period. It was evident that agriculture in rural Cuba was not ecological over the mainstream, in terms of both widespread intent and knowledge base.

At the same time, this experience displaced the previous uncertainly of field conditions and research potential, and established a solid grounding for subsequent enquiry in terms of the issues to be followed up and of realistic field research operations. It was clear that further enquiry would fruitfully include not only agrochemical input use but also issues around seed quality and quantity, water and mechanisation.

6.5.2 Adequacy of the analytical and theoretical frameworks

The theoretical framework provided an adequate structure. Yet issues had arisen from the field - of power dynamics, pressures and incentives of each actor group in the process of change, which were not adequately addressed in the analytical model of the modified Agricultural Knowledge System. The model had not provided the structure for asking why things happened, nor for individual preferences, nor for more details on the pushes and pulls between each actor/group. Farmers were turning out to be the main stakeholder group of this research, and it was their decision-making strategies which were being questioned within the context of the system. In this sense, a more holistic livelihood framework appeared a more appropriate way of obtaining a clear view of the research findings. Because of this, the rural livelihood framework was experimentally applied for subsequent field work.

6.5.3 Implications for subsequent field work

Given the above, the following step was to enlarge the depth and breadth of the research - depth in following up on the research issues, and breadth in covering a wider study area and wider range of farm co-operatives, cropping systems and actor groups. Greater emphasis was placed on the role of farm power and irrigation - identified by farmers as crucial to their production, and less on seed systems as this had already been partially covered. Now that it was clear that Cuban agriculture was not ecological in the mainstream, the aim would be to further identify the determinants of current practices. Subsequent research would also further investigate the impact on food security. The following chapters describe these results: Chapter 7 focuses on agricultural production systems; Chapter 8 on their support systems; Chapter 9 on changes in the food system; and Chapter 10 on the dynamics and politics of the growth of the organic movement.

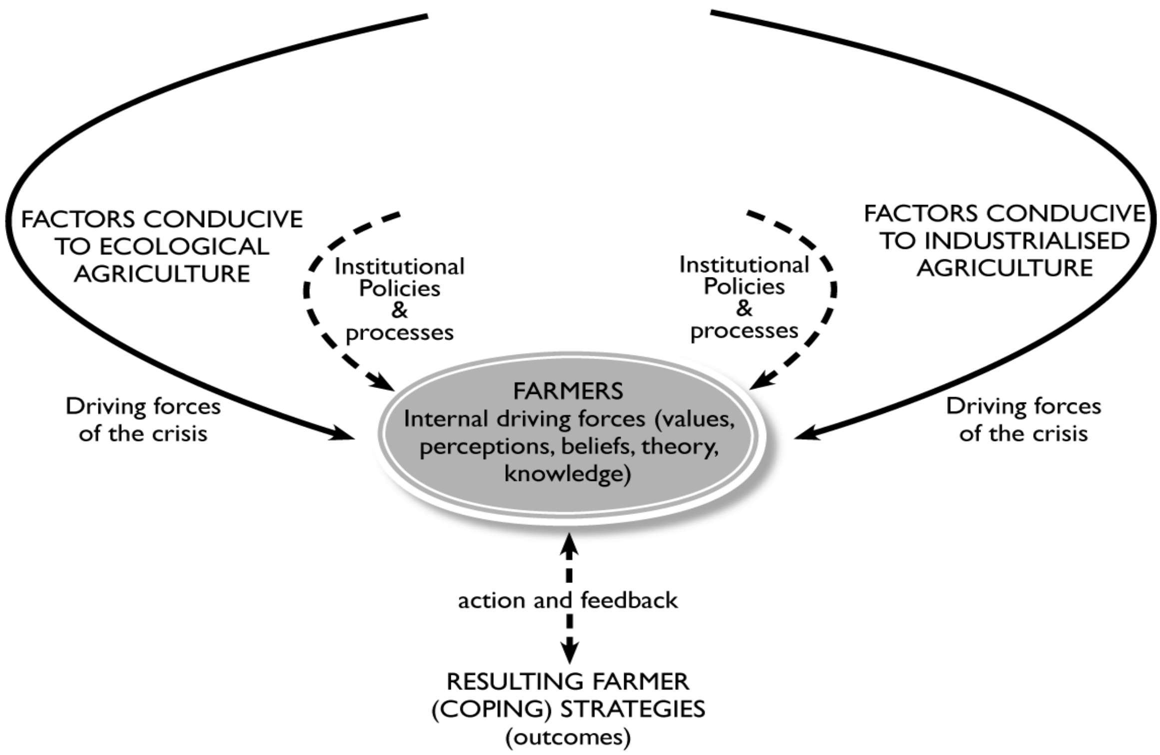
7 DETERMINANTS OF FARMING STRATEGIES ACROSS 3 PROVINCES: THE FARMER PERSPECTIVE

7.1 INTRODUCING NEW FRAMEWORKS AND FOCUSES

7.1.1 Objectives of this second field study

This field theme aims to provide a broader perspective of the rural situation. The first field study, as described in the previous chapter, provided a first snapshot of farming systems in rural Cuba and, and, through its analysis of the seed and cropping systems for maize, demonstrated that that certain features of an ecological system could be identified but that it was not mainstreamed either at farming or institutional level. If agriculture in Cuba was less industrialised, then what was the nature of the system that Cuba was operating? What approach(es) were farmers practising, and most importantly, what factors were determining or conditioning this?

Figure 7.1 Scheme of farmer component of the livelihoods model, showing impacts and internal driving forces, and resulting coping strategies



Using the livelihoods framework, this study, again a descriptive analysis, focuses on cropping systems for maize and banana and their support networks. Based on insights from the first study, it incorporates issues relating not only to agrochemical use but also to fuel availability, irrigation and traction systems. Whilst continuing to work under the formal umbrella of the Participatory Plant Breeding Project, it moves beyond seed systems to encompass general farming strategies, a broader range of farm types, and spread over a wider, national geographic area (in the Provinces of Havana, Cienfuegos and Holguin). The results of this study are presented in two chapters; the current chapter pertaining to the perspectives of farmers, and the following chapter (8) on those of the institutional support sector. This chapter describes farmers' livelihood assets and other endogenous factors, then institutional processes and other exogenous factors, and finally the resulting outcomes in relation to production strategies, all as seen from the farmers' perspectives. Figure 7.1 depicts the part of the rural livelihoods framework which will be addressed in this chapter.

7.1.2 Introducing new farms and field methods

The two types of production co-operative under analysis here represent two extremes: CCS co-operatives, composed of private farmers who owned their own land, and UBPC co-operatives, which had only recently been transformed from State farms.[125] Within four municipalities (one in each of Cienfuegos and Holguin, and two in Havana) co-operatives were selected by local host institutions; nominally on the basis of their representativeness of the region, but also determined by their cropping systems, accessibility and familiarity with the local hosts. Therefore, in terms of wealth, level of sophistication, and productivity,[126] these co-operatives could be presumed to be in the top third of those in their areas, and as with the baseline survey of the preceding chapter, the absence of sampling meant that analysis here is descriptive rather than statistical. In all, 114 interviews were undertaken, 52 with farmers and farm workers (including members of executive committees) and a further 62 with actors in the support system. The field work took place between October 1999 and December 2000. Chapter 4 describes the methodology in more detail.

7.1.3 Introducing a second study crop: banana

This study centred around maize and banana cropping systems. Maintaining maize retained continuity with the previous study, and maize held an interesting position as a staple, yet non-prioritised, food crop. Banana provided a contrast: as a tree crop it would involve a different production system. While also a national staple food (occupying a traditional and popular part of the Cuban diet) it was more highly prioritised, sold on the tourist market, and in 1999 was one of the few crops for which certified organic projects reportedly existed.[127]

During interviews, different types of banana were referred to. There are two main types in Cuba: the fruit banana, which is eaten raw and called 'fruta', and the plantain or 'vianda'[128] which can be consumed cooked or raw. The two main clones of the plantain type are 'burro' and 'macho'. Popular varieties of the fruit type are the Manzano, Cavendish Enano (dwarf), Gros-Michel and others. More recently, new varieties have been introduced from Costa Rica - FHIA[129] clones - which include both plantain and fruit types (Gutiérrez Rojas, 2001).

The main trends in banana production provide a context for the field work responses on banana production. Both land area under banana cultivation, and production quantities, have risen steadily since the 1970s, including a rise from 291,378t to 493,061t between 1989 and 1999. Over half the productive area is in private hands. Yield figures show a slight but clearer difference between State and private production in the 1990s, whereby State production fell whilst private production rose slightly or at least maintained levels.[130] In 1999, State plantain yields were 7.1t/ha and fruit yields were 12.4t/ha. Private sector figures for this year were lower at 5.4t/ha and 5.9t/ha respectively (ONE, 1996; ONE, 2000).

[125] For a more detailed description of CCS and UBPC cooperatives, see Chapters 2 and 5.

[126] For example, compared to national yields of banana for 1999 which were 7.1 t/ha plantain and 12.4t/ha fruit, in the co-operatives visited yields were 11.2t/ha and 20.3t/ha respectively.

[127] Results on certified organic banana production feature in Chapter 10.

[128] 'Vianda' is the generic term for root and tuber crops, including sweetpotato, taro, cocoyam ('malanga'), and plantain bananas.

[129] The Honduran Agricultural Research Foundation (FHIA)

[130] Yet in terms of technology use, and although banana was a prioritised crop, only 1,000 ha of private production received prioritisation for irrigation (MINAG, 1998).

7.1.4 Introducing new study areas: in the Provinces of Cienfuegos and Holguin

The coastal city of Cienfuegos, the capital of the province of Cienfuegos, lies 250 km south east of Havana, and the city of Holguin, a further 490km east of that. Figure 7.2 shows a map of the Provinces and study areas within them.

Figure 7.2. Cuba showing the three provinces and municipalities of the study

Holguin is the largest province of the three, more than twice the size of Cienfuegos, and with the highest percentage of rural population at 41%. All three provinces are economically dependent on sugar, with some additional locally-specific specialisations (ONE, 1998).

The study municipalities of San Antonio and Batabanó in Havana Province have been described in the previous Chapter 6. The study municipality of Cumanayagua is the largest and most mountainous in Cienfuegos Province. Here, productivity is average to good. Although it contains approximately half of the UBPCs of the province, one third of the CCSs (with 1,268 members), and three quarters of the CPAs (with 432 members), it houses only a small number of the provincial State Enterprises and related farms, and individual private farmers. The municipality of Gibara, in Holguin Province,[131] was known as the granary of Cuba because of its historical production of a wide variety of grains by small farmers, but currently, like the rest of the Province, suffers from severe soil infertility, drought and salinity. In Gibara, and amongst other farming types, are 51 CCS co-operatives, and 10 UBPCs. Differences between the two include the CCSs irrigating only 19% of cultivable land, compared with 31% for the UBPCs, and CCSs having a work density (on cultivable land) of 28person/ha, compared with 3person/ha on UBPCs (from statistics, Gibara municipality, 1996). In this region, researchers have been experimenting with diagnostic methodologies since the mid-1990s and therefore more insightful information is available. For example, according to Ojeda (1997), it was the most diversified and intensive farms, selling to the State, which had the highest, in fact only, levels of input use.

7.2 FARMERS' ENDOGENOUS SITUATION

This section reviews the circumstances of farmers relating to farm structures, assets and resources. This provides a basis for understanding the subsequent choice of coping (and production) strategies adopted in different contexts.

[131] Holguin is the province where Christopher Columbus first landed on Cuban soil, at Bahía Bariay in 1492, and is also the birthplace of Fidel Castro, in the village of Birán (Baker, 1997).

7.2.1 Farm organisation

In both CCS and UBPC co-operatives, many assets were collectively managed. The majority of CCS co-operatives studied had been 'strengthened' (*fortalezida*), that is, selected for better access to facilities (including finances), the power to acquire land in perpetuity and hire labour, and more autonomy. Of the UBPCs visited, two turned out to be continuing as old type State farms. Although wishing to convert to a UBPC, one member (F/U/14) explained that “*We first need to show that we are profitable. The process is slow.*” The other UBPCs were formed between 1993 and 1999 and held all their land in perpetuity. To further improve performance, some had gone through further downsizing; in the case of one farm, from a 1,000 ha UBPC in 1993 to four smaller UBPCs in 1998.

Each co-operative was attached to a specific municipal or provincial State Enterprise according to its main farming activities. The Enterprise assisted in the implementation of State production plans, provided technical assistance and distributed resources. In recent years tensions had arisen, as the Enterprises were historically specialised in specific commodities, whereas farmers were seeking to diversify. In Cumanayagua-Cienfuegos, for example, one CCS co-operative, which had for years been producing mixed crops, was, as a result of being ‘strengthened’, attached to the local Tobacco Enterprise. Many of its members continued to produce mixed crops, but the Enterprise was only able to support tobacco production. Despite this, both forms of co-operative maintained some degree of autonomy, particularly the UBPCs compared with their previous incarnation.

7.2.2 Land and labour

Both types of co-operative varied in size, but farms in Cienfuegos and Holguin bore closer similarities in terms of land and labour than those in Havana. Farms outside Havana were larger[132] but comprised a far higher proportion of uncultivated land. Membership of the co-operatives in Holguin and Cienfuegos Provinces was about 75% higher than in Havana Province and, to some extent, this correlated with the larger land areas of the former. Co-operatives in Havana Province also had a higher proportion of productive land under irrigation.

CCS co-operatives had more members than the UBPCs, although relatively few of these were land owners and fewer were female.[133] In fact, although CCS co-operatives were characterised by their ownership of land, this varied. Certain 'advanced' farmers within these CCS co-ops were eligible for extra land in perpetuity, on condition of agreement with the State as to which crops they would grow. One CCS held almost half of its land this way (F/C/10), producing mixed crops and tobacco. In other cases, CCS farmers rented land to the State.

Membership figures on the CCS co-operatives were at a peak in 1999/2000. The benefits of being ‘strengthened’ had attracted the extended families of existing members. Farmers F/C/4 and F/C/20 explained that "*there is now a better income and other benefits such as having access to a shared tractor.*", and “*Now we’re strengthened, we have a tractor, machinery and a lorry – although it often breaks down*.” A similar situation applied on most of the UBPCs, where the lack of machinery meant that there was an increased demand for labour. Compared to the State farms, the UBPCs could “*guarantee work all year round and offer a better level of wellbeing*" (F/U/16).

Organisation of labour varied between the co-operative types. On the CCSs, labour was organised by each farmer family on their own land. By contrast, labour on the UBPCs was largely organised by crop and/or area, to which workers would be linked (*vinculado*) in brigades.[134] In this

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[132] Although the land holding of individual members within the CCS co-operatives varied in size according to region: between 2.4 to 14.4 ha in Gibara-Holguin, 6.7 to 26.8 ha in Cumanayagua-Cienfuegos, 12.1 to 26.8 ha in San Antonio-Havana, and 3.0 to 26.8 ha in Batabanó-Havana.

[133] Roles for women included cooking, administration, sales, vet, doctors, and farm labourers.

[134] On one UBPC, for example, its 63ha of banana production was divided into 12 fields, each 5 ha field having two linked workers (*vinculadores*), and every six fields having a head of the block. In each field, the two workers tended 20 rows each, and had a choice of working alone or together. They also united with other workers over inputs and other issues.

way they could receive extra incentives for good production results. Some UBPCs had not yet implemented this system, although were considering doing so, as one UBPC farmer (F/U/24) explained "*We only formed in 1999 and are still not linked but we plan to be. We can choose the moment*." Unlinked farmers, who continued to be rotated for short periods on different crops and areas, were aware of the benefits, as farmer F/U/26 explained: "*If I got the opportunity, I'd like to be linked to banana production and sell it to Fruta Selecta.*[135] *Then I'd work voluntarily, for longer hours. I'd take more care at harvest time, remove the weeds, do better soil preparation, remove the diseased leaves and suckers, remove the male buds, chop the leaves and put them between the plants to maintain the humidity*." Both CCSs and UBPCs also seasonally contracted short-term labourers, and contract labour wages, and demand, were higher in the west of the country. CCS farmer F/C/2 from Holguin noted the sufficient labour supply in his region over the 1990s, while in Batabanó-Havana, 60% of contract workers came from the east of the country.

7.2.3 Farmers' education and experience

Age, education and agricultural experience

In terms of age and agricultural experience, farmers on CCS cooperatives were on average nine years older than those on the UBPCs. This was partly due to the many young farm labourers who made up the UBPC work force. Co-operative technicians were young, often in their twenties. In addition, CCS farmers had on average twice as much agricultural experience as those on UBPCs (even more the CCSs in Havana) and four times longer spent on the same co-operative. This was largely influenced by the more recent formation of the UBPCs, but there was also evidence of higher turnover of the UBPC workforce.

Educational levels differed between roles on the co-operatives. The majority of CCS and UBPC farmers were school leavers. A few UBPC farm workers were illiterate. Co-operative presidents and administrators were more likely to have higher formal qualifications. Out of a sample of 33 farmers, 9 were agricultural technicians or higher school level, 2 were university graduates, one was currently undergoing higher training, and 3 had been trained in the military.

Range of work experience and mobility

A large proportion of the farmers, especially those on CCSs, had lived on the farms all their lives, as one explained "*I have always been a campesina. I left school at 7th grade to work on the land with my grandmother, and now I live on my son's land*." However there was also a degree of mobility and changing of jobs. Previous non-agricultural occupations included teaching, chauffeuring, and the military. There was movement between co-operatives and between other agricultural organisations: some farmers, for example, had previously worked in marketing, irrigation, urban agriculture or forestry. There was also mobility within co-operatives, both horizontally and vertically; elected Presidents, after their term of service, may be found as simple heads of farm f*incas*.

Local and traditional knowledge

Almost all the farmers were children of campesinos. This provided an important knowledge base for them, as did knowledge from, and exchange with, other farmers and neighbours. The less knowledgeable were the UBPC farm workers, who were generally younger with lower formal educational levels, and may have migrated from other Provinces where climate and crops were different, or had shifted from old State farms where they had only been required to follow instructions. UBPC farmer F/U/9 explained "*The more recent members have come here with land in perpetuity – they have very little agricultural knowledge – they are just 'obreros'.*[136]

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[135] Fruta Selecta is the State marketing enterprise for quality products, purchasing at higher prices.
[136] *Obrero* means 'labourer' or 'worker', as opposed to farmer.

Some farmers noted the usefulness of traditional knowledge during the crisis of the 1990s. For CCS farmer F/C/25: "*I refer back to traditional knowledge more than before - for crop varieties, practices such as rotation, and so on, though some things are just not possible now because of the Plan*." Very few deliberately experimented with traditional knowledge: farmer F/C/16 recounted experimenting with lunar cycles: "*I planted on the waning and on the crescent. The waning gave better results - more yield. I got this knowledge from my parents*."

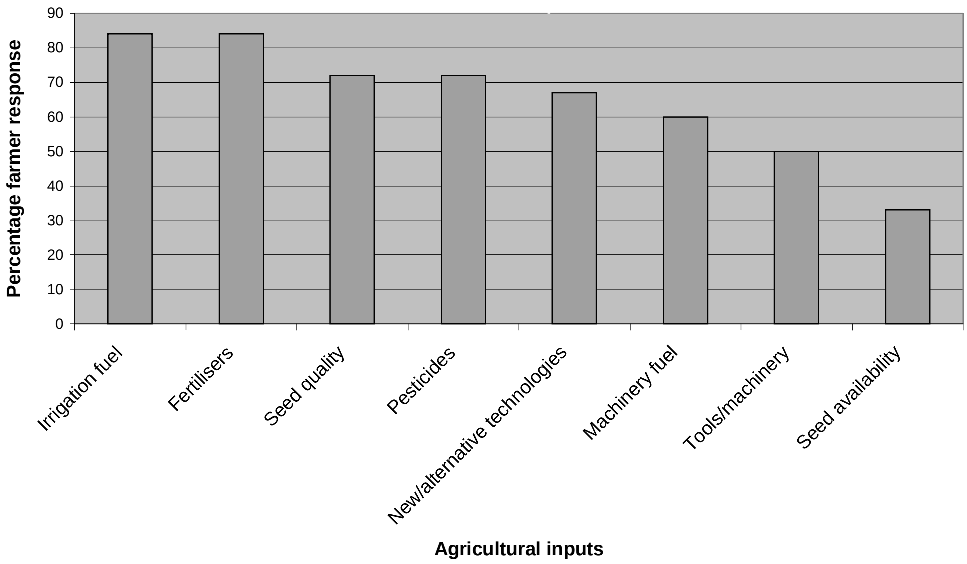
7.3 EXOGENOUS POLICIES AND PROCESSES AS SEEN FROM THE FARMERS' PERSPECTIVE

7.3.1 Availability of and access to agricultural inputs

The main inputs limiting production

Of the range of agricultural inputs, the majority of farmers interviewed identified the lack of irrigation fuel and of fertilisers as being the major limitations to production. Figure 7.3 depicts the farmer responses on main input constraints to production.

Figure 7.3 Farmer identification of main agricultural inputs limiting productivity, 1999/2000 (% farmer response of non-representative sample)



Irrigation fuel was felt as a limitation in all provinces and co-operatives. Fertilisers were a greater limitation amongst UBPCs and outside Havana Province. Other important constraints were seed quality and lack of pesticides. Lack of fuel for machinery was a particular limitation in the UBPCs. Only one farmer, F/C/19 in San Antonio-Havana, claimed that inputs were not limiting his productivity at all. He explained: "*We don't lack anything right now. We are very good. We always use organic matter and have good land. We have an electric turbine for irrigation and a tractor. We use resistant varieties so don't need pesticides, though we do use a very small amount of chemical inputs*."

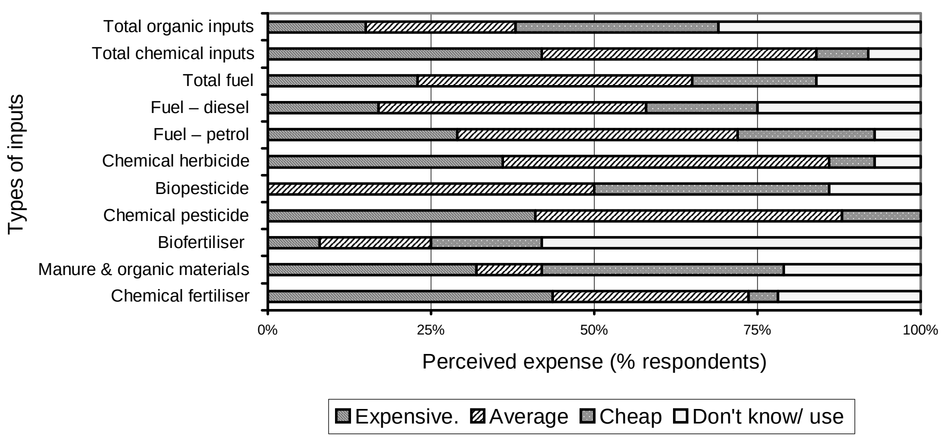
Access to inputs and their costs

Prices of agricultural inputs varied according to province and input source, and depending on whether the input was being used in conjunction with a crop in the State plan. Prices of manure and organic waste also varied according to the source and transport means. For example, one farmer in Havana obtained free manure in return for cleaning out the local dairy, whilst another in Holguin had to pay $4.4/t from his local dairy. Prices paid for black market goods were substantially above those bought from other sources.

Farmers generally agreed that input prices had increased by between 60-300% since the 1980s. Chemical fertiliser had previously cost $3.6/t in Havana, and currently at $11-25/t had thus tripled in price. Estimates of petrol prices from the 1980s indicated that they had doubled, but this varied by province. The figure was currently 20-25c/litre in Havana (compared to 9c/litre in the 1980s). The quality, availability and variety of inputs were also felt to have declined since the 1980s.

Some trends were clear in terms of costliness to the farmer, as shown in Figure 7.4. Overall, three times as many farmers considered organic inputs to be cheap, and chemical inputs to be expensive, and especially for farmers in Cienfuegos and for UBPCs. Some farmers and especially those on CCSs, considered manure to be cheap, yet others, and especially those on UBPCs and in Havana, found them quite expensive. CCS farmers felt that fuel was expensive, whilst UBPC farmers felt it was of average price.

Figure 7.4 Perceived comparative expense of purchased agricultural inputs (as % of farmer response of non-representative sample)



7.3.2 Socio-economic factors influencing farmers

Incomes and incentives

CCS farmers were financially independent, though paid tax to the State and funds into the CCS co-operative. These farmers did not readily state their real net incomes, but others considered them to be wealthy. One CCS farmer in Gibara-Holguin (F/C/18) estimated that he earned $20/month, but the President of his co-operative estimated double this figure.[137] Contracted labourers in San Antonio-Havana were paid approximately $1.5/day, more than three times the wage in the 1980s, and received extra incentives such as free roots and tubers.

On the UBPCs, 70% of profit went to the workers, and 30% to the UBPC (F/U/4). Members' salaries were linked to fulfilling a basic quota and often also on performance results. In Havana and Cienfuegos Provinces, basic salaries of $0.45/day were quoted, and with good performance this could rise to $0.5-0.6/day, and monthly take-home could be as much as $20. In addition there was a performance-related profit share; one farmer in Cumanayagua-Cienfuegos (F/U/12), for example, took home an extra $85 every 3 months for his results with banana, while another in Batabanó-Havana (F/U/20) received $7 bonus every two weeks. Box 7.1 describes the system of earning for workers who were 'linked' to banana production.

[137] Compared to the average researcher's salary of $15 per month.

Box 7.1 Earnings on a UBPC banana plantation, Batabanó-Havana (prices in dollar equivalent)

During the period of establishment of the banana plantation, the banana workers earned $20/month for "keeping their rows clean", and then an additional 0.5c for each healthy plant. If there was wind damage, they would have to replant, and were penalised 5c for each dead or neglected plant. They also had to pay for any support required for their area. At the end of the period the profit would be calculated, and each worker would receive 50% of the gains from his or her particular area. The total salary was estimated to amount to approximately $40/month.

Farmers producing an export crop such as tobacco or citrus also received stimulus in the form of dollars, and this could mean a farmer walking away from harvest with up to US$150 (F/C/14). Part of the dollar revenue was held by the co-operative in order to purchase dollar goods.

All farmers, both CCS and UBPC, felt that salaries had risen significantly since the 1980s. For UBPCs, the improved welfare of their workers, through salaries and other incentives, was critical to improved production performance. There were subtle but noticeable differences in wealth both within and between co-operative. At one end of the scale, a visit to CCS farmer F/C/2 (who had a reputation for innovation) revealed a 4-wheel drive vehicle parked in his garden shed, and a newly tiled roof to his two-storey house. At the other end of the scale, visiting a struggling UBPC revealed shared dormitory-style accommodation in wooden huts, with the on-site cafeteria serving rice, beans, boiled cassava and maize meal as typical lunch fare. Workers on this UBPC received just a basic salary of approximately $11 per month.

Overall, farmers were financially better off than they had been in the 1980s or early 1990s, and even fared better than other sections of the population. This included casual rural labourers. Within this, some farming segments were faring better than others. Even on large scale farms, incentives were working to add a human-scale dimension and so increase individual responsibility and performance.

Production costs

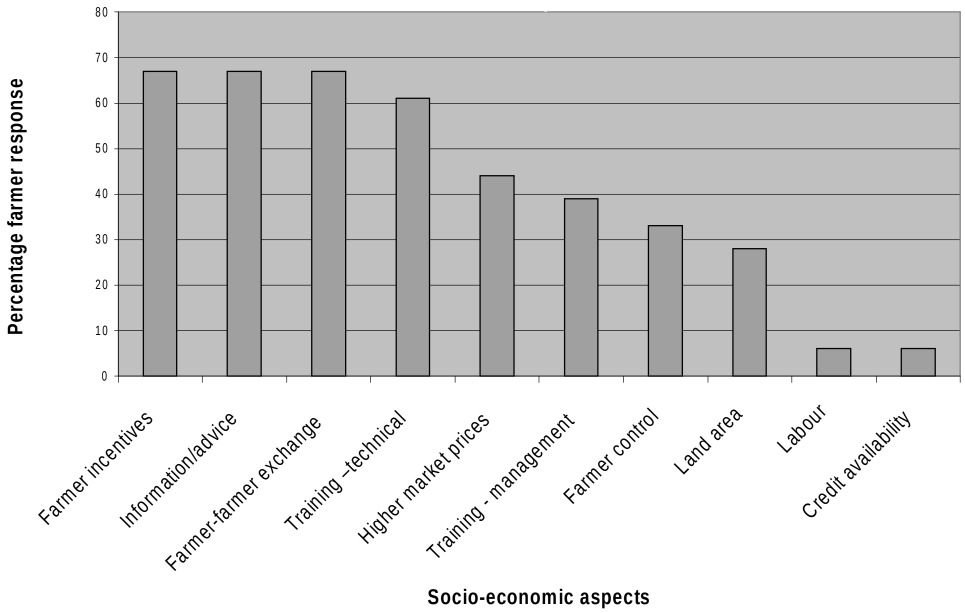
About half the farmers felt that production costs had risen compared with the late 1980s, whilst the other felt that they had fallen. Reasons for the rise were related to the increase in input and labour costs, whilst the fall was put down to higher market prices, higher yields and better control of the productive cycle. UBPC farmer F/U/7 from Holguin provided more detail, "*When we were a State enterprise, we were not profitable, but we have turned this around by making it more efficient, and the UBPC has been profitable for 2 years now - our production costs are 4.45c/t*." Yet, another UBPC farmer in the same municipality, with very similar production costs of 4.4c/t, was of the opinion that his costs had risen.

Farmer identification of the main socio-economic limitations to production

Farmers found socio-economic factors to be less of a constraint than agro-technical ones. The most frequently identified socio-economic limitations were the lack of technical training, farmer-to-farmer exchange, information/advice, and incentives for farmers, as shown in Figure 7.5. Farmers did not feel that greater self-control or management training would improve production, although UBPCs rated these as slightly more important than CCSs. The constraints of labour and credit were almost negligible, and land area was a limitation only in Gibara-Holguin Province.[138]

[138] However, with more in-depth interviewing and triangulation, some of these issues subsequently emerged as being more important to farmers than suggested by these responses, as described later in this chapter.

Figure 7.5 Farmer identification of main socio-economic aspects limiting productivity, 1999/2000 (% farmer response of non-representative sample)



7.3.3 Technical assistance and support

State technical assistance and research involvement

To ascertain levels of support for agriculture, farmers were asked for which areas of farming practice they received technical assistance. The responses are shown in Table 7.1. They most frequently received assistance with pest and disease control, and then on seeds and soil management. UBPC co-operatives received significantly more technical assistance on these topics. For all farmers, technical assistance was free.

Assistance and advice were of a diverse nature and largely prescriptive. Some, such as farmer F/C/2, received advise on the use of inputs, "*The technical expert from the Seed Enterprise gives advice on everything to do with plant health, with a focus on the use of chemicals*." A few had received demonstrations in the use of biopesticides. UBPC farmer F/U/5 explained how MINAG had provided plans for diversification, which were obligatory but with no penalty for non-compliance. Over half the farmers had soil analyses undertaken, which frequently had to be paid for. This was a marked change from the past, when, according to one farmer "*Before the Revolution, 'El Quimico' came every year to analyse the soil and provide inputs. After the Revolution, the soil wasn't analysed, and in the 1970s and 80s we just added more and more inputs*."

Table 7.1 Thematic areas of technical assistance received by the farmers (% farmer response of a non-representative sample, multiple unranked responses)

Theme of technical assistance	All municipalities/provinces (%)		
	CCS	UBPC	Total
Pests and diseases	70	90	80
Seeds	67	80	74
Soil cultivation/ mechanisation	44	90	68
Soil/crop fertility	50	80	65
Irrigation	34	60	47
Processing/ marketing	34	50	42

(n=54 max)

State technical assistance could come from a range of sources: the State Enterprise to which the co-operative was annexed, MINAG, the Sector Cooperativa Campesino (SCC), Sanidad Vegetal, the Seed Enterprise, and research institutes. Assistance on processing and marketing came from Acopio. There had been some change over the decade. Assistance used to come from a provincial level, but now came from more locally-based entities, and was more appropriate to farmers' conditions. Although there were less inputs, there was more interchange and knowledge. For CCS farmers, a major change had occurred around 1996, when the MINAG delegation, through the State Enterprises, had taken over responsibility for providing support (including input distribution) from the Sector Cooperativa Campesino and ANAP. Farmers felt that the SCC and ANAP had provided better support, and that for the last few years they had felt very isolated. There had been little clarity over new roles. One CCS administrator (F/C/29) noted "*I've worked in the private sector since 1987, and I've seen the changes over the years. I think the private sector suffered a lot during the 1990s, but the biggest impact was in 1997 when it had to start obtaining assistance and resources from the Enterprises, because previously it had its own separate source of assistance*". During the course of the field work, in October 1999, the SCC was reinstated, and several farmers noted the positive results of this. For UBPC farmers, assistance also now came from more appropriate and local sources. Farmer F/U/25 described this positive change "*From 1995 to 1999 this was a state military farm which received lots of resources but no technical knowledge. Now everything's changed. We have one-day courses and strategy plans organised by the Enterprise. We are a demonstration farm*." Generally, the UBPC farmers felt more strongly that technical assistance had always been, and remained, good. There was more training available and more information on bioproducts.

In general, there appeared to be more interaction and support for the UBPCs than for the CCSs, as the former had access to a wider range of formal support agents (remnants of their old ties as State farms), while the latter had to make more effort to seek out support and to travel for it. Overall, farmers continued to expect State assistance, including on-farm visits, and this support appeared to have been politically beneficial in terms of the moral support it provided during the crisis years. There was little obvious tendency toward promoting either industrialised or ecological technologies to farmers. Approximately 37% of farmers, from both UBPCs and CCSs, had been involved in scientific trials, and of these, over half applied the results of the trials to their production systems afterwards. These trials included work on minimum tillage, soil fertility, bioinputs and yields.

Internal support and training

Each co-operative had one or more internal technical support staff, who were often the first port of call when a farmer needed assistance. Some other CCS farmers, however, claimed that they didn't receive any assistance from within the co-operative itself. Internal and external training courses were run, by both the co-operatives and support entities. Some farmers voiced the decrease in training, such as CCS farmer F/C/13: "*There are less courses now - everyone goes to Sanidad Vegetal for instructions, so they don't need the training*."

Box 7.2 Responsibilities of a UBPC worker linked to banana production (F/U/22), Batabanó-Havana

Juan started working on the UBPC just 6 months previously, and was part of the work team linked to banana production, which entailed him being responsible for a 2.7ha area containing 8,000 plants The State Enterprise prepared this land for planting, to rotivate, level and remove stones. Juan was involved in planting - covering each microplant with 5cm of soil just to the level of the leaf. The UBPC's plant health expert was in charge of all fertiliser and pest control applications, and other workers removed the suckers from the plants. An ox-handler, also linked to a specific area of the farm, came when needed. Juan helped to apply the inputs and may hoe every day. He had never been on a training course as he was, he explained "*just a banana worker. Some more able types may go on training courses*." As he was linked to the land, he received a bonus for producing more than the agreed State production plan.

In many cases it was only the co-operative technician who received training, and not the other farmer members, and this was particularly so in the UBPCs, which had a more hierarchical management structure. Box 7.2 describes the level of support provided to one ‘vinculated’ banana worker on a UBPC in Batabanó-Havana.

Training and awareness about ecological agriculture

From the above, there appeared to be a relatively low level of training on technical issues relating to ecological agriculture. On more focused questioning, 25% of farmers or other co-operative members had received training on agroecology (see Table 7.2). The most common training theme, identified by 63% of farmers, was on biopesticides. Less than half had received any training on biofertilisers or seed management, and no-one at all on water conservation. Apart from biopesticides, CCS farmers appeared to have received more training than those on UBPCs. When listing specific chemical and biological pest controls, several farmers did not know which category to place certain controls.

Table 7.2 Training on ecological practices received by the farmer or other co-operative member (% farmer response of a non-representative sample, multiple unranked response)

Theme of training	Total of municipalities-provinces (%)		
	CCS	UBPC	Total
Bio-pesticides	56	70	63
Bio-fertilisers	63	30	44
Seed management	50	30	39
Agro-ecology	30	20	25
Water conservation	0	0	0

(n=54 max.)

Almost all farmers, and especially those from UBPCs, had not heard of organic agriculture. A minority of CCS farmers had encountered the concept through ANAP, and perceived it as being *“production without the use of chemical inputs”*. Yet 45% of farmers could name one or more groups or institutes which were training in or promoting agro-ecology.

7.3.4 Markets and product destinations

Looking at changes in marketing arrangements for agricultural produce may contribute not only toward understanding incentives and risks to production during the 1990s, but also toward the degree to which there may be a more localised marketing system, and/or one which includes channels for quality produce. It also contributes to understanding food system arrangements.

Range of product destinations

Prior to the 1990s, the only market outlets had been Acopio and social provisioning. Farmer F/C/13 explained: "*In the 1980s, all produce went to Acopio and the plan was more fixed because there was no other market, so the CCS did not have a marketing department then, and it received no extra payment for overfulfilling the plan*." Currently, produce were destined for a range of markets and purposes: the State production plan (organised by Acopio), self-provisioning, co-operatives’ own internal cafeterias, farmers' markets, the Seed Enterprise (maize), the State tourist market (via Fruta Selecta/Acopio), livestock enterprises (feed), and to social institutions such as hospitals and schools. Individual CCS farmers could also sell directly to their co-operative, which would market it for them, while UBPCs were not allowed to sell via an intermediary (F/U/20). Acopio received between 50-100% of any planned crop. Apart from that, quantities to each outlet varied. For example, one CCS in Cienfuegos was selling 50% of its maize to Acopio, 30% went for its own self-provisioning and the remaining 20% to the farmers' market. In contrast, a UBPC in Holguin sold 10% of its banana to Acopio, 37% went to the workers' cafeteria, 21% for self-provisioning and 32% to the farmers' market.

Making the State production plan

Almost all the co-operatives under study made production plans with the State for maize and/or banana. On the UBPCs, the plans were drawn up between the cooperative administration, Acopio, and the State Enterprises. On the CCSs, the individual farmer members were also consulted. Such plans took the form of agreements and did not necessarily cover the whole of the co-operative's area given to the crop, nor the whole of the crop produced. So, for example, of the 13.4 ha of plantain banana on one CCS in Gibara-Holguin, 6.7 ha was in the State plan to provide 36t banana (5.4 t/ha). The same co-operative was also growing 54ha maize, all of which was dedicated to producing 32t maize for the State plan (0.59t/ha). Plans could also be made over months or years: one CCS had agreed to provide 4.5t per month of banana from 2ha (2.3t/ha), for a period of 5 years, although their actual banana yields were more like 23.5 t/ha (F/C/24); meanwhile a CCS farmer (F/C/22) in the same municipality had half of his 1ha of banana in a State plan to produce 13.8t a month between April and June. Yields agreed with the State were not ambitious, ranging between 0.3 and 2.8t/ha for maize, and 2.3 and 14.4t/ha for banana.

The production agreement used to include a 'technical package' of inputs, but this now often applied only to crops that were *'preferida'* or *'prioritizada'* - prioritised by the State. Even with prioritised crops, sometimes inputs simply were not available, and an annex would be included in the contract stating that the State was unable to supply any inputs for this crop, and this was reflected in the quantities expected. The plan was based on a total tonnage of produce per year. So the 14.4 t/ha/pa of banana in the plan of farmer F/C/25 contributed to his total commitment of providing 450 t/year of produce. The majority of farmers felt that the quantities demanded had decreased since the 1980s. One farmer (F/C/15) described "*The plan has reduced because of lack of inputs, but this has not made much difference with maize - it is more noticeable with horticultural crops*."

Although Acopio had increased its purchase prices over recent years,[139] it had also reduced guaranteed purchases and only bought when the crop was in short supply. Yet Acopio had become more flexible, occasionally allowing planned produce to be marketed more favourably elsewhere, as farmer F/U/11 from Cienfuegos described: "*Acopio allows us to take what we've produced for the plan to Havana to sell it there at a higher price*." Surplus to the plan could be sold elsewhere for both types of co-operative. Strategies for these sales varied. Some co-operatives simply made a pre-agreement with Acopio. For example, the first 30% of farmer F/C/3's banana 'macho' crop was purchased at a price of $6.8/t, and the remaining 70% at $17.6/t. These agreements did not fetch the highest price – separate over-fulfilment plans and farmers' market sales fetched more – but the market was guaranteed. As farmer F/C/25 explained "*Acopio pay double for over-fulfilment, and triple if the quality is good enough for Fruta Selecta*." Other farmers took the surplus to the local *La Placita* sales point or the farmers' market.

If the plans were under-fulfilled, then Acopio would levy a fine, unless the failure was due to factors beyond the farmer's control, such as bad weather, or the State defaulting on the supply of agreed inputs. CCS farmer F/C/15 estimated the fine as being the same as the market price of the crop. UBPC farmers also described disciplinary action and a reduction in wages, and, in the case of tobacco production, forfeiting their dollar earnings. Farmers could, and did, take out insurance against the risk of under-fulfilment: UBPC farmer F/U/8 had insured 13ha of banana against pest, disease, and bad weather, at a cost of $130/pa. This figure was based on calculations of previous annual losses. In the year 2000, some of the co-operatives visited had over-fulfilled their plans, and

[139] Acopio was paying better in the late 1990s than previously, and farmer F/U/20 thought he knew the reason why: "They want to eliminate the farmers' markets, so they subsidise produce - they buy beans for $0.66/kg and sell them for $0.33-0.44/kg." This would encourage the farmer to sell to Acopio, and subsidised State markets would undercut the farmers' markets.

others had under-fulfilled. The weather, and in particular drought, was usually to blame for under-fulfilment, and hard work and good State support for over-fulfilment.

Market prices for maize and banana

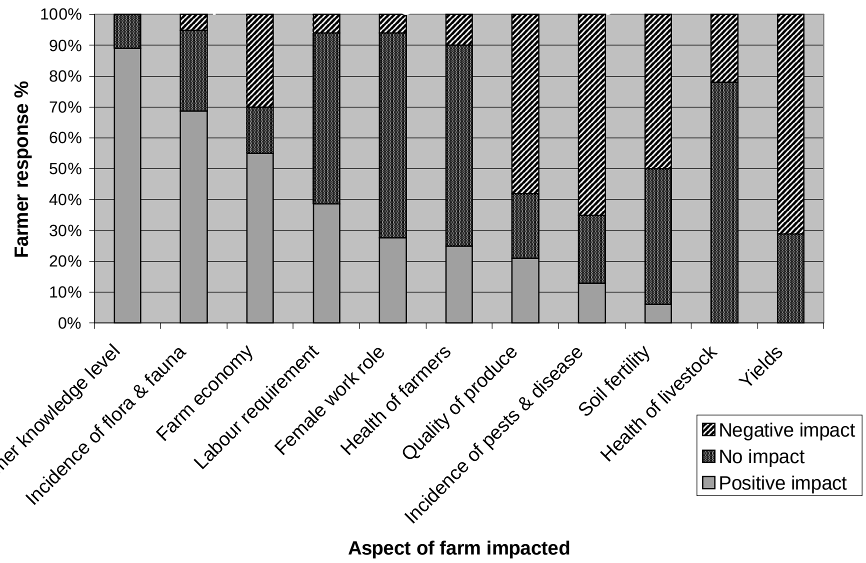
Comparing prices was difficult as farmers used different unit sizes and different local measurements. For example, maize prices were variously calculated on the basis of quintale of cobs, quintale of grain, per thousand cobs, or per cob. Banana prices were based on individual fruit fingers, hands or bunches, as well as by weight. Different varieties of both crops had different sizes and weights and banana was also priced on quality. Prices varied between sales outlet and also changed dramatically by month, season and year. Prices were fairly similar across provinces.

In 1999/2000, maize could sell at 0.4c/cob or $24/t grain to Acopio, 1 to 5c/cob or $165/t grain in the farmers' market, and up to $330/t (for hybrids) to the Seed Enterprise. In the same period, first grade banana could sell to Acopio for up to $33/t, and second grade for $11/t. Over-fulfilment of bananas brought payment of $38/t. At the farmers' market, it brought $27 to 77/t, and through Las Placitas markets up to$33/t. Fruta Selecta, purchasing quality bananas for the tourist trade, purchased for $28/t.

7.3.5 Perceptions on the impact of the reduction in agrochemical availability[140] on farm assets and resources

Farmers variously ascribed the decline in agricultural chemicals to a lack of dollars to purchase inputs, the fall of the Soviet bloc, and/or to the US blockade. Several farmers did not know, or did not want to give, reasons for the decline. Since the start of the Special Period, farmers had clearly seen some impacts on different aspects of their farm livelihoods. These are shown in Figure 7.6.

Figure 7.6. Farmers' perceptions of the impact of the decrease in agrochemical availability on specific livelihood aspects on their co-operatives during the Special Period (% farmer response of unrepresentative sample)



The reduction in agricultural chemicals had a positive influence on several aspects of the co-operatives. Almost 90% of respondents thought that farmer knowledge levels had increased. This was due to a combination of learning about new technologies and day-to-day learning. UBPC farmer F/U/20 exclaimed that *"The crisis has taught us how to produce in another manner…the change is mainly for the management who need to think more about what they do. Still, since*

[140] Fuel availability was not included in this question because it originated in the earlier stage of field work when agrochemicals were the focus.

linking man to the land, the workers have also been changing mentally." Farmers were now more involved with their work "*Now, 90% of CCS members attend meetings because they have become more interesting*.", and, on UBPCs, "*Linking man to the land means increased attention and knowledge*." Knowledge-based changes included changing planting dates to take advantage of the rains and so avoid pest and disease attack, and the more efficient use of resources. Farmer F/C/5 exclaimed that "*Every year we learn something new and especially about plagues. We have learned to use inputs more efficiently."* Other farmers supported this view: "*There are some crops which we have learned we do not need to use any inputs on at all now*" (F/U/5) and "*We have had to learn to plant in season, and to prepare enough land ready for this or else we can't achieve the plan. It is possible to improve planting beyond the optimum season.*" (F/C/28). CCS farmer F/C/20 reflected that "*We completely wasted our resources in the 1980s because they were all free*."

A large proportion of farmers, 68%, felt that on-farm flora and fauna had been positively affected and especially when compared to the detrimental impacts of the previous decades. Farmers explained that this change had not been immediate but had become apparent within the last few years - since about 1997. Farmers were aware that there were more butterflies, birds and bees.

Just over half the farmers felt that their economic status had improved. This view was widespread on UBPC co-operatives for whom higher market prices offset low yields and input costs. CCS co-operative members were more inclined to think that there had been a negative impact or no impact on the farm economy. CCS farmer F/C/5 explained that "*Incomes have always been low for some crops but now overall we are a little more comfortable*."

The greatest negative impact was on productivity, identified by 70% of farmers responding, and more pronounced on CCSs than on UBPCs. Yield drops of between 15 and 50% were quoted. Despite this, a significant 30% felt that there had been no overall effect of the agrochemical reduction on yields, and farmers' more qualitative explanations, painted a somewhat different picture. One CCS farmer (F/C/13) in Cienfuegos put it down to the weather: "*In the early 1990s there was only a small drop in yield. Now it's much worse because of the drought and the climate – there is less rain now and the sun is stronger*." CCS farmer F/C/20 from San Antonio was forced to change crops: "*In the 1980s we planted less maize and more taro which required more inputs, as did carrot and cabbage. Since then we've had to plant more roots and tubers as these require less inputs, and these have lower yields."* However, yields of certain crops had improved for institutional reasons, as explained by one UBPC farmer (F/U/19), "*In the 1990s some crop yields increased if they were prioritised, because they received more inputs and more attention, such as tobacco. In fact we've been receiving inputs for a wider range of crops, and this is because we now have MINAG in charge instead of the Tobacco Enterprise.*" Yields also fluctuated over time, as described by farmer F/C/23: "*In the crisis yields dropped between twenty to thirty percent, but this depends on the natural conditions – they rose last year because of good weather and the increase in input availability."* UBPC farmer F/U/11 noted the fall and then rise over the last decade "*In 1993 to 1994 we still had inputs and reserves including spare parts. So we were profitable for two years. It was in 1995 that yields fell – up to 1997 were the most difficult years*." Similarly, UBPC farmer F/U/14 noted the recent rise in yields "*Over the last three years productivity has been improving. Yields are higher because more attention is paid and there are more incentives*." UBPC farmer F/U/20 was even more positive, "*Our potato yields have doubled because of using biological control and four applications of fertiliser*.", as was UBPC farmer F/U/26: "*Now yields have increased because there's more availability of petrol, fertilisers and pesticides, because of agreements with other countries and because of national research – some fruits can now be harvested in 6 months instead of 3 years because of new grafting techniques*."

An almost equally large majority, 65%, felt that there had been a negative impact on the incidence of pests and diseases. This view was more widespread on CCS co-operatives than on UBPCs. Twenty per cent of respondents felt that there had been no impact. Those who saw a negative impact felt the lack of chemicals had allowed pest numbers to increase. "*Now we have whitefly and Thrips palmi because there are few pesticides and those which there are arrive late*." (F/C/5), while farmer F/C/12 explained that "*We planted 50,000 tomato seedlings and lost 45,000 of these to blight, because we had nothing to combat it.*" Farmers reported increases of *Thrips* *palmi*, maize leaf borer and black sigatoka. Yet farmer F/C/16 saw it from the biodiversity viewpoint, explaining that "*Previously there was less banana weevil because there was more diversity - now there is a monoculture and the landscape is bare with no trees to hide the view.*" Some unorthodox, but not uncommon, views were also expressed "*Pests have increased because people are bringing them into our country*." Those who felt that there was no impact on the level of pests and diseases, argued that bioproducts made up the shortfall in chemicals, and that pest levels were dependent on levels of rainfall. Farmer F/C/16 was part of the small minority who had seen a positive impact, saying, "*Before the Special Period there were more plagues and attacks because we were using more poisons and so there was more pest resistance*."

A slightly smaller but still significant number, 58%, felt that product quality had decreased because of the lack of agrochemicals. This group directly associated quality with volume of the marketable produce. A relatively smaller number, 20% of farmers, felt quality had improved, due to the decrease in pesticide and other chemical usage.

Half the respondents thought that soil fertility had decreased due to the lack of agrochemicals, although a large minority saw no specific impact on soil fertility. The decrease in soil quality was put down to poor management including frequent soil preparation, coupled with a low use of organic fertilisers, which contributed to erosion. One farmer explained "*On the one hand we use oxen now, but on the other there is not enough manure*."

In other areas, such as the health of farmers and livestock, labour requirements and the role of women on farms, the majority of farmers thought that there had been little impact. The majority of farmers were aware that agrochemicals were harmful to the environment (flora, fauna and the soil) and to human health (intoxication and allergies), though some felt they caused insufficient harm to be of concern. Nevertheless, a quarter of farmers felt that human health had improved, owing to the lower use of agrochemicals and specifically a reduced incidence of skin disease. While many farmers thought that the changes had had little effect on the health of livestock, a large minority perceived a negative effect, largely due to the lack of availability of medicines and the impact of lower yields on nutrition.

There was varying agreement about whether labour requirements had increased or decreased and both were seen as largely positive. The majority of farmers thought that the changes in agrochemical availability had no impact on labour requirements, and those that did see an impact thought that this were positive. There had been some increase in labour demand as "*We have no herbicides and there is more planting to do, and we also help others more*." Changes in labour organisation on the UBPCs also had an impact on output, even where numbers had stayed the same, "*With linking the man to the land, the man is more productive*." and "*Labour has stayed the same because we have become more efficient*." The role of women had remained broadly similar, largely because of the custom of avoiding the use of female labour in the field where possible (even with an increase in labour demand); *"There are fewer roles for women now because field conditions are bad and we try not to use them for manual labour*."

Overall, opinions on the effects of the decrease in agrochemicals were quite balanced between positive, negative and or neutral. Each farm had different experiences according to its specific circumstances. In general, CCS farmers had a slight tendency toward a more negative view compared to UBPC farmers who saw more positive or neutral impacts. These responses indicated that the relationship between agrochemicals and impacts on farm livelihoods was not a clear one and could not be easily generalised, and especially for issues such as yield changes.

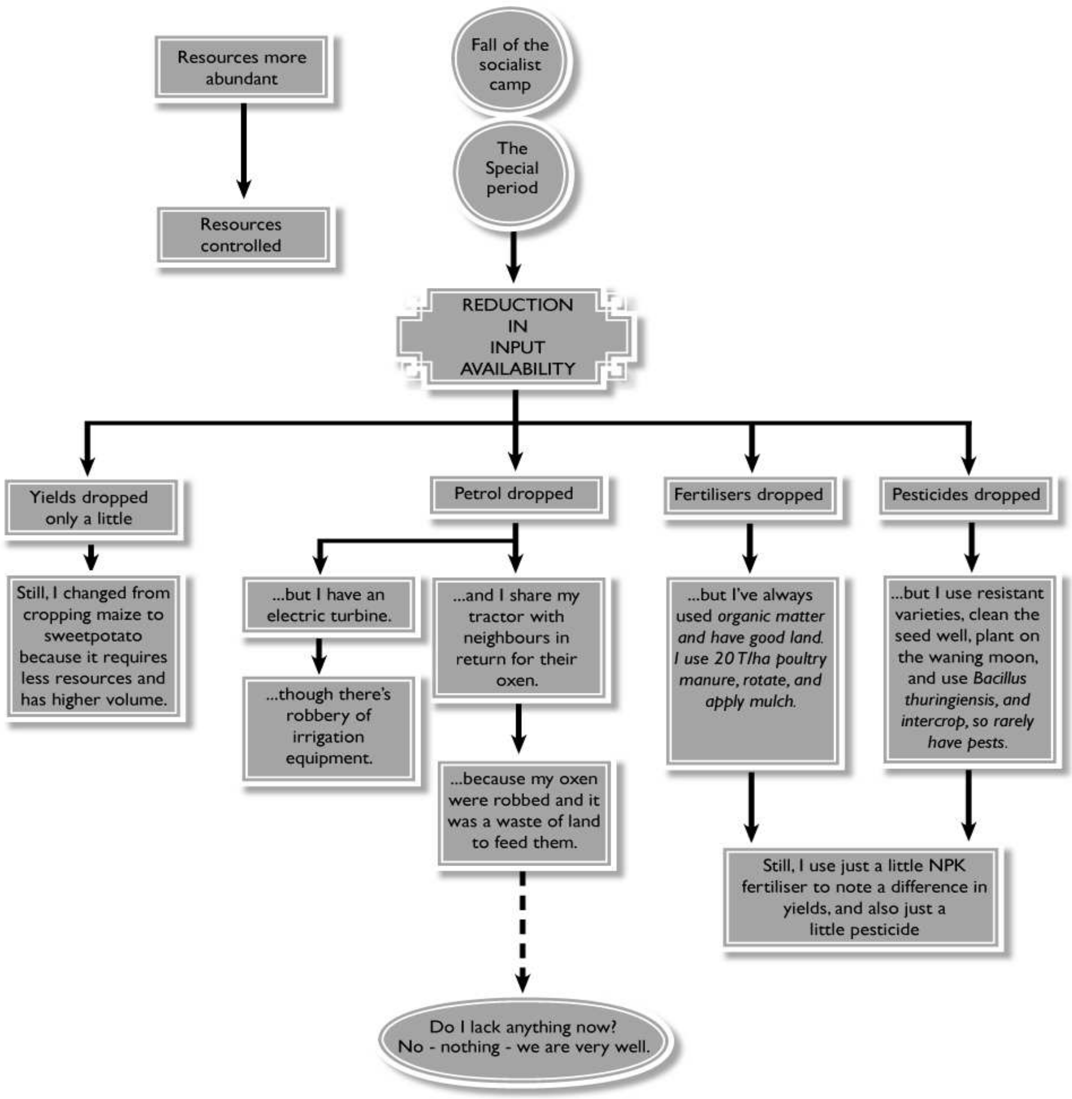
7.4 FARMERS’ PRODUCTION STRATEGIES

7.4.1 Major cropping systems and strategic changes

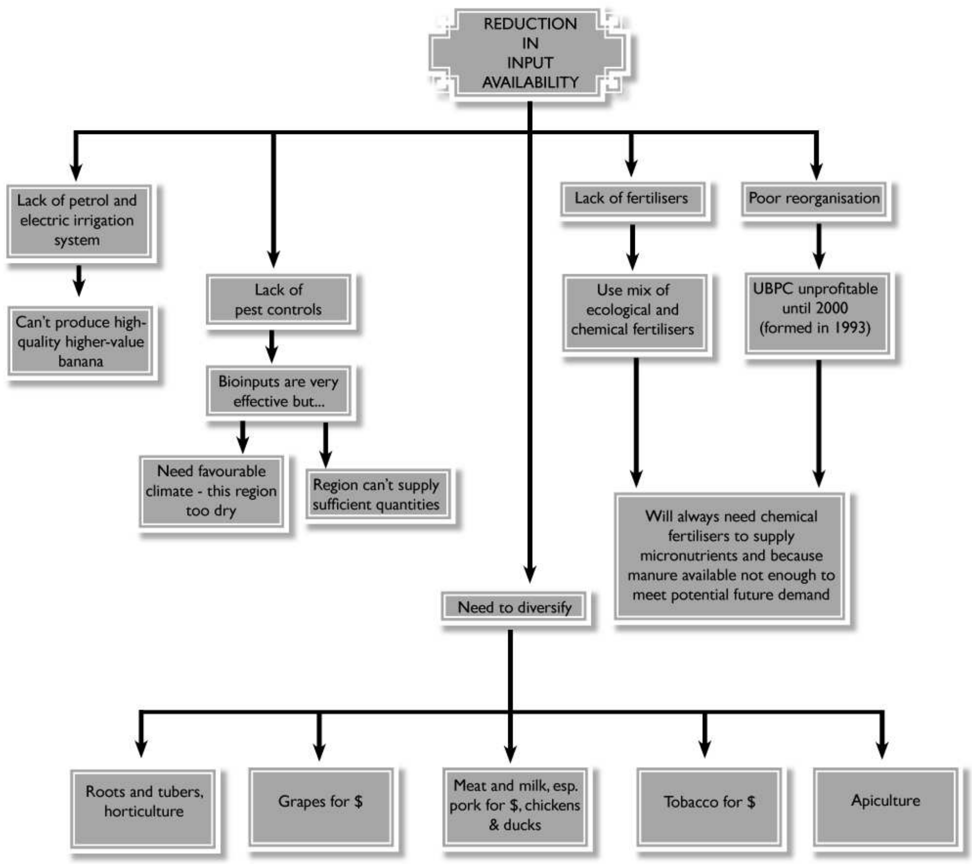
The main production activities were livestock, roots and tubers, horticulture – especially tomatoes, flowers, grains and potatoes, tobacco and fruit. Yield figures varied with no discernible differences between regions or type of co-operative. Certain crops, such as potato or tobacco, had fairly standard yields across regions and farm types (16.8-20.1 and 1.0-1.3 t/ha respectively). Others, such as tomatoes varied considerably (from 8 t/ha on the UBPCs in Cienfuegos, to 20t/h on those in Holguin).

Production activities had changed since the 1980s and early 1990s. Although the strategic changes did not explicitly intend the application of ecological approaches, implicitly this is what appeared to be occurring. Previously, for example, farms were less diverse, whereas now, as one farmer explained, *"We've survived by two strategies: better market prices, and diversification – we've had an organoponico since 1993. We have more production with less costs – less inputs, more manure and more efficient use of irrigation*." Diversification programmes were being encouraged at the national[141] and local levels and especially for UBPCs which were venturing into 'aquatic livestock', apiculture, lombriculture, and produce for the tourist market. Two contrasting strategies as a result of the Special Period are depicted as 'problem tree' diagrams in Figure 7.7, as constructed with farmers.

Figure 7.7 Problem analysis of coping strategies of two farmers during the Special Period, dealing with the reduction in input availability; the first – a CCS farmer - continuing with business as usual, and the second – a UBPC farmer – diversifying.



[141] Initiated by Raul Castro, brother of Fidel, who was leading 22 rural innovation programmes, also including the re-introduction of oxen.



Other farmers chose to concentrate on a few crops, specialising in, for example, garlic or sweetpotato which received State support. Farmer F/C/11 explained "*I plant maize, tomato and bean out of season by taking care and preparing the land well – so they are all high value*", and another stated "*Our survival strategies were linking man to the land, looking for short-term crops of high yield and high value such as flowers and the use of bio-inputs to control pests*." (F/U/12). Markets influenced this change, as one CCS farmer (F/C/19) explained "*We changed from planting maize to sweetpotato because it needs less inputs and is higher volume – Acopio pays on volume*." Others showed sensitivity to market price changes, such as farmers F/C/10 "*We are planting more cassava in this year because the market price has risen*." Near the big cities, changes had occurred in order to meet urban market demands for horticultural crops.

7.4.2 Maize and banana cropping systems and strategic changes

All the co-operatives were producing maize and/or banana, as main crops and/or for self-provisioning. Yields for the year 1999/2000 varied considerably but there was no clear regional or organisational pattern. Maize yields ranged from 0.1 and 1.8 t/ha grain (average 0.92t/ha), and for banana ranged from 10.1 to 27 t/ha for fruit banana (average 20.3 t/ha), and 3.4 to 30.2 for plantain type (average 11.2t/ha). It had been a poor year for maize, although for different reasons: insufficient petrol for irrigation in Cumanayagua-Cienfuegos, drought in San Antonio-Havana, and a longer-term issue of poor soils in Gibara-Holguin. Meanwhile, banana producers in Batabanó-Havana were having to replant after the recent hurricane. Some farmers explained that yields had generally decreased since the late 1980s and the crisis. Other farmers described a fluctuation in yields, with an improvement towards the end of the decade, as farmer F/U17 described: "*In the 1980s, banana yield was 17 t/ha, then it dropped to 6.7-10.6 t/ha in the early 1990s. Now it is up to 20-27 t/ha*."

Cropping systems had been affected by the Special Period in various ways. Some effects were directly due to lack of inputs, such as of irrigation. Maize, for example, was cropped once or twice a year, and earlier planting was now dependent on early rains. Farmer F/C/18 recalled "*Previously* *we could plant anywhere, but now this is not so*." Yet maize was frequently incorporated into a rotation, and this influenced planting time and location on the farm, more than input availability or soil type. Other impacts on cropping systems were due to the increase in robberies. CCS farmer F/C/17 explained "*I have to harvest my maize green, because we're near the railway and robbers would steal all my dry maize so I would need night guards otherwise*."[142] This problem also impacted on seed saving strategies as it was virtually impossible to dry seed from the previous year. Banana was planted either in the winter period, with irrigation, or March to June with the rains. A few CCS farmers planted with the waning of the moon, because the plant will be "*stronger and have more bunches*" (F/C/19). More farmers had heard of this technique but did not practise it. The life cycle of a banana stand had halved over the years, and this change was put down to an increase in drought, soil pests, climate change, and the increased intensity of cultivation. The shorter-lived stands would be rotated with annual crops such as bean and tobacco. Intercropping in banana plots was commonplace in the first year after planting. One UBPC farmer intercropped banana with chilli pepper "*to take advantage of the land, and the pepper likes the shade and the irrigation too. The peppers that I planted on their own all died*." Farmer F/C/3 explained that he intercropped with cassava in year two, to ensure a harvest of some staple food in case of drought. In the more mountainous region of Cumanayagua-Cienfuegos, banana was intercropped with coffee as a pest control method: "*When there's more sun, there're more pests, so we intercrop the banana with coffee to provide shade, and it makes a difference*" (farmer F/C/14).

Other strategic changes in maize and banana production, stemming from the Special Period, were more subtle and related to how the crops were integrated into the whole farming system. There were many coping strategies within, as well as between, regions. Box 7.3 describes the different coping strategies of two banana farmers from different CCS co-operatives in Gibara-Holguin. Both farmers had been forced to use their resources more carefully, to change crops and to diversify. Carlito1 was unable to obtain extra land from the State, and was actively attempting to increase the fertility of his soil by incorporating manure from his livestock herd. Carlito2, on the other hand, had been able to get access to more land and was farming more extensively.

Box 7.3 Contrasting coping strategies of two CCS banana farmers in Gibara-Holguin.

Carlito1 recalled that, at the time “*when we had better relations with the Soviet Union*”, he used to plant 8 ha of plantain ‘macho’ banana, using good amounts of chemical fertiliser. When the crisis occurred, yields dropped by 50% and they also had drought problems. He was unable to increase his planting area owing to the lack of resources and his new petrol quota covered only 2% of his needs. He therefore switched to planting crops that did not require so many inputs, such as chickpea which he now sold to Acopio. He also changed banana variety to ‘burro’ which was more drought tolerant and did not require much pesticide. This current year he had started to collect manure from his own livestock for improved soil fertility, and he was planting 3.2ha of ‘macho’ banana and 2ha of ‘burro’.

Carlito2 also used to plant banana ‘macho’ in the 1980s, though he used little in the way of agrochemicals because in those days production was more traditional. When the crisis came, fuel was reduced and at first this affected his irrigation system, but he learned to use less water. His yields also dropped, although this was highly dependent on the weather. He used to use more manure in the past, explaining that “ *nowadays I am more lazy*”, although when he had time he did continue with a technique learned from his father of gathering forest leaves to spread as a mulch around the stems of his fruit banana. Nowadays he found that market prices were high and generally his production had increased, partly through diversification through the same introduction of chickpea, but also because he had been able to obtain more land from the State, in perpetuity.

7.4.3 Choosing maize and banana planting material and varieties

Farmers displayed a range of different strategies and preferences around planting materials, and these could be categorised as being brought about by economic circumstance, low input and other agronomic conditions, and markets and other factors. The impact of the decrease in agrochemicals therefore played one important but not exclusive role, and more than anything brought out farmers’ innovative capacities and provided learning opportunities.

[142] A CCS farmer in Batabanó-Havana was hiring 3 guards at a total cost of $4.5 night.

In practice, the CCS co-operatives obtained their maize seed from neighbours and by self-saving, and in Havana province from the Seed Enterprise which was also the sole source for all UBPCs. Some were limited by lack of transport, while others were still able to prospect. Farmer F/C/2/00 from Holguin had also noticed that, although there was little seed exchange between provinces, "*there is now an increase in the number of intermediaries who travel around buying and selling seed*."[143] Banana planting material came in the form of rhizomes (*name* or *yemas*), root suckers (*hijos*), or micro-plants (*vitroplantas*), the latter which could be obtained if banana production was part of a plan. Both CCS and UBPC co-operatives tended to self-save the plantain 'burro' varieties, or swap these with neighbours and obtain the modern micro-plants from State bio-factories.

Generally, the CCS co-operatives used a wider range of traditional varieties than the UBPCs. There were distinct regional differences in the varieties and materials used, and only a limited range of modern varieties available (although farmers were starting to classify some longer established modern varieties as being traditional). The greatest range of both traditional and modern varieties were used in Havana Province. Modern maize varieties were preferred by farmers for their yield but, beyond that, traditional varieties were believed to be superior - in terms of flavour and pest resistance, and also drought resistance, hardiness in poor soils, and wind resistance. Approximately 50% of farmers had found that modern varieties and hybrids required higher levels of inputs. The other half felt that there was no difference. Modern FHIA banana varieties, were generally considered to have prohibitively high water requirements and especially by for those farmers lacking irrigation. They also required more inputs.

7.4.4 Use of petroleum-based inputs for maize and banana

Quantitative calculations were made of the general usage of petroleum-based inputs amongst the farmers surveyed. There were no discernible regional patterns in input use. Table 7.3 summarises the findings. Key words emerging in describing levels of use were *'if available'*, *'depending on climate/rainfall'*, *'as a curative - not preventative'*, and *'localised or spot application'*. In general, more farmers were using agrochemicals and petrol for their maize production than for banana, although banana accounted for more pesticide and herbicide use.

Table 7.3 General use of petroleum-based inputs for maize and banana production, 1999-2000 (% farmer response of a non-representative sample)

Input	Maize production			Banana production			Maize & banana production		
	CCS[a]	UBPC	Total average	CCS[a]	UBPC	Total average	CCS	UBPC	Total average
Chemical fertiliser	85	58	72	64	86	75	74	73	74
Chemical pesticide	71	63	68	45	41	43	61	48	55
Petrol	55	70	62	30	30	30	43	50	46
Chemical herbicide	25	14	20	36	36	36	32	28	30

n=54 max.

[a] CCS farmers in Holguin had received no State inputs at all for the year 1999 (F/C/6).

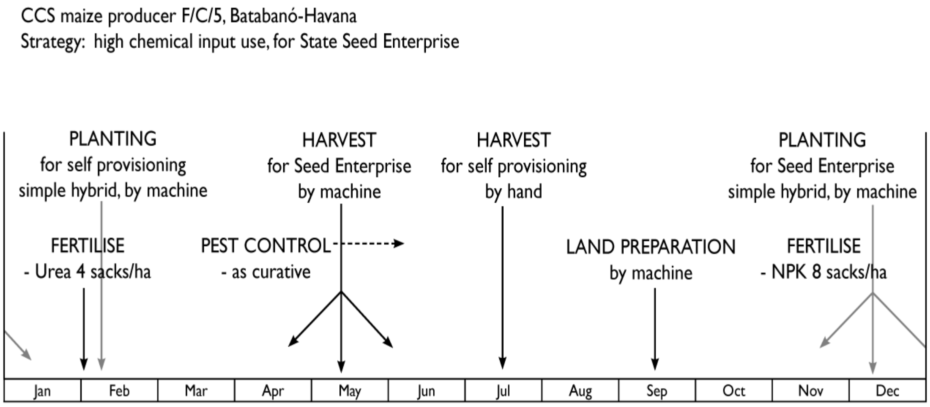
Fertilisers were the most used input on maize crops, employed by 72% of farmers, a figure almost matched by pesticide use (at 68%). In all cases the incidence of agrochemical use was higher amongst CCS farmers than among UBPC farmers. Sixty two per cent of farmers used some petrol on their maize crop. Quantities used ranged from 'almost zero' to 74l/ha. Some farmers simply used whatever inputs were left over from their State-prioritised crops, such as tobacco. Differences

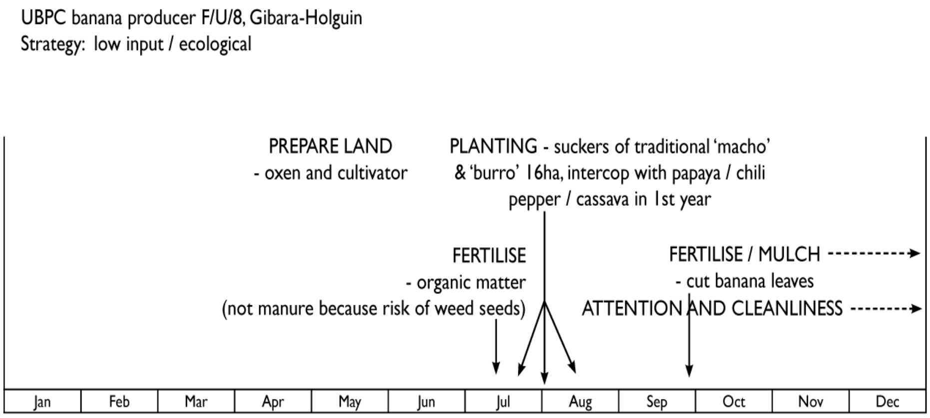
[143] This is likely to be a black market activity.

between the two types of farms were low, although UBPC farmers did more frequently use chemical fertilisers. Quantities of petrol used ranged from '2% of needs' to 171l/ha.

Almost all the farmers agreed that their agrochemical usage had decreased since the 1980s, with estimates that current levels of use were 20% of what they had been previously. For others (former low users) the difference was not so great and levels may have been very similar. CCS farmer F/C/2 recalled "*I estimate that we are using the same amounts now as before the crisis, but the difference is that previously it was much easier to obtain them from the State Enterprise.* Another, F/C/7 explained, from his smallholder point of view "*In fact we do use the same levels as in the 1980s, but in any case it was never our custom to use very much at all because we are traditional producers and so we only plant on a very small scale*." Some farmers were not using chemicals at all. Figure 7.8 displays some sample seasonal cropping calendars for maize and banana, which show the cultivation strategies employed by farmers.

Figure 7.8 Seasonal cropping calendars, contrasting CCS farmer producing high-input maize for the Seed Enterprise (F/C/5), with UBPC farmer using a more ecological approach for banana production (F/U/8)





The State was only able to provide a limited amount of the petrol required by most farmers. For CCS farmers, the State supply met between 2 and 70% of their requirements. For some, the lack of petrol was a limitation that they couldn't see a way around as it affected their whole system. As farmer F/C/5 explained "*There's nothing else I can do really, if there's no petrol, because in the winter there's no rain and then no irrigation either, and there's no point in applying inputs if the soil is not humid. I've heard of other farmers who produce with no petrol - in Peru - but they must have different soils….*"

CCS farmers frequently appeared to resort to the black market to meet the shortfall from the State supply sector. Black market prices were 3-6 times more expensive, too high for UBPC farmers. One CCS farmer recognised that he was in a fortunate position: "*Inputs are actually cheaper now than in the 1980s. I pay $0.8/t for nitrogen fertiliser from the Seed Enterprise, and $4 to $5/t on the black market. We CCSs can afford these black market prices, but the CPA and UBPC co-operatives cannot, and this is the reason they turn to alternatives*." UBPC farmers also found other ways of coping, as one explained "*We borrowed inputs from the campesinos who had more reserves*."

7.4.5 Soil fertility improvement practices

Changing levels of synthetic fertiliser use

The CCS co-operatives obtained their chemical fertilisers from one or more of the Sector Cooperativa Campesino, the Mixed Crops Enterprise, the State Seed Enterprise, and the black market (including that sold by other co-operatives), and the UBPCs from the MINAG Delegation/storehouse through the State (Mixed Crops) Enterprises. For all farmers, sugarcane waste (*cachasa*) came from the local Agro-Industrial Centres (CAI). There was little awareness amongst farmers on sources of biofertilisers.

Drawing again from Table 7.5, 74% of farmers were using agrochemical fertilisers on their maize or banana production. Quantities of chemical fertilisers used in maize production ranged from 0.15 to 1.0 t/ha NPK, 0.11-0.2t/ha urea, and 0.15-1.0t/ha nitrogen. For bananas, quantities ranged from 0.07-0.7 t/ha urea, 0.5-0.8t/ha NPK, and 0.22-2.9t/ha potassium. Farmers in Havana Province were asked to contrast current levels of fertiliser use with those in the 1980s, and confirmed that current usage was way below that of the previous decade. Their responses are shown in Table 7.4.

Table 7.4 Comparison of use of soil fertility inputs in the year 1999/2000 compared to the late 1980s, for farmers in San Antonio and Batabanó - Havana Province

Farmer	"I used to use"	"Now I use"
Maize:		
F/C/23	NPK 0.8t/ha Urea 0.4 t/ha	None - I didn't receive any.
F/C/17	NPK 0.4-0.6 t/ha	0.2 t/ha when available
F/C/20	NPK 0.4-0.8 t/ha Urea 0.3 t/ha Poultry manure Compost 8 carts/ha	A little A little None none
F/C/15	NPK 0.6t/ha	NPK 0.2 t/ha
Banana:		
F/C/19	NPK 1.6t/ha x 3	Chicken manure 20t/ha

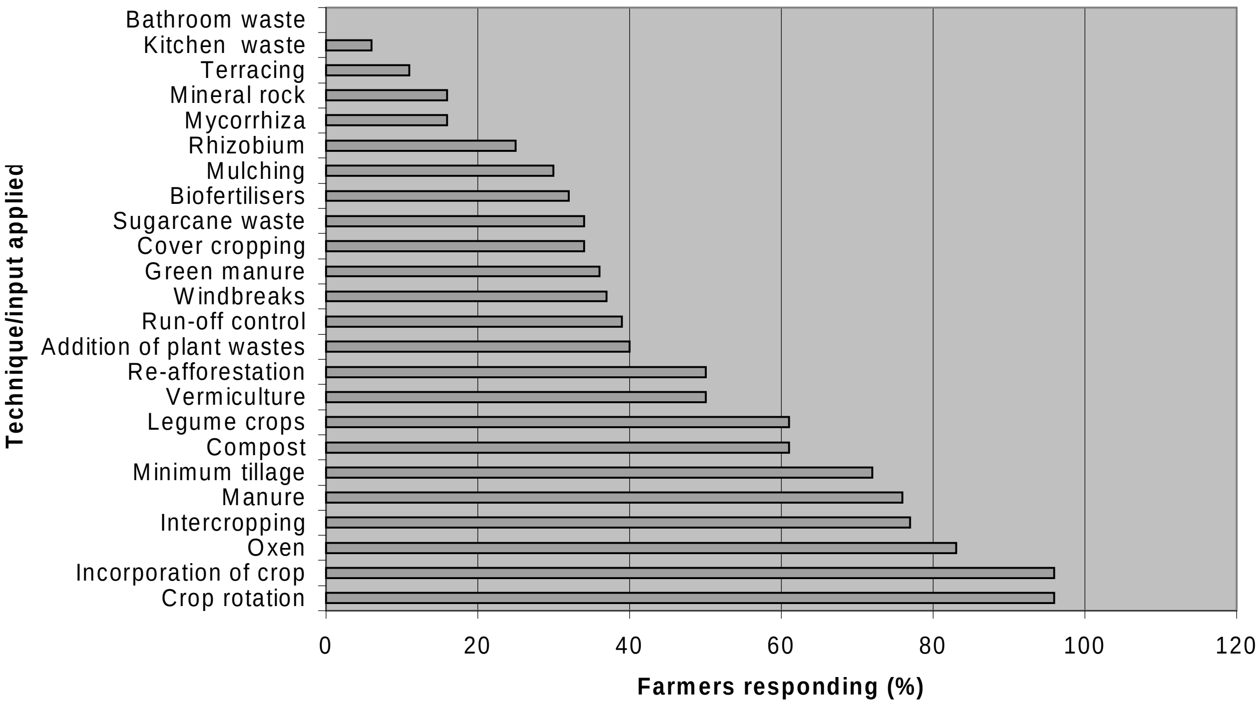
The levels of fertiliser received by farmers varied. Farmer F/C/12 from Cumanayagua-Cienfuegos explained that "*Last year I got no fertiliser from the CCS administration, and this year I got 0.1t. We have a contract and a plan, but the inputs never arrive.*" A popular complaint was that even with sufficient fertilisers, they were ineffective without moisture. "*We do lack fertiliser but we can't use it if there's no irrigation.*" (F/C/16).

Ecological soil fertility improvement practices

In terms of alternative soil improvement strategies, and as shown in Figure 7.9, almost all farmers, 96%, were practising crop rotations and incorporating crop residues into their land, and 83% used oxen which not only provided manure but also helped avoid soil compaction. 77% practised intercropping, and 72% minimum tillage. In both cases, these practices were more widespread on UBPCs than on CCSs. Both the use of legume crops and the addition of compost were practised by

61% of respondents, and half were using worm compost and/or producing it themselves. The other techniques listed were being practised by less than half the farmers. These practices were slightly more widespread on UBPCs, especially the use of biofertilisers, which was used on 50% of UBPCs but only 11% of CCSs. Some farmers had not heard of several of these techniques, including those of green manuring or the use of biofertilisers. Terracing, including contour planting, was only practised in the hilly area of Cumanayagua-Cienfuegos, the area where drainage control and reafforestation measures were also most widely practiced. In addition, farmers were also more efficient with the use of chemical fertilisers, recognising that nitrogen fertilisers applied on dry soils would be wasted. Rotations were often practised so as to take advantage of the fertiliser residues remaining after a State-supported crop. Of note is that the actual frequency, or quantities, of use of these practices were not clear.

Figure 7.9. Current use[a] of ecological techniques and inputs to improve soil fertility[b], for maize, banana and other crops (% farmer response of a non-representative sample)



[a] For the first round of interviews in Havana, the questioning attempted to differentiate between farmer knowledge and actual practice. This revealed a low level of actual practice of techniques compared to the claimed level of knowledge. In later interviews, the questioning was simplified to identify only the extent of actual practice of techniques. [b]In fact several of these techniques were being used for other prime reasons, such as windbreaks to guard against cyclone damage.

In terms of factors which might limit the usage of these techniques, the most commonly identified was the availability of organic inputs, a problem for 88% of farmers. The second most important factor was a lack of knowledge and/or training on these techniques, (55% of farmers). Lack of trust in the techniques, (47%) and cost, (42%) were other major constraints. Labour was only a constraint in the time required to collect organic inputs. The greatest difference between CCSs and UBPCs was their confidence in these practices, with twice as many CCS farmers being distrustful.

Farmers described their diverse experiences with these constraints. "*Manure is expensive and anyway there isn't any. We used to use chicken manure – it was given free if we cleaned out the State poultry factory – but now its in such demand and the State Compost and Tobacco Enterprises take it instead.*" (CCS farmer F/C/20). Even when ecological materials and bioinputs were freely or cheaply available, transport and fuel were required to collect them. As one farmer (F/C/11) explained "*I think manure is marvellous and cheaper and I want to apply it, but I haven't yet, because it requires a lot of quantity and work for it to be collected and I only have oxen for* *transport.*" UBPC farmer F/U/10 explained "*The State Enterprise recommends that the UBPC uses manure, but the UBPC makes the final decision and has to pay and collect it from the Vaqueria*"[144] (though for some other UBPC farmers, the State Enterprise made farm deliveries). As such, the lack of industrial inputs limited their ability to use ecological approaches.[145]

Some farmers were constrained by other factors such as land availability, although they did not identify this directly. Applying manure to the land meant that it should be left fallow for between 20-40 days, yet some (but not all) farmers had such tight rotation schemes (induced by State production plans) that this was not possible. This was also a constraint on adoption of green manuring. CCS farmer F/C/5 explained "*I can't rest my land because the State plan requires all land to be productive.*" Personal inclination also played a role, farmer F/C/8 admitted that "*We used to use more manure, but now I am too lazy to do this*."

Desired soil fertility strategies of farmers

The vast majority of the farmers, 83%, confirmed that, if they had increased access to agrochemical fertilisers, they would use more, specifically N-P-K and urea for maize, and potassium for banana. Increased yields was the main reason for this preference, but farmers in Cienfuegos and Holguin also stressed the ease and rapidity of using chemical fertilisers, especially for short-duration crops such as maize. Farmer F/C/8 explained that "*I prefer to use chemical fertilisers than manure, because the chemicals are faster acting even though they are more expensive*". Some were concerned that manure or organic matter would contain weed seeds, or would not contain the micronutrients that chemical fertilisers were thought to hold. Others were more concerned about the sufficiency of supply of organic materials, both now and in the future.

This preference did not mean that ecological practices would not be used. Several farmers were aware of the negative health effects of agrochemicals and would increase their use of ecological inputs if they more readily and cheaply available. Farmer F/C/16 explained "*I have very high yields – double the average – and I prefer to use a mixture of organic and chemicals. Organic matter provides a vegetative topsoil but chemicals and irrigation help for plant growth*." Several were planning to produce their own supplies through increasing livestock numbers and composting and vermiculture (though some preferred to purchase from the State because "*it's purer than direct from local producers*."). Farmers in areas of poorer soil fertility – Cumanayagua-Cienfuegos – were aware of the benefits that ecological inputs could bring to their soils. Farmer F/C/11 described the situation "*We've been using the soil very intensively so it yields less now. The only way to improve it is to not cultivate – but I can't afford to do that. So instead I'm trying to add manure*."

A minority of farmers had no intention of using more chemical fertilisers in the future. Some were satisfied with the levels they already had, and the residual effects they were getting from the State-prioritised, high-input crops. Others felt that knowledge was the key, "M*ost farmers apply too much fertiliser because they don't know their soils and have not had a soil analysis undertaken*." (F/U/5), and UBPC farmer F/U/17 believed that "*To improve yields, what we need is a dairy herd, compost, and more traditional knowledge*". Several farmers would prefer organic inputs if there was a choice, and a few did not use chemical fertilisers at all, especially if they had easy access to alternatives such as CCS farmer F/C/25 "*I apply manure from my own herd and also collect it free from the dairy and poultry Enterprises, in return for cleaning the dairy*."

[144] Dairy Enterprise.

[145] Increasing knowledge levels could also work both ways and inhibit ecological approaches, such as for as CCS farmer F/C/9 "We used to do much more intercropping, but now we have the knowledge that crops grow better if they are planted alone, so we produce in monoculture."

7.4.6 Pest and disease control practices

Changing levels of synthetic pest and disease control use

Sources of inputs for pest and disease control were similar to those for soil fertility. Biological control inputs came from the CREEs. Referring back to Table 7.5, 68% of farmers were using chemical pest and disease controls for maize production and 43% for banana. Herbicides were being used far less: 20% for maize and 36% for banana. For maize, pesticide dosages ranged from 0.06-0.2t/ha Duplex formula[146], with dosages and frequencies of other types being minimal, and dosages of herbicides were often negligible - for example 0.004t/ha. Pesticide dosages for banana ranged from 0.5 - 40 l/ha, and sulphur was constant at 0.02l/ha. Dosages of herbicides on banana were also low, at around 0.03t/ha. Ethanol (*Flor de Mayo*) was used for ripening for specific markets. Table 7.5 contrasts levels of chemical pesticide use amongst farmers in Havana Province in the 1980s and late 1990s. Although levels appear to have declined, some farmers increased usage, due to increased incidence of plagues.

Table 7.5 Comparison of use of chemical pest and disease control inputs in the year 1999/2000 with the late 1980s, for farmers in San Antonio and Batabanó - Havana Province

Farmer	"I used to use"	"Now I use"
Maize:		
F/U/20	Karate 2-3 applications 0.07t/ha Duplex Formula	Much less.
F/C/23	No pesticides - because no plagues	Duplex formula
F/C/17	No pesticides - because no pests. Duplex formula as curative.	Pesticides. Duplex formula as curative.
F/C/20	Carbaril as preventative	Carbaril as curative
Banana:		
F/C/19	Carbofur to clean seed Pesticides Mineral oil	Nothing (has resistant varieties, Carbofur prohibited)

The main pest or disease affecting maize was the maize leaf borer (*Spodoptera frugiperda*) and then whitefly, and almost all farmers recalled these to have been the main pests in the 1980s. For banana, the most common pests and diseases were the weevil borer (*Cosmopolites sordidus*), the soil-borne pathogen *Fusarium* wilt or 'Panama' (*Fusarium oxysporum*), and the fungal black and yellow sigatokas (*Mycosphaerella fijiensis* and *M. musicola* respectively). Overall and even with the reduction in chemical controls, both the quantity and variety of pests and diseases had not increased substantially.

Ecological pest and disease control practices

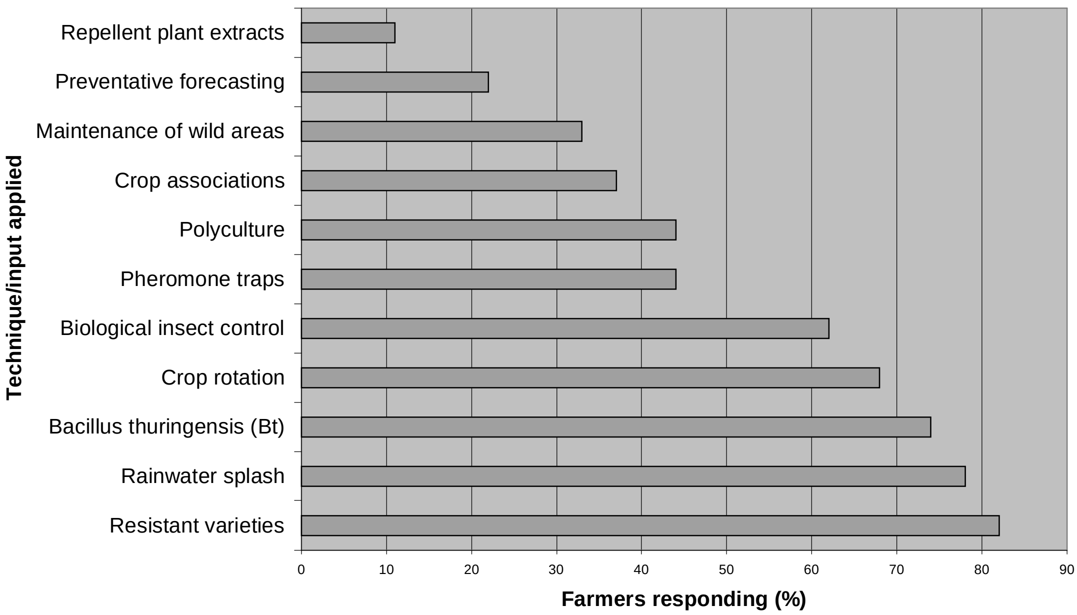
The most popular ecological technique to control pests and diseases, used by 82% of the farmers, was the selection of resistant crop varieties. This is shown in Figure 7.10. The next most popular (practised by 78% of farmers and more CCS than UBPC), was taking advantage of the rains to disrupt pest life cycles, particularly against maize leaf borer. The application of *Bacillus thuringiensis* (Bt) was also popular, used by 74% of farmers (and more by UBPCs). Dosages of Bt varied from 8t/ha to 4l/ha, at variable frequencies. For farmer F/U/24 "*We dissolve Bt in water and distribute it through fumigation pipes at 4 litres/ha.*". For banana, dosage was 14.9t/ha every 2 years. One farmer had been taught by Sanidad Vegetal to mix equal portions of Bt with Tamaron for tobacco. Crop rotations were practised by 68% of farmers, and biological insect control by

[146] Duplex Formula was a mixture of Parathion and Carbonil.

62%.[147] Farmer F/U/12 described how biocontrols were only applied as a curative, due to their expense. Most farmers were unable to identify any specific biological control agents for use in combating pests in maize or banana.

Other pest and disease control techniques identified were manual de-pesting and distributing maize straw around the base of other plants to prevent *Thrips palmi*. For banana, de-leafing and maintaining clean rows (removing leaves and weeds from field), and ensuring good soil preparation were identified. Although it was actually illegal to leave banana leaves in the fields, owing to the recognised risk of disease (F/U/8) several farmers had noted the benefits of using fallen matter as mulch either around the stems or between rows. Several farmers mentioned the importance of cleaning the banana 'seed', in order to kill the larvae of pests such as the weevil borer. Some farmers applied powdered soil or calcium to the leaf nodes of maize to get rid of leaf borer. One had integrated a series of practices for the control of pest and disease: "*The secret of high yields is to take care of the crop and the seed. I've just used more care and attention now. I have the highest cassava yields in the country - 20t/ha when the provincial average is 10t/ha. I apply Trichograma - it's easy to use as the plant health technician decides when to apply it - in the mornings, and one packet is sufficient. Hoeing is required now but it doesn't need more labour because we just changed strategy to hoe when the weeds are smaller - this is more efficient.*" (F/C/17).

Figure 7.10 Current use[a] of ecological techniques and inputs to control pests and diseases, for maize, banana and other crops, (% farmer response)



[a] As with the soil fertility techniques in Figure 7.9, farmers in Havana named both the techniques which they were practising and those which they were aware of.

In terms of limitations to these techniques and inputs, two thirds of farmers identified lack of input availability and knowledge/training. Within this, 90% of CCS farmers found knowledge to be the limitation, with only half the number of UBPC farmers supporting this. In particular, the absence of biopesticides to substitute for specific chemical equivalents and/or to combat specific pests was felt to be a limitation. Almost half the farmers, the majority from CCS co-operatives, lacked confidence in these techniques.

Related constraints identified by farmers included a lack of tradition to use such techniques, unfavourable climatic and resource conditions (for the use of bioinputs), the slow-action of these inputs, and a continued reliance on top-down support. Farmer F/U/6 noted that Bt required humidity

[147] When farmers were asked, in a different context, whether they applied biopesticides to their maize or banana crops, 43% (largely UBPCs) affirmed for maize, and 30% for banana.

whereas his region of Holguin was dry. Farmer F/C/22 commented that "*Beauvaria is cheaper but there's no culture for it and anyway I only have a small area. It's also difficult to apply. It's easier by plane*." Several farmers noted having poor results with bio-inputs. Other farmers were waiting for alternative inputs to be introduced by the State. As UBPC farmer F/U/14 pointed out "*We are not using bioinputs because it's up to the plant health technician and Enterprise to introduce them*." Similarly, CCS farmer F/C/12 pointed out that "*Our plant health technician never shows us biopesticides, and the nearest CREE in the province also supplies chemicals.*"

Desired pest and disease control strategies of farmers

Compared to soil fertility strategies, farmers were less dependent on chemical approaches for the continued control of pests and diseases: approximately one third of farmers (all of those on UBPCs) said that, even if chemical inputs were more readily available, they would not use them. Reasons they gave for this response related to costs, human and soil health, and effectiveness. They recognised that good management practices were sufficient to control pests: "*Biological control is better - it's more economical, more available, less toxic and it has been effective*." *Bacillus thuringiensis* was considered by several to be very effective. Several tolerated a low level of disease, particularly those who had some knowledge of pest ecology. Farmer F/U/8 described the presence of black sigatoka: "*It is a problem when there is more rainfall, but it never occurs in the dry. Even though it is always there in banana 'macho', the crop can still be cultivated with about 10% losses in the dry years. I just make sure that the rows are kept clean. Some of my plantations have stood here healthily for 9 years*." UBPC farmer F/U/7, who as an agronomist had worked with biocontrols in the early 1980s, gave his opinion: "*I don't apply any fumigant because of the cost of application is higher then the cost of damage by the pest. Of course one has to follow a course of treatment, but this is similar for the course in agrochemicals, and the chemical controls only the larvae and not the eggs of the pest. Overall, I see a transition from chemicals to natural and biological control.*"

Nevertheless, pesticides were still being used as a preventative or curative, and two-thirds of the farmers would use more chemical pest controls if they could, naming 16 different product types just for maize. Reasons for wanting to maintain or increase usage related to lack of knowledge on alternative possibilities, lack of confidence in their performance, and unwillingness to change to something perceived as being more difficult to handle. Some were simply satisfied with pesticides and did not feel a need to change, such as CCS farmer F/C/13 "*My chemicals work fine. I don't need to try anything else. When I want to buy any chemicals, I simply get authorisation from the CCS technician*." Others knew of no other way, or felt that "*Alternatives are for the long term*."; "*When there's a plague you have to use them*." For some crops there was felt to be no effective bioinput, and in some environmental conditions no choice, "*I have to use herbicide because the stoney soil means that I can't work it.*" (F/C/8). Several still lacked confidence and had heard of negative rumours about the use of biocontrols. Farmer F/C/20 felt that biological controls were just too complicated to use: "*I would have to apply them by backpack, walking over 12 rosas*[148]*, many times. It would be more expensive because I would have to pay for extra labour. If the product worked all right then it would be cheaper than chemicals, but there is a risk that it might not work so well. The campesinos don't have aerial sprayers, so it would take four back-pack sprayers 3 to 4 days to cover 10 rosas, and they recommend to repeat the application every week. Also, I would need to go to the CREE to collect the product and this is difficult because it's far away*".

Other farmers (though fewer than for soil fertility) would prefer an integrated approach involving the use of both chemical and ecological approaches. Farmer F/U/12 summed this up by saying "*We'll keep using bioinputs – they're here to stay. But we still need chemicals*." More recently, the quality and availability of chemical pesticides had increased (F/C/22). At the same time, and following the same pattern as with fertilisers, lower dosages would be applied, and less toxic chemicals would be used.

[148] Approximately 10 ha.

7.4.7 Water management techniques

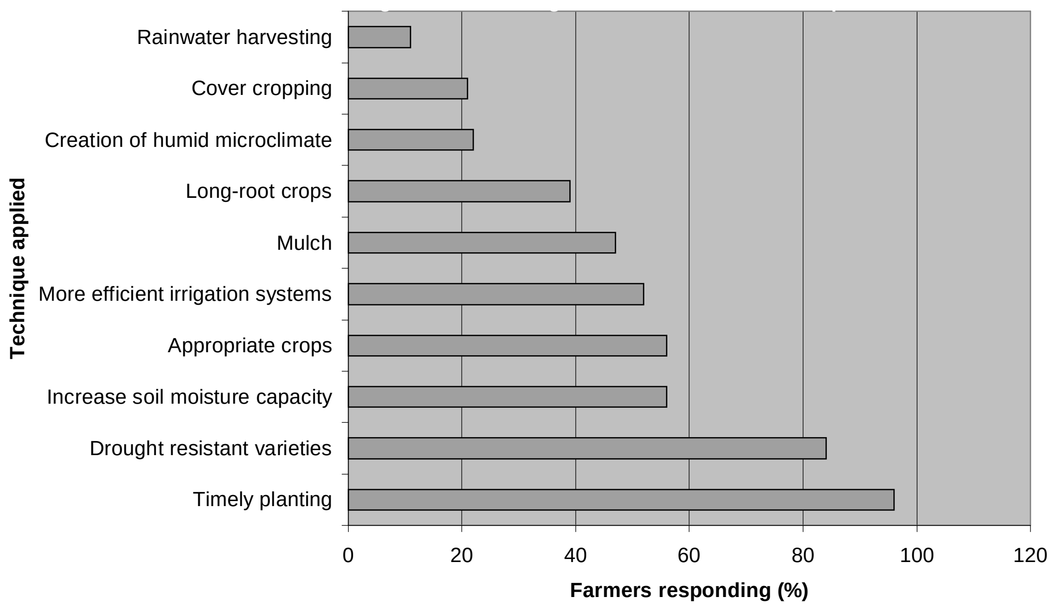
Current status of irrigation for maize and banana

Irrigation water was obtained from different sources across the country: from wells in Havana, rivers and small reservoirs in Cienfuegos, and wells, rivers, and reservoirs in Holguin. Although these sources were fairly reliable, those dependent on petrol-driven pumps were more vulnerable to fluctuations in water levels. Fifty eight percent of farmers used irrigation on their maize crop (mainly UBPC farmers), though largely only when necessary, during dry periods and/or at critical plant growth moments. Some called this 'survival irrigation'. For banana, 68% of farmers applied irrigation, and more intensively than for maize. The most traditional and common system was flood-irrigation by petrol-driven turbine. Sprinkler irrigation was also fairly common, and a few farmers had electric pumps.

'Ecological' water management practices

Almost all the farmers, 96%, were planting to coincide with rains and almost all had increased the efficiency of their irrigation schedules so as to use less petrol. This is shown in Figure 7.11. Several commented on the influence of planting time, annual rainfall variations and soil type. They described watering only when absolutely necessary on a localised basis, for maize this could be as little as twice a year in times of good rainfall, and every 5-6 months for banana. The great majority of farmers (84%), were using drought resistant varieties; those in Gibara-Holguin in particular had suffered from drought over the past four years. Fifty six percent were attempting to increase moisture capacity in their soil through the application of organic matter, and the same proportion were selecting more appropriate crops. Approximately half the farmers were applying mulch to maintain humidity. Mulching of banana consisted of both banana waste and maize straw.

Figure 7.11 Current use[a] of water management/conservation techniques for maize, banana and other crops (% farmer responses)



[a] As with soil fertility techniques in Figure 7.9, farmers in Havana named both the techniques which they were practising and those which they had heard about.

Farmer F/C/16 explained "*I cut the banana leaves and pile them in the middle of my rows, as mulch. This helps to maintain humidity and I don't have any problem with pests. I put the pile 4 metres away from the roots and they grow toward this for humidity, so I have a more efficient shallow rooting system*." There was almost no awareness of the potential of cover cropping or other methods of creating a humid microclimate and retaining moisture, or of rainwater harvesting and storage.

Through conversation it emerged that many more farmers had been attempting to adapt their irrigation strategies than the figures imply. Farmer F/C/1 from Gibara-Holguin told his story: "*At the crisis I had to invent. For my rice, a water expert from 'Cuba Café'*[149] *showed me how to adapt my tank for gravity irrigation. Family in the Canary Islands passed on the technique of creating a cascade 6m in height, with a reservoir, to irrigate the land below - it's an old technique from the beginning of the century, and now in the 1990s its being used more again.*" Another strategy to improve irrigation equipment was the maintenance of water channels: "*It's important to keep channels free from weeds. I always did this but now I've improved the efficiency - by hand is most effective, but it can also be done by tractor or oxen.*" (F/C/5).

The major factor limiting the use of more water management techniques was the availability of inputs, identified by half the farmers, and more so on the UBPCs. Specifically, modern and electric irrigation systems were available but only to farmers with access to dollars. Inputs were also seen in terms of quantity of irrigation machinery: farmer F/U/17 explained that up to this year he had only one turbine to serve 2,804ha. A close second issue was the lack of knowledge and training, cited by 42% of respondents. Issues of labour and trust, and even credit and cost, were not thought to be limiting.

Desired water management practices by farmers

All farmers would use more conventional irrigation systems if they had access to them, to increase production by prolonging the cropping season. In general, irrigation was considered extremely important by the farmers, because it was also a critical prerequisite for applying chemical fertilisers, as well as some biological controls. Changes to irrigation systems were the most common technological adaptation that farmers had made, when farmers were asked in another context if they had made any technology changes on their land.

The majority of farmers desired electric turbines, although a few would be content with gravity irrigation. They had seen those few farmers with electric pumps as being unaffected by the decrease in petrol availability, and perceived new systems as being more efficient. The favoured types of distribution system were localised drip irrigation - seen as being most efficient, and sprinkler - seen as being better for the soil. A small number of farmers had made sufficient profit in the 1990s to upgrade their irrigation systems, on both CCS and UBPC farms. The microjet *ferti-riego* system was popular. Only a very few farmers were interested in increasing alternative strategies. CCS farmer F/C/19 explained that he was not so affected by the reduction in irrigation because he had always maintained a high soil organic matter content.

7.4.8 Traction and machinery management

Changes in levels of farm traction and machinery

Quantities of farm machinery currently varied, from one pair of oxen for all farm activities (CCS farmer F/C/7) to 50 oxen and 3 tractors (UBPC F/U/9). Levels of mechanisation also ranged from an almost complete reliance on manual labour to a reliance on mechanisation for everything apart from the harvest. Equipment was frequently old and needed replacing: CCS farmer F/C/4's tractors dated from 1965, and many were old Soviet models.

Machinery use had changed since the start of the Special Period. Overall there was no clear picture of a drastic decline in machinery use, and in some cases there was even an increase in its

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[149] A State coffee corporation.

use, depending on the circumstance of the co-operative. Oxen supplemented rather than replaced machinery, and in Havana here was generally less oxen use. For some, lack of fuel to drive machinery, and old equipment, were reasons for not undertaking sufficient land preparation, yet others found the opposite to be the case, such as UBPC farmer F/U/14 "*Previously we prepared the land with less care and more compaction. Now we use a tractor to break the soil, and then oxen to make the furrows*."

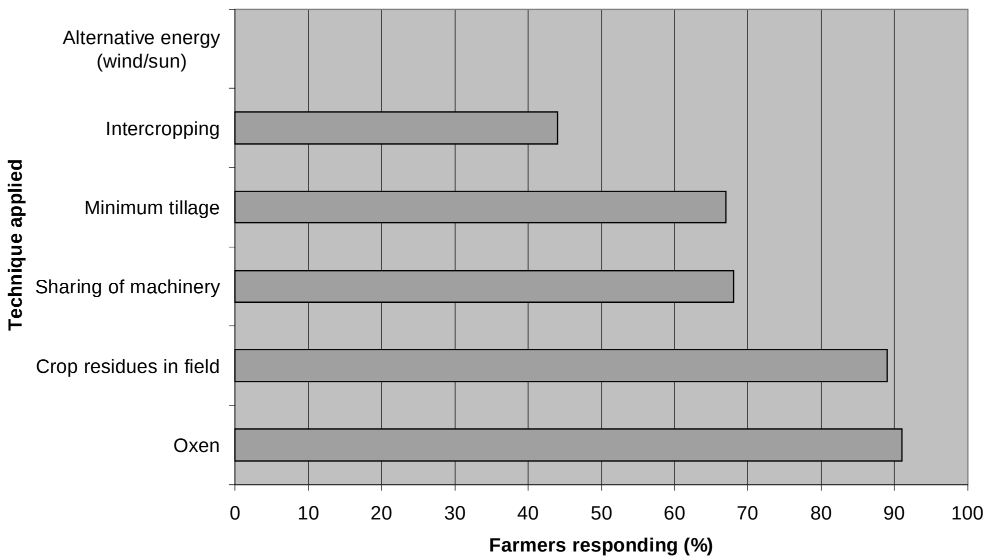
Planting was undertaken variously by tractor, manual means, and/or oxen. For cultivation activities (including the application of bioinputs), 55% of farmers had made changes compared to the previous decade, and again a mixture of traction and labour was used, oxen use had again risen, as had the use of lorries. Some tasks, such as weeding, were still carried out by hand. Harvesting had involved changes in traction for 53% of farmers, with more supplementing manual labour currently, as well as tractor and oxen, in all provinces. For the postharvest transport of produce, mainly tractors and lorries were used, and 31% of farmers had seen changes: again the supplementing use of oxen had increased on some farms, and decreased on others, and the use of lorries had generally increased.

Most changes had been made by UBPCs (who were comparing with their previous incarnation as State farms). The most marked division between CCSs and UBPCs was in Gibara-Holguin, where the CCSs were almost completely reliant on use of oxen and manual labour both in 1988 and 1999/00. Although types of traction and labour were fairly similar for maize and banana, the use of oxen, and their increased use, was more prevalent for banana production.

'Ecological' (energy efficient) traction techniques

In order to save on the use of farm machinery, almost all farmers, 91%, used oxen, and a similarly high number, 89%, left crop residues in the field rather than removing them. Almost 70% practised minimum tillage, more on UBPCs than on CCSs, and a similar number shared machinery with neighbours or other co-operatives. This figure would be higher if it included the number who hired machinery. None of the farmers were using alternative energy sources such as wind or solar power. This is shown in Figure 7.12.

Figure 7.12 Current use[a] of ecological (energy efficient) techniques to save on use of machinery, for maize, banana and other crops (% farmer responses)



[a] As with soil fertility techniques in Table 7.9, farmers in Havana named both the techniques which they were practising and those which they had heard about.

As well as the practices listed above, farmers were now taking far more care of their machinery and equipment, maintaining them better, making more efficient use of them in the field and only doing the necessary cultivation tasks. Equipment had also been modified for use by oxen rather than tractors.

The main factors limiting the use of such energy-efficient techniques were input availability and knowledge/training, confirmed by 56% and 50% of farmers respectively. Issues of labour, credit, cost and trust were not seen as limitations. Even with the promotion of oxen, several farmers had experienced problems with their usage and were cutting back. Theft (and subsequent cost of guards), mortality and problems in feeding the oxen were the most common problems. One CCS farmer in San-Antonio-Havana (F/C/18) explained that "*We actually use less oxen now because they get robbed*." Some preferred to hire equipment from the CCS or oxen from their neighbours. Those with adequate resources opted for mechanisation, such as CCS farmer F/C/2: "*In the 1980s I was using oxen but saw that they were too slow, and I decided that it would be better to invest in a tractor than continue hiring labourers*." Whilst farmer F/C/25 found a range of reasons "*I only use the same number of oxen as previously, because I am not prepared – not adapted, the youth are not trained in it, the soil is compacted so its not easy to work with oxen –they can only do light tillage*."

Desired level of traction by farmers

Approximately 70% of farmers confirmed that they would use more farm machinery if they had more access to petrol, whilst the rest would not. Only one farmer, from a UBPC, claimed to be in receipt of sufficient petrol to operate his farm machinery. They also wanted more machinery – the most desired were tractors, sowers and cultivators, all because of their capacity to make better and more uniform cultivation and this to increase yields. Only one farmer (F/U/8) preferred to use oxen, for the reason that "*They are better for the soil, do not require much more time, are more precise and attain a higher quality*."

7.4.9 Sales strategies

Relationship between markets and inputs

In the current situation, there was little correlation between the destination of the produce and the level of inputs used, unless producing for the State plan or Seed Enterprise when inputs were supplied. Generally, the same levels of inputs were applied for the whole crop, whatever its destination, including self-provisioning. Ripening agents, such as ethylene were applied to banana if it was to be sold ripe to tourist or some farmers' market destinations.

Product quality

Notwithstanding the absence of quality standards for the State ration, farmers were generally aware of the requirements of the different markets and most of them selected their crops to attain the best price where possible. For them, quality largely signified size and absence of disease. Acopio purchased maize by weight, so size was not considered so important, especially in Havana province. In Cumanayagua-Cienfuegos, farmers described how they would remove bad parts and would feed the worst cobs to livestock. The Seed Enterprise paid a better price than Acopio for maize but demanded a relatively good quality. Quality selection was more important in the case of banana, with Acopio paying 3 prices according to size, and the contracts between the CCSs and Acopio including basic quality standards. Still, one farmer (F/U/10) explained that "*We send the bad produce to Acopio and the good to the fairs*." None of the farmers sold maize or banana to Fruta Selecta or other tourism-related entities, one farmer (F/U/6) explaining "*They demanded a better quality and to achieve this I would have to invest in microjet irrigation equipment*."

Marketing strategies

Despite the growth in diversity of markets, many farmers did not avail themselves of these. Major reasons were of costs, ease, labour, transport, market demand, and marketing expertise. Several farmers preferred to sell all their produce to Acopio rather than send the surplus to the farmers' markets. UBPC farmer F/U/3 in Holguin explained "*There are too many middlemen and I would have to pay them all a salary and provide meals each day, and besides, the Acopio price is almost the same*." Yet Acopio prices were not always high for every crop; in Gibara-Holguin, Acopio prices had dropped by a third over the last 3 years because "*Acopio has an abundance of maize – their storehouse is full*." (F/C/2). Farmers did not always have the know-how to sell on the farmers' market. UBPC farmer F/U/12 from Cumanayagua-Cienfuegos explained that "*In Havana our burro banana sold quickly, but not the FHIA, because the people there are not accustomed to it - it's more watery*."

Yet other farmers took advantage of the farmers' markets, and those in Havana had lower taxes to encourage farmers to sell there, including farmer F/U/10 who travelled from Cienfuegos to sell maize. Neighbour farmer F/C/11 sold 30% of his maize crop to the Acopio plan and 30% to the farmers' market at currently 5 times the Acopio price because it was out of season, the remaining 40% going to self-provisioning and seed. Similarly for economic motives, CCS farmer F/C/16 from San Antonio-Havana explained "*The CCS president takes my banana to sell in Havana. I get four times the price of Acopio, and I don't have to go there myself*." Other market outlets were explained by UBPC farmer F/U/17 "*We don't have a State plan for banana, so what we produce we use for self-provisioning and send some to the Tobacco Enterprise, to which we are annexed. The rest we sell in the local Placitas, to schools, and to Acopio, and to private purchasers - these pay the best*."

7.5 FARMERS' PERCEPTIONS ON THE FUTURE

This analysis gave rise to a variety of perspectives on the potential of the petroleum-scarce agriculture they were practising. Many farmers believed that chemicals would always be necessary for agricultural production. Without them, they feared that yields would drop, that more work would be required, given existing resource and infrastructural conditions, and that risk would be increased. CCS farmer F/C/25 explained "*Without chemicals it would be impossible, because the land isn't like it was before - there is no fertility or irrigation. There are not the conditions to experiment because we have too many standards to meet such as for the Plan. The only solution is to go back to the 1970s. Even if double the price, this country can't produce without chemicals*." A few farmers pointed out that there would not be enough organic inputs (such as manure) to go round if everyone wanted to use them. Several supported the idea of having a mixture of practices. Many farmers felt that it would be possible to use an ecological approach for some crops, in some conditions, or at some point in time, UBPC farmer F/U/20 explained, "*We can produce without chemicals for some crops, such as maize or cabbage - it depends on the planting date. For other crops we can't, such as potato - there is no alternative to fungicide. Also banana needs pesticide and fertiliser*."

Within this myriad of viewpoints, there was no obvious correlation between attitude and location or farming type. For example, two CCS farmers in Gibara-Holguin, brother and sister who had lived all their lives in the same isolated region, displayed very different attitudes to farming approach. One was concerned that manure may contain weed seeds, the other preferred manure because chemicals required good rains to be fully effective. Similarly, the former preferred to use chemical pesticides, while the latter used the approach of equilibrium. Contrasting attitudes were also found emerging from the same co-operative, and even the same individual. During discussion on one UBPC in Cienfuegos, a farm worker and head of production both agreed that "*We can't produce without chemicals and maintain the same yields*." but the co-operative's president interjected to dispute this "*Yes we can, but it just needs more work*." CSS farmer F/C/3 in Holguin felt it was possible to produce good yields without the use of chemicals and to be ecological at least on a small scale, stating *"The best fertiliser is grass and manure – this gives good yields for about 4 harvests."* Yet on further questioning he admitted that he was hoping for petrol and chemicals to return.

Was it feasible to produce with a completely ecological approach? Banana producer F/U/8 was already producing thus, although he was not aware of this. Following his father's advice that *'The most important factors are attention and cleanliness"*, he was operating a more benign production system. A few farmers would choose ecological, and more thought it was possible for Cuba to be so if certain conditions were satisfied. Conditions included: availability of substitute inputs, fuel, economic incentives, knowledge and learning, and will. Farmer F/U/6 felt that "*It would be possible to grow organic FHIA bananas if we can find an alternative source of potassium, such as ash. I myself have already done this*." Soils were a concern for CCS farmer F/C/13, whereas for other farmers such as F/U/26: "*It there are no chemicals or fuel we would just need more animal traction. Bio-inputs can obtain good yields*." and *"In the future we would still need petrol but we've found alternatives and continued producing - by giving better attention*." (F/U/17). Demonstrations and incentives were also required. CCS administrator F/C/29 would promote ecological agriculture "*through earnings, and demonstrations*". Farmer F/U/5 was adamant that "*It is fundamental that the President [*of the co-operative*] has an interest in alternatives for them to be successful. All that is needed is the will*." Thus from the farmers' perspective, a wide range of changes would be required to strengthen any move toward a more ecological production system.

7.6 DISCUSSION OF RESULTS

A lot of issues have been thrown up from this analysis of farmers' perspectives of the impact of the crisis. This section addresses the key issues of the research questions: that is to determine the types of production system, farmers' coping strategies, and the factors which were conditioning these. Other issues are taken forward for a synthesised discussion in Chapter 11.

7.6.1 The 'reality' of the production system in the study areas in Cuba

The reduction of external inputs: a variegated impact

Agrochemical availability, and fuel, had decreased dramatically in the early 1990s, possibly by up to 80%, yet the reality was more complex. Farmers were initially buffered by reserves so the worst period in this respect was between 1995-1997 when these reserves had run dry. This coincided, for private farmers, with the restructuring of the State support system: the temporary disappearance of the SCC and the transfer of some support functions of ANAP to State Enterprises which were not geared up to meet the new conditions.

Some farmers were more hard hit than others. Farmers without a custom of high input use were using similar (low) levels of inputs as in the 1980s, and those who were more recently incorporated into modernisation programmes were using more than previously. For the rest, inputs were starting to become more available toward the end of the decade although they remained very low for many crops. Petrol availability remained low, generally meeting only 20-60% of needs, and farmers were sourcing much of this from the black market.

Farm yields dropped in the early 1990s, between 15-50% according to farmers. This decline is not fully reflected in national statistics due to the reclassification of types of co-operative and inclusion of some farm types which previously had not been included. Equally, performance comparisons of State and non-State sector are not always clear, because of this reclassification and the half-way status of some co-operatives, such as UBPCs. In addition, production patterns tended to follow a four-year cycle, as identified in Chapter 6. Bearing these factors in mind, farmers were in agreement that yields were now, at the end of the decade, increasing.

Other improvements were identified by farmers. Even though input prices were rising in the late 1990s, they were still cheaper than in the 1980s. The use of oxen and rotations had improved soils. The use of bio-inputs had risen. Acopio had increased its purchase prices (although no longer guaranteed purchase), and farming was becoming a popular profession. There had been a lot of learning.

Farmers' coping strategies

Agrochemicals were thinly spread. Sixty percent of farmers were using chemicals on maize, and 53% on banana. Chemical fertiliser was most widely used, by approximately 75% of farmers, and 43-65% were using pesticides. Chemical fertiliser applications ranged from 0.11 to 1 t/ha nitrogen based fertiliser, and pesticide dosages from 0.06 to 40l/ha. Farmers were familiar with a broad range of pesticides and herbicides.[150] Their varying attitudes toward agrochemical use fell within three broad categories:

i) 'Frugal': would not use many inputs anyway, responsive to crop and environment;
ii) 'Never enough': would always accept more to fight off insecurity, but would store much of it and also be frugal;
iii) 'Never': did not believe in using chemicals unless absolutely necessary - usually had some training or encounter with agro-ecology.

Notably, it was very rare to encounter a farmer with the same 'gung ho' attitude to input use which had prevailed in the years prior to the Special Period.

Although none of the farms studied had taken up ecological agriculture as a farming system, many husbandry practices were ecological, simply because farmers had to look for other means to maintain or increase production, and thus turned to on-farm and locally available natural resources. Farmers also learned to use agrochemicals more efficiently and with respect to climate and rainfall, and to apply them as a curative rather than a preventative, in more localised, 'smart' or precision, applications. Use of pesticides had decreased: although pest levels had risen. As a result some more traditional farmers were having to use more pesticides than before. Specifically in relation to input shortages, two broad approaches were adopted to cope with the situation:

i) Active/creative non-acceptance (opportunistic): finding alternative means to continue activities. This attitude required some knowledge of alternative possibilities coupled with a drive or need to implement them.
ii) Passive acceptance (fatalistic): accepting that nothing could be done without petrol. This attitude was supported at farm level, e.g. through the perceived importance of petrol as the key for in driving irrigation and hence fertilisation. This approach ignored the potential for alternatives.

Farmers who were most satisfied with their current situation showed a number of common characteristics: they had electric irrigation pumps; used organic matter; owned, or had easy access to, a tractor; used resistant varieties; and applied only a small amount of chemicals. Further, some interesting farmer innovations had emerged, including:

- leaving banana trunks to act as rainwater channels and promote spread of nutrients from the decaying plant,
- Bt being applied on large scale through fumigation pipes,
- many farmers using an integrated approach and obtaining high yields from this,
- hoeing when weeds were smaller as a more efficient method,
- planting maize to catch the rains that disrupt the leaf borer's life cycle,
- generally taking more care and attention with agricultural activities,
- adapting water diversion reservoirs,

[150] Contemporary scientific data from Cuba supported these findings. In a survey of 450 campesino farmers in 9 municipalities in the central provinces of Villa Clara, Sancti Spiritus and Cienfuegos, Rojas et al. (2000) found that 54.5% of farmers were using only chemical pesticide control for maize leaf borer, the most common being a mixture of Parathion and Carbonil. Biological controls, meanwhile, were being used by 3.3% of campesinos, mainly *B. thuringiensis.* Only 1.3% were using both types of control. Of the farmers who used chemicals, 50.3% did so because they felt them to be most effective, whilst 33.6% because they had access to them. For the use of biological controls, 76.4% used them because they were beneficial, with 12.5% using because of ease of access, and 11.1% because of cost. Chemical pesticides would be applied just once, and biological on a weekly basis.

- fine-tuning the production system, mainly through changing planting and harvesting dates (to avoid pest attack) and generally being more efficient,
- intercropping with drought-resistant crops to secure food during climate fluctuations.

In terms of farm management, farmers and co-operatives had adopted a mixture of coping strategies, which are classified below. Except for the final two, these strategies were supported by State programmes.

Rationalisation Farmers had learned to be more efficient and produce more with less - more control and fewer losses, more rational usage not only of inputs but also of labour, and more 'care taking'.

Taking responsibility. "*Previously everything was given to us, but now we have to look for it and invent it.*" (F/U/7). The strategy on UBPCs of linking man with the land provided more individual incentive, increasing production volumes and incomes.

Improving incentives. The co-operatives themselves had worked to provide better conditions and incentives for their members, and especially on UBPCs.

Self sufficiency. On the UBPCs, and for CCS contract workers, self-provisioning had developed and increased.

Intensification. Farmers had intensified to increase efficiency. In terms of timing this meant more harvests per year (more short-season crops), more intercropping and synchronised rotations. One farmer for example (F/C/2) had increased his maize yields from 4t/ha to 6t/ha through using improved varieties, increased mechanisation, the use of irrigation and more efficient planting schemes.

On-farm diversification and complexity. Farms expanded their range of produce, and increased on-farm connections and complexity, so that by-products from one activity could be used for another (e.g. mixed livestock-crop farming). This reduced external dependencies.

Market niches and specialities. By focusing on local human skills and agro-ecological potential, farmers captured State incentives for niche production such as out-of-season crops.

Business as usual. Several CCS farmers felt little impact to their farming systems and had mad few changes. These were traditional, more isolated farmers.

Working with nature. Increased awareness of natural conditions and working with them became an alternative management strategy, characterised by a strive for biological equilibrium and found on specific farm *fincas* run by specific individuals.

Because of the lack of inputs, land use patterns had changed. The lack of irrigation limited possibilities for using land for certain crops. Crops were also changing – with a focus on less input-hungry crops, and those which were bulkier (roots and tubers), as these would fulfil the tonnage-based, State production plans. The State prioritisation of certain crops, the incidence of robberies, and the rise of urban agriculture which popularised specific foodstuffs, also affected the choice of crops planted. Fallow land was decreasing with the pressure to intensify. Farm sizes had decreased, regional diversity increased, legume production had increased as a national priority for increased self-sufficiency rather than for improved soil fertility, and livestock numbers had decreased due to the lack of fodder (though there was consumer and State demand to increase livestock numbers).

7.6.2 Endogenous and exogenous factors affecting farmers' coping strategies

Farm-level capacity

On the one hand, farm level capacity was good. Land was not a shortage, and holding in perpetuity (rather than permanent ownership) did not appear to limit longer-term investment strategies as long as the farmers held control. In fact farmers displayed a drive to increase on-farm resilience and sufficiency, and autonomy from the State was increasing. Labour was also relatively plentiful, and incomes and incentives were generally good. The co-operatives themselves contained a substantial number of educated and trained farmers, in different specialities, as well as farmers with other professional experience. CCS farms had a high level of traditional knowledge, passed down through the generations. Internal technical staff considerably strengthened the capacity of the co-operatives. These staff appeared to be open to the use of ecological strategies.

On the other hand, physical assets were in poor condition, and this, combined with the risk factor, inhibited farmers from experimenting. The focus on input substitution and on upgrading current technologies and equipment led away from looking to alternatives such as, in the case of water management, rainwater harvesting. Farmers had low levels of awareness about alternative energy, water conservation techniques, quality issues, biological control agents and marketing techniques. Knowledge levels varied between types of co-operative[151]. In terms of learning, farmers had some awareness about negative impacts of agrochemicals and had seen that different components of their production systems would perform well under ecological approaches even if they did not put a name to it.[152] There was a strong overall view that, as long as there were no external disruptions such as pest outbreaks, then ecological approaches, if available, were feasible. Knowledge levels and learning had increased, through ongoing practical learning as well as introduction of new techniques and technologies and of training courses. Some shifts in attitude were noted – both amongst the management and workers, and especially on UBPCs. However, the extent to which on-farm traditional knowledge was used and experimented with varied considerably, and particularly because it was held amongst the older workforce whereas technical staff tended to be young. UBPCs had less traditional or local knowledge, partly due to a higher turnover of migrant workers.

Farmers' aspirations were mixed, with most wanting to use more agrochemicals as and when available albeit in an integrated approach. Some farmers' experiences had led to a perception that a decrease in use of agrochemicals would imply: an increase in pests and diseases, a decrease in yields, a drop in quality - being associated with product size, greater risk, too much work under current resource conditions. The perception of controlling nature was present; applying a mixture of agrochemicals was referred to as 'throwing a bomb' (*tirar una bomba*), and pesticides had brand names associated with 'aggression', 'fighting' and 'trustworthiness'. The ability to apply external inputs gave the farmer more control.

In this context, and similar to the results of the previous chapter, the concept of low-input agriculture was seen in a negative perspective, bought about by a lack of resources. It was termed 'low-income' agriculture, to denote that farmers did not have the resources to purchase agrochemical inputs. Chemical inputs were associated with more affluent times and thus they were still desirable. For farmers, chemical inputs were more trustworthy, applicable in any situation, and easier and more rapid to apply and be effective. To the farmers, ecological systems were less resilient, and this matched their perception of deficiency. For example, farmers felt that such soils were less able to cope under what they felt were deficient management regimes. Only a few farmers expressed need to encourage, and wait for, ecological equilibrium to return.

As in the previous chapter, many divergent opinions were evident in farmers' perspectives on the efficacy and relevance of industrialised compared to ecological husbandry practices in the Special Period, again highlighting the heterogeneity of each farmer's situation and the pragmatism of the farmers' approaches. A selection of these opinions, and possible issues at stake, are provided in Appendix VI. Issues at stake included farm-level capacity and knowledge (such as interpretations of yield drops during the transition period and agro-ecological changes after the industrialised period), approaches of optimisation or maximisation, and perceptions on product quality.

[151] In a survey of 150 co-operatives - CCS, CPA, UBPC and Mambisa Division (state) types - within Holguin Province, Lopéz et al. (2000) found that it was the CCS and UBPC farmers who applied the least IPM and who had the least knowledge about it.

[152] Similarly, contemporary research by Lopéz et al. (2000) in Holguin Province identified two farmer groups using IPM techniques: those who applied IPM as a consequence of formal learning on the subject, and those who applied IPM as a consequence of empirical evidence of success of at least one of the measures involved.

Driving forces of the crisis

When Cuban farmers were asked to identify the main limiting factor to production, their initial response was generally: "*Falta petroleo*!" Lack of petrol - for irrigation and machinery - was perceived as critical and was far more of a constraint on production than the scarcity of agrochemical inputs. Substitutes for the latter could be found, yet petrol could not, apparently, be replaced and was needed for daily activities such as preparing the land, improving drainage to prevent surface run-off and soil erosion, and for weeding activities. On the co-operatives, daily and weekly planning and scheduling meetings were dominated by the careful prioritising of the small petroleum reserves to hand. Although the seasonal cropping calendars drawn by the farmers continued to feature the application of modest amounts of chemical fertiliser and pesticide, machinery and irrigation were virtually absent from these calendars. Much land preparation was by oxen, and chemicals applied manually. In turn, petrol shortages influenced varietal selection: drought resistance was seen as a petrol-saving characteristic as it reduced the need for operating irrigation systems. There was a strong sense that petroleum drives production, and any alternative strategies would have to directly address the basic concerns of water and traction if they were to be seen as viable long-term solutions.

At the same time, the crisis, coupled with the sanctions and political isolation, had instilled a need for national independence amongst Cubans. In this sense, domestically-produced farm inputs such as bio-pesticides were preferred not only because they were cheaper and better, but could also be produced in Cuba. The same philosophy held at the farm level, where many farmers aimed to produce their own inputs in order to increase on-farm security.

Institutional influences

Grappling with the problem of increasing production on large land holdings, and as well as reducing farm size, the State had come up with two innovative mechanisms: first, the application of biocontrols, which were extended, widespread, using the traditional transfer-of-technology, prescriptive approach;[153] and second, by developing and promoting the practice of 'linking man to the land', which encouraged human-scale care and attention for broad-scale agriculture. While the extent of success of the former was unclear,[154] the latter appeared to be hugely successful as an on-farm incentive.

Extension services promoted a raft of production technologies in the petroleum-scarce situation, which were varying shades of industrialised and ecological. Although the institutional support provided by State enterprises was relatively strong (compared to other countries), the way that co-operatives were annexed to specific, specialised enterprises restricted the type and choice of support received. Campesino farmers in particular received less support from the formal sector in terms of on-farm services and physical resources. With limited transport, these farmers could not meet all their needs by themselves. In terms of training, and with a growing awareness amongst research institutions that private sector farmers required demonstrations and convincing, more applied and relevant research and extension topics were attracting more farmers to meetings, especially those from the CCS co-operatives. Farmers felt that the extension services had improved, both in terms of their knowledge and effectiveness of communication / availability of information, although State training tended to target the executive members of co-operatives, and training focused on technologies, rather than techniques and principles, and omitted crucial issues of water conservation, processing or marketing.

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[153] Similarly, the State military farms, some of the best-performing in the country (although not investigated in this field work) were managed through a highly disciplined top-down approach which very successfully utilised biological controls.

[154] Leyva (1999) notes that although there are 25 biofertilisers under research study, only two (*Rhizobium* and mycorrhiza) are used in practice. Similarly only 4-5 green manures out of a total of 32 are practically used. Reasons for this include a lack of custom and ease, and the as yet unknown real costs of their use, which have not yet been properly evaluated.

Given that the majority of farmers had expressed interest to increase their usage of ecological practices, certain external factors inhibited this ability. These included the rising costs and decreasing availability of manure, sporadic availability of bio-pesticides, insufficient promotion by the State, robberies (of oxen), requirements of the State plans, and general lack of transport to access off-farm inputs (and equally for institutional support to reach the farmers). Farmers identified a number of specific factors which would enable their increased use of these practices:

- increased attention, care, and cleanliness to field management,
- more alternative sources of soil fertility inputs in the medium term,
- more alternative ways to overcome pest problems, in the medium term,
- increased learning for the campesino and the State farms,
- increased earnings as incentivisation,
- political will of the co-operatives.

7.7 CONCLUSIONS

7.7.1 Comparative differences

Although the analysis of farmers' perspectives has done so from a generalised view, the role of central planning in Cuban agriculture created a framework but did not lead to homogeneity, and this is important in terms of choosing – or not choosing – institutional co-ordination styles. There were significant regional differences, and degrees of individual freedom and opportunities for enactment of market and social mechanisms, between co-operative types and between crops. In fact, each co-operative was very different, and within the CCSs each farm member differed in terms of farming strategy, level of income and so on. Some key variables are discussed below.

Regional differences

In Havana, nearer to the capital, farmers were more market-oriented and production was more intensive. Thus organic input prices were at a premium, and farmers were also more concerned with accessing pesticides in order to maximise their efficiency and market presentation. In the other two provinces, traditions and customs played relatively stronger influences on farming practices, such the higher use of oxen. Further, unskilled migrant labour tended to gravitate to Havana, and this showed amongst UBPC co-operatives where those in Holguin contained more mature, local and experienced workers and management and as a consequence held more local and traditional knowledge and were more committed to longer-term sustainable strategies.

Differences between CCS and UBPC co-operatives

CCS farmers were more autonomous and at the same time received less State support than the UBPCs. They tended to interact in the free market and the black market more easily. Generally, they were also wealthier and more industrialised than the UBPCs, although patterns in Holguin were slightly different where the UBPCs were more organised and the CCS farmers poorer and therefore using cheaper, ecological inputs. Table 7.6 compares the differences in attitudes and activities of CCS and UBPC co-operatives.

Compared with the CPAs in Havana in previous study, there was overall less farmer knowledge on, and practice of, ecological techniques. This was partly owing to the presence of the Agro-Ecological Lighthouse *fincas* on the CPA farms, and also to the generally higher levels of that type of knowledge in Havana Province.

Table 7.6 Comparison of CCS and UBPC co-operatives

Aspect	CCS perspectives and practices	UBPC perspectives and practices
General use of inputs	Use more agrochemical inputs – due to having more reserves in the early 1990s and being more able to afford black market prices.	Use more ecological inputs, more intercropping and minimum tillage.
Soil fertility	Distrustful of ecological soil fertility practices. Use more manure, no bio-fertilisers.	Fertilisers a limiting factor – manure too expensive. Use more bio-fertilisers.
Pest control	Pesticides a limiting factor – too expensive. Use more rain control of pests.	Use more Bt and biological controls. Would not use more pesticides even if available.
Seeds	Seed quality a limiting factor. Use of more traditional varieties and self-saving.	Seed easily obtained from the State Enterprise
Irrigation	Able to purchase modern equipment, and electric pumps.	Greater lack of irrigation equipment.
Farm traction	Higher use of oxen.	Increased use of tractors as well as oxen
Fuel	Fuel prices expensive (black market?)	Fuel prices average
To increase ecological production	Need better market prices	Need greater control and management training
Technical assistance	CCSs marginalised in the late 1990s due to the dissolution of the SCC and the changing role of ANAP.	Receiving more technical assistance especially on-farm.
Knowledge and experience	Farmers had worked for longer on the same co-operative, had more agricultural experience, were more educated and held more traditional knowledge.	Especially in Havana Province, co-operative members were younger and less experienced.
Agricultural wages	Variable. In Holguin, a typical CCS farmer earning $40/month. But the richest farmers found in this type.	Variable. In Holguin, workers taking home up to $16.3 per week plus an additional $150/month. (But if no profit-share or linking man to the land, earnings could be as low as $11/month)
Impact of the Special Period	Experienced a more negative impact and especially on farm economy, although market prices had increased overall.	Experienced a more positive impact, because conditions vastly improved compared to when they were operating as State farms.

7.7.2 The significance of continued agrochemical use

Out of the petroleum-scarce situation, diverse strategies were being adopted to improve efficiency. These were emerging from the necessities imposed upon farmers directly by the crisis or through policy, or from the necessities imposed upon agricultural institutions.

Throughout the decade, the continued, albeit lessened presence of agrochemicals played a crucial role in maintaining production throughout the 1990s, partly in terms of their physical contribution to yields where there was a lack of other inputs or knowledge-based techniques, but, perhaps more importantly, in terms of maintaining a degree of moral cohesion in the agricultural sector. Their presence indicated that the situation had not completely fallen apart and was going to get better, and this helped to maintain a positive spirit. Farmers still managed to build more productive and resilient systems in the face of the crisis, and learned about more sustainable management of inputs.

These changes provide evidence of a huge investment in learning that has been, and is still being, made within Cuban agriculture. Although this may not be showing huge productivity results in the short term, its rewards are likely to be seen longer term. In this sense, although the increase in agrochemical availability at the end of the decade might imply that Cuba is not heading toward an ecological agricultural system, the long term impacts of the learning it has experienced are likely to at least temper future usage and the future scale of use of alternative strategies. In any event, Cuban farmers were certainly at a transitional stage of input substitution, and were more likely to move forward than backward. Even with their increasing autonomy, much would continue to depend on institutional influences, and this is discussed in the following chapter.

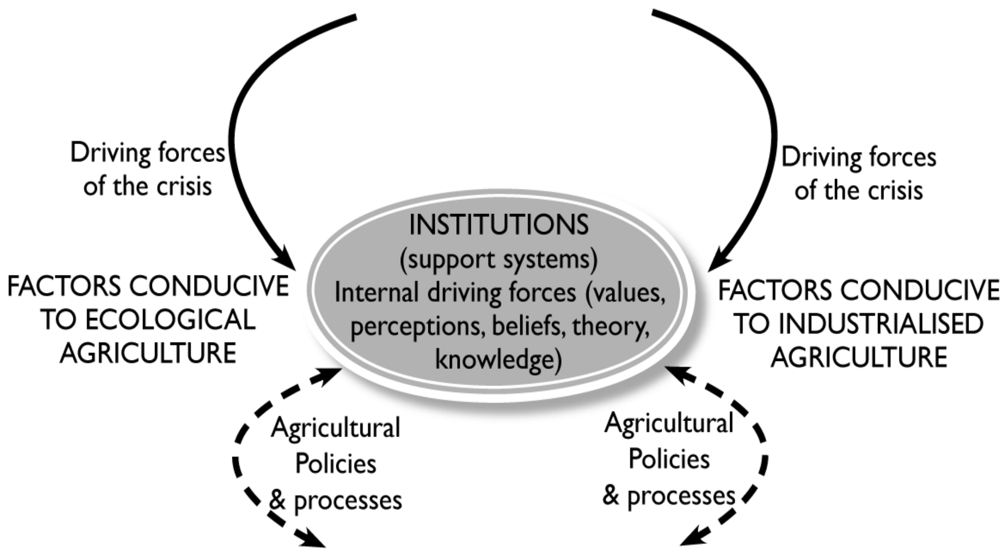
8 DETERMINANTS OF FARMING STRATEGIES ACROSS 3 PROVINCES: THE INSTITUTIONAL PERSPECTIVE

8.1 INTRODUCTION: INSTITUTIONAL POLICIES AND PERSPECTIVES

8.1.1 The institutional component of the rural livelihoods framework

Following on from Chapter 7 which discussed the impact of the crisis from the farmers' perspective, this chapter follows on by taking a similar analysis from the perspective of institutional actors, in terms of their internal, endogenous context and resultant coping strategies in terms of policies and processes. Figure 8.1 shows the institutional focus of this study, taken from the analytical livelihoods framework. These actors were all working for the State, either closely in ministerial entities, or at a slight distance in research and higher education institutes (of which 15 were visited), or, for the case of ANAP (National Association of Small Farmers), a State-aligned entity with a mandate to represent small farmers. Ministries comprised MINAG, but also CITMA (Ministry of Science, Technology and Environment), MES (Ministry of Higher Education) and the Ministry of Public Health. Within these, departments of policy, research, extension and other support, production, and marketing were targeted. These included groups working on soils and plant health, plant breeding, mechanisation and irrigation, as well as agricultural service and input provision enterprises and CREEs. Between October 1999 and December 2000, a total of 125 such actors were interviewed in Havana, Cienfuegos and Holguin provinces, at national, provincial and municipal level offices. During the fieldwork information was obtained in three different ways: through direct interviews and conversations, through attending conferences and similar events, and through obtaining papers from authors who had not had the opportunity to publish their work.

Figure 8.1 Scheme of institutional component of the livelihoods model, showing impacts and assets, and resulting coping policies and processes



8.1.2 The centralised institutional nature pre-1989

Chapter 6 provided an overview of the organisational arrangements of the agriculturally-related institutions, which are located under the Ministry of Agriculture (MINAG), the Ministry of Science, Technology and the Environment (CITMA) and the Ministry of Higher Education (MES). The key starting point for change in the 1990s, in terms of institutional resources and agency, was that "*Almost all institutes were focused in Havana, so interaction was all vertical, each institute with its own approach and duplicating work*." (KI/10). MINAG, which comprised its own provincial and municipal delegations, the commodity/support enterprises, the departments of soils and plant health, the CREEs, and Acopio (the State food marketing entity), supported the entire agricultural sector on issues of resources,[155] strategies, legalities, economics, and technical assistance.[156]

8.2 INSTITUTIONAL RESOURCES, ASSETS AND AGENCY

8.2.1 Isolation and reorientation of physical and human (information) resources

All research institutes experienced a critical reduction in resources during the 1990s, which affected their capacity to undertake research and to publish and exchange information and collaborate. Some crucial research programmes were dropped through lack of resources, such as on desertification, and others were refocused, such as a livestock programme which switched from "*researching extensive ranching systems using fertilisers and pesticides, to organic techniques and self-consumption*." (MA/R/24). The national research centres, based in Havana, limited their field work to Havana province, because of transport limitations. Institutional genebanks lost a lot of planting materials, because of lack of petrol to reproduce *in vivo*, and also because of the *Thrips palmi* outbreak in the mid-1990s which too three years to control (MA/R/18).

This severely restricted the domestic exchange of research results and developments; one of the few mechanisms surviving through the period were the multi-level Forums of Science and Technology (described in Chapter 5, these official meetings at provincial and national levels, of a wide range of agricultural stakeholders, allowed for research and production results to be presented, and prizes awarded), to which producers and CREEs attended, amongst others. The lack of recent material meant that researchers were relying on old literature and outdated concepts; in the early 1990s, material that was being published domestically was oriented to high-input, high-resource approaches. One research centre's library contained 37 Cuban scientific journals, only 13 of which had volumes dated after 1992-93 and only four of these had almost continuous series. Socio-cultural literature was lacking from both post- and pre-1989.[157] Foreign journals also petered out after 1990. A virologist working on methods to control the banana mosaic virus admitted that she had no idea of recent international developments in her field (MA/R/28). Only scientists with good foreign contacts had maintained the ability to publish abroad (MA/R/27).

Some positive, albeit stoical, perspectives were voiced. Researchers from one institute claimed to have been able to borrow resources from others and so had been little affected.[158] Another researcher (MA/R/17) felt that for their soil fertility work, "*the ensuing changes changed the monotony – it was challenging to have to invent and find alternatives, to look at more practical things and be less theoretical and abstract*." According to this researcher, neither had retraining been required, because "*we were the ones producing the innovations – so we trained others*." Conditions were slowly improving and people learned to adapt. Several institutes was currently

[155] Excluding credit which was obtained from the bank.

[156] For the private farmers, training and political matters rested more with ANAP.

[157] Under the library heading 'sociology' was a list of Marxist-Leninist tomes. Little attention had been paid to the social aspects of production; this was not felt by the State to be necessary in such a socialist country (KI/10). Rural social studies were in fact undertaken but within university faculties of geography and sociology rather than by agricultural research institutes.

[158] Yet during several attempts to visit this particular research institute, the author encountered closures due to flooding of the buildings, serious transport problems, and poor communication facilities.

applying new methodology and techniques from abroad including GIS, and one had contributed to the publication of four Cuban journals since 1997.

Whereas previously, the research sector had interchanged primarily with socialist countries. Now each head of department was charged with strategising for the development of contacts and network involvement elsewhere, including, for example, the European-based Alpha network, and European and Latin American countries in general. Provincial research and education centres were also strengthening their domestic networks.

8.2.2 Drive for increased financial self-reliance

After the crisis, the State was unable to continue with its complete subsidisation of the agricultural sector. At 2000, its national subsidy totalled $125 million, and the rest had to be self-generated, but with the stipulation that unprofitable operations were to be maintained (MA/38). In particular, and since 1997, the agricultural sector had to be self-sufficient for all its dollar requirements, which for MINAG meant charging private farmers for inputs at 50% of their real costs and making up the other 50% itself (MA/20). MINAG offices used some of their land for self-provisioning, and some were trying to make more of this resource: one municipal delegation in Havana Province was experimenting with grape production with the intention of selling to hotels (to access dollars) and to the local community.

Similarly for research institutes, whereas previously they had received annual incomes from the State, they were now required to become financially semi-independent, including paying certain overheads such as electricity in dollars,[159] and more competitive, having to bid on research themes issued by the Ministries. In terms of sales of their products, the institutes required dollars for the equipment or inputs they were generating for farmers, in order that they pay their own bills and be able to purchase spare parts and raw materials. Therefore MINAG and other enterprises would purchase these products in dollars from the research institutes and sell on to the farmers in pesos. Agricultural equipment, for example, could cost from $100 for a simple ox plough to $1,750 for a sugar multi-plough. The CREEs sold directly to farmers in pesos. Currently, all universities were setting up ‘requested investigation services’ (*servicios de investigación pedido*) by which their advice could be obtained for a small fee – the fee covering only about 10% of their real costs. Private farmers (including UBPCs) had to pay for researchers’ extension services, and MINAG paid for services to State farms.

Box 8.1 Development of commercial soil inputs in the research sector

A soil mycorrhizal input, Ecomic, had been developed by one research institute. Trials in Havana showed this to improve maize yields, achieving 3.31t/ha (though this data was not compared to a control). Its widespread use was, however, limited by a low availability of substrate and other challenges (MES/R/4), and it was therefore seen as playing only a support role to production.

Another institute had registered inoculants of VAM[160] fungus under a brand name 'Micofert', recommending it for intensive nursery and seedbed use in agriculture and forestry. This inoculant came in 2 forms: Micofert Certificado (with 90-100% purity), and Micofert Agricola (with 85% purity). In terms of performance, 1 million inoculated plants were shown to save $7,000 in nursery activities (Garcia Ramirez, 1999), and it could double the germination rate of micro-plants. Development of the product had been gradual over the decade. As early as 1993 it was being used at an experimental level, and after 46 experiments the institute then formed, in 1997, Production and Commercialisation Departments to take charge of its development. Currently, the product was being exported to Spain, and a production plant had been set up in Venezuela.

Other attempts at income generation were variable. One institute had a small farm equipment workshop, but financial limitations to its purchase and processing of raw materials meant that it was

[159] Electricity was costing one provincial institute $400/month (where a researcher’s salary was $15/month). Because of this, the institute’s accountant attempted to charge the author $50 to interview each of its staff. With little experience of negotiation, however, all fees were easily waived.

[160] Vesicular Arbuscular Mycorrhiza is a combination of beneficial root-infecting fungus and the plant root.

not yet profitable, notwithstanding the high farmer demand for its products. Box 8.1 provides two examples of experiences concerning the research and production of fertiliser products. On top of this, awareness was growing of the demand for quality produce from the domestic and international tourist market, and this market was becoming increasingly attractive as institutions looked around for ways to generate dollar incomes. International project collaboration was another source of dollars. ANAP, for example, had to curtail its free international training programmes for developing-country farmers and instead reorient toward this source of funds.

8.2.3 Internal organisational restructuring and change

A systematic review of changes in institutional mandates was not possible, given the dearth of published documentation in the way of annual reports. This dearth was partly due to the resource-scarce situation, but also because of the general lack of performance assessment.

Nevertheless, the Special Period had warranted significant internal restructuring. Processes of both decentralisation and expansion occurred. Decentralisation of MINAG had, according to SEDAGRI (1998), lead to "*better control, responsibility, order and discipline*." CITMA was formed out of the old Cuban Academy of Sciences. Certain communication channels also improved; after 1992, MINAG met with all research institutes on a weekly basis, to identify new ways of increasing food production.[161] Some entities had merged, such as the Soils Institute with the Soils Department of MINAG, and the Sector Campesino Co-operativa (SCC) with the agricultural enterprises. One university, for example, described how it had first gained an agricultural department as the regional, centralised agricultural institute had lack sufficient resources to cope. After some success, the university was planning to expand this department to serve other regions. Prior to this expansion, however, it had to ensure that it was not competing with other agricultural centres, "*The main thing is not to create a situation of unemployment in the neighbouring province*." Box 8.2 describes the institutional changes experienced in another institute, this time around research themes and approaches, and highlights the unaided steps that institutes had to take to move from pure to applied research and development. Because internal changes were largely instigated by external pressures, so they are further discussed in the following section on externalities.

Box 8.2 How changes in research approach affect internal structures

One institute under the Ministry of Science and Technology had been investigating mycorrhiza since 1978. However, this was pure research, and the crisis exposed the small degree of understanding of actual usage of mycorrhiza. 1992 brought a number of specific changes: individual responsibility for a thematic area, applied research including field experiments, and changes in staff and projects. These changes entailed pure scientists, such as biologists, having to learn about agronomy and other applied sciences. Scientists had received no training on how to work with farmers, and field trials were undertaken on a large scale in conjunction with State Enterprises, in which farmers were given instructions on what to do. Researchers had learned through this new approach, for example that the most natural mycorrhizal strains were to be found on campesino farms rather than State farms. Even with their little practical knowledge, they were also charged with providing training on the use of mycorrhiza.

8.2.4 Staff training, incentives and mobility

MINAG support staff were noticeably older than those in the research institutes. Almost all were children of farmers, had higher-level qualifications, and substantial experience in the agricultural sector. Staffing levels were high; one municipal delegation of MINAG employed 500 staff (this included the municipal Acopio, CREE, and the enterprises).

As with the co-operative structures described previously, research institutes also provided some degree of mobility, both horizontally and vertically, which was noticeable in the number of younger

[161] This process led MINAG to recognise that "more serious than the scarcity of resources is the loss of time, money and skill resulting from a lack of inter-institutional integration." (Mato et al., 1999).

people revolved into higher management levels, and the ex-management subsequently serving in much lower-ranked positions. One management level staff commented, "*I think it's an error to allow older people to stay in positions of power. Even Fidel has a substitute - everyone has it, to continue the Revolution*."[162] (MA/R/16). Currently a researcher, he had previously been director of his institute, and president of the national Science and Technology Forum. Geographic mobility – such as for conference participation - was limited, owing not only to fuel restrictions but also to difficulties in accommodation and food arrangements away from home.

Especially in the research sector, groups had been forced to learn hands-on during the Special Period. The obvious examples are of the urban agriculture sector and the CREEs, but also for other groups, and Box 8.2 provides and example of one group's experience. Other training was more planned. For example, plant health specialists of INISAV had to undergo retraining on ecological input use (MA/R/29). MINAG staff remarked that there was currently more stimulus for internal training, and they received training on a monthly basis, yet several still felt that their role was of the trainer, and that "*it would be difficult to retrain the researchers, because time is required to change mentalities*." (MA/33). MINAG staff were themselves receiving training in participatory approaches and extension, provided by universities and research centres. Notwithstanding the continued presence of top-down approaches, a new national Agricultural Extension System was instigating the adoption of new university curricula whereby researchers would receive training as extensionists, and mid-level technicians would be dedicated full time to extension work. The focus here was on promoting integrated production techniques. Some researchers were able to receive valuable extension training abroad.

Salaries in the research centres remained low. In one provincial research station, for example, a chauffeur would receive $7.5/month salary, researchers between $12.5-$15 with a maximum of $25 depending on their scale, and the director would receive approximately $0.75 extra. Thus there was little financial incentive to aim for higher level management and all the administration it involved, although other factors, such as prestige, contacts, travel and other opportunities somewhat compensated for this.

For the researcher, hours were long and they were obliged to carry out self-sufficiency tasks at their institutes. Yet these jobs carried status and were interesting, and held the opportunity for further study to increase their qualifications. The research community was also very competitive, and this was (historically) encouraged through inter- and intra- institutional competitions with grand prizes, as one researcher described, "*On the 13th and 14th of July is our institute's Forum of Science and Technology, with small prizes. Then the work goes to the national Forum where the prizes are cars, houses or televisions.*"[163] (MA/R/21). Criteria for successful research were narrow and focused on quantitative agronomic factors – primarily yield - with little longer-term socio-economic concern. Amongst the CREEs also was competition for best production levels, and for production of the more complicated products.

8.2.5 Research definitions of sustainability

Definitions of sustainability, and therefore projects upon which these were based, varied considerably within the research sector, but almost all showed compatibility with international definitions and an advanced understanding of the concepts involved. Further, they generally took consideration of economic feasibility, a factor which they had not had to consider pre-1989. Caballero Grande (1998, p.1) defined sustainability as: "*the whole process whose multiplication in time and space is guaranteed from the point of view of technical production, economics, social and environmental.*" More succinctly, soils researcher (MES/R/4) defined the concept of sustainability in Cuba as being "*the melting point between external theory and the actual situation or problem.*"

Terminology could also misleading. Castro et al. (2000), in a paper relating to trials of different sorghum varieties, referred to '*low input conditions*' which did not involve the use of agrochemicals

[162] Although from what the author saw, directorship posts were held by the relatively older staff members.
[163] During the course of this field work, at least one Cuban asked the author about the type of prize she would receive for producing a good thesis.

at all. Similarly, in an institutional paper on IPM of sweetpotato by López et al. (2000), the management measures discussed did not include the use of any agrochemical inputs but focused on the prescriptive application of a range of advanced biological controls (including a timely dosage of predator ants at 100ants/ha).

8.2.6 Institutional perceptions on the impact of the Special Period on agriculture

For several researchers, Cuba's agrarian problems had started not with the crisis but with the over-industrialisation in the 1980s. Similarly for MINAG departments, the sanctions of the 1980s brought on delays in the arrival of imported inputs. Therefore, whilst some changes had happened because of the crisis, such as the use of oxen, others had emerged prior to this in order to improve production and lessen import dependence, such as the development of the CREEs, and of research into alternative soil fertility approaches.

Amongst the support sector, most individuals (more so than for farmers in the previous chapter) could identify several positive aspects and outcomes of the Special Period, in relation to agriculture. Communications had improved, between the enterprises and the UBPCs. In certain commodity sectors (such as citrus) there was more training and incentives, and increased market awareness. Further, the number of international projects and training opportunities had increased (and these often supplying inputs). Both positive and negative impacts on yields were noted. Some agricultural staff felt that yields were good or had even increased with fewer inputs, although others thought that yields were lower than before. There were several qualifications to this, in terms of input levels, management approaches, land area being farmed, and the natural resource base. In terms of input levels, one banana agronomist from Havana Province explored the changes in more detail: "*People blame the lack of petrol, but in the late 1990s yields are higher than in the 1980s. In our municipality, we have 1million tons of production - the same as in 1992, so we are more efficient now.*" (MA/20). He went on to describe the significant declines in volume and frequency with which artificial inputs were being used: "*In the time of the vaca gorda,*[164] *we used 6t/ha potassium, but now we only have 1.5 t/ha. We used to apply 1.5 t/ha urea every 2 months, but now only 0.45t/ha twice, and we used to fumigate twice monthly against sigatoka - by aeroplane - but this stopped in 1992.*" Then, however, he added "*We are still trying to get back to the input levels of the 1980s.*" On the other hand, several interviewees felt that the best producers in the country were the military farms, and this was due to their strict discipline and control rather than their input use. These farms contained the best CREEs and *organoponicos*, and all were self-financing.[165] A positive influence on production was that farmers were continuing to return to the land, despite the termination of State support for this, and especially professionals to the CCSs, and redundant coffee plantation workers. In terms of natural resource management, some soils had deteriorated during the Special Period, owing to their overuse and lack of organic matter, whilst others areas had benefited from use of oxen and reduction in agrochemicals. The negative impact of poor soil fertility on yields was seen as a continued problem.

Regarding the successes of ecological production, researchers felt that this had been dependent on the type of farm and its previous operation; highly industrialised farms had experienced significant yield declines. Campesinos had made a group transition and were currently more ecological, because of both financial pressures and their recent learning experiences (KI/4). Another social scientist (MES/R/8) had observed this finance-driven innovation, "*Farmers were practising new strategies, neither stemming from the research institutes nor from traditional knowledge, but new innovations such as intercropping with plantain, or planting early varieties because of the demand from the farmers' markets.*" Researchers generally felt that private producers were more resilient, although there were inter-farm and inter-provincial differences and much depended on individual farmer preferences. This had implications for the future: one researcher felt that if Cuba was to feed itself – and this was possible given the land available – it would have to do so through a transformation to campesino production. Examples were given of UBPCs which, to achieve

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[164] The affluent times of the 1980s, literally translated as the 'fat cow'.
[165] The author made several unsuccessful attempts to visit a military farm in Havana Province.

success, had realigned themselves along the lines of CCS so much so that in one case "*the UBPC structure was falling apart*." (MA/R/6). Generally, smaller UBPC units worked better and were therefore being further subdivided.[166] Notably, this perception of resilience was applied to CCS co-operatives which were given a lot of ideological free reign (compared to the CPAs), where "*it is only a common fund that unites the members*" (MES/8). Other reasons for the higher performance of the CCSs was that they generally chose to construct their houses nearer to urban centres and therefore to markets. A contemporary study (Herrera, 1999) also identified the benefits of strengthening the CCSs, and that those more tightly tied in with the State enterprises fared worse in economic terms. However, several researchers were reluctant to see any further ideological shift, and one saw the current process, including the rise in foreign investment and capitalism, as being ideologically compatible. Describing the current 'third agrarian reform' based around co-operatives, he explained, "*This time it is of proletariat origin, rather than* campesino*, as old State farms change to new type State farms in an attempt to put administration and economics into the hands of the workers*." (MES/6).

For the support sector, and in terms of the future, again most interviewees felt that there would be no return to the high input levels of the past, although availability and use would generally increase. They had learned that an integrated, environmentally conscious approach gave similar, or higher, yields, and that input use would vary according to local agro-climatic conditions. Within this, some felt that it was possible to farm on an ecological basis, and others not. Several interviewees would promote ecological techniques given the choice. For others, the legacy of industrialised farming had disrupted the ecological balance to the extent that chemical inputs were necessary to maintain yields. For example, some pest levels were beyond what could currently be controlled by biological means, although perhaps in time they could be bought down to manageable levels. Some saw that ecological approaches had a potential but there that were some current bottlenecks in the system inhibiting their wider uptake. Farmers want to see immediate economic returns and need to see the benefits. Whilst extensionists were aware of the possibility of producing without chemicals, knowledge about how to do this needed further development and dissemination amongst the farming community. Equally some inputs, for example, mycorrhiza were seen as useful but were not produced in sufficient quantities to distribute to everyone. If they were more widely available many agronomists would prefer to use them as they were healthier and cheaper. Labour and knowledge were also seen as bottlenecks, and the speed at which new approaches could be introduced. Finally, more ecological agriculture was seen as being suitable for urban and peri-urban areas, whilst integrated approaches were necessary for the rural regions.

Classifying Cuba's overall 'alternative' farming approach, Socorro Castro (1997), identified its main technology features as being: the IPM programme, the alternative animal health programme, soil management and plant nutrition based on soil capacity, animal traction, radical changes in livestock production, urban agriculture, cultivation systems including integration of crop with livestock, rotation and diversification, and reforestation. For research groups dedicated to ecological production, Cuba was at a transitional stage of input substitution.[167] One researcher provided a more detailed and thoughtful perspective on Cuba's potential "*In fact Cuba talks about ecological agriculture which is one step beyond organic agriculture – it has to show sufficient yields to solve the food crisis*." He went on "*I personally believe we can do this even at a global level – we previously experienced serious yield drops partly because of the conventional system which stopped responding to chemical inputs. In the 1940s no chemicals were used and our yields of beans, corn, squash and so on were all double what they are today. The conventional model can't solve the*

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[166] This accords with the literature of the time that suggests that changes in land tenure have reduced farm sizes, increased production and "*converted the countryside into a mosaic of crops*." (Perez & Vázquez, 2002 p.111).

[167] Perez & Vázquez (2002 p. 112) explain that "*The Cuban model of conversion has been marked by an initial phase of input substitution, replacing chemical inputs with biological ones within an IPM framework. In this phase there is an integrated contribution of increased use of predatory insects and pest pathogens, with a more rational use of synthetic chemical pesticides*." They go on to describe a further stage (p. 126) "*But it should be clear that biological agents do not provide the only way to substitute for chemical use. Only through IPM programmes that include a broad array of ecological practices will it be possible to establish population regulation with an appropriate equilibrium between natural enemies, pests and crops*."

problem, but the agro-ecological model can through a slow but steady process of increasing yields and quality." (MES/5). A colleague explained, "*There is no alternative to sustainable agriculture. Both organic and green revolution agriculture are like agribusiness.*" (MA/R/6). For another, "*Organic agriculture is based on bio-inputs and is expensive because of certification, whereas agro-ecology may include the use of agrochemicals if absolutely necessary*." (KI/4). For this group, integration was the most important factor, of mechanisation and of soil nutrition, and this required, "*a change in consciousness*." In this approach, chemicals were not renounced but were minimised, and the group pointed out that major constraints were not fertilisers, pest controls or tractors - they had alternatives to these - but were good management and irrigation and especially given the increasingly uncertain rainfall patterns induced by climate change.

In this respect, Cuba would return to using slightly more chemicals when possible,[168] and may only be attracted to organic agriculture for the market potential. Certain crops, such as sugar, potato, banana and rice, may still be produced intensively, and in addition were regional variations. Yet Cuba would still continue to look for biological alternatives as well as an integrated approach. Experience in the 1990s had shown the benefits of achieving ecological equilibrium over control methods. For plant health researcher MA/R/29, "*The level of education and debate in our country is conducive to maintain the use of alternatives even after a change*."

Future challenges for the sector were identified as: soil management, maintaining equilibrium, increasing utility of alternative inputs, development of new farming models, adopting new methodologies, diversification, improved accounting mechanisms and markets, increased education on sustainability, improving the quality of rural life, and "*The implementation of appropriate technologies in harmony between local available resources, external inputs and productivity.*" (Socorro Castro, 1998).

8.3 CHANGES IN INSTITUTIONAL POLICIES AND PROCESSES

8.3.1 Changes in overall support for agricultural production

Three-way driving forces for change

Throughout the decade, massive changes took place as MINAG sought to decentralise and at the same time to fulfil the changing requirements of farmers.[169] Some coping strategies proved more successful than others, and in the latter cases, rectification processes were also evident. The crisis and the ensuing scarcity of resources had "broken the equality", as inputs which had previously been available for everyone had to be prioritised. This organisation of resource distribution was tasked to the provincial agricultural enterprises, which formed teams of inspectors to ensure the intended destinations of resources were reached. The provincial MINAG delegations had become responsible for fulfilling new State regulatory and production requirements. These requirements started in 1993 with the provision of land in perpetuity, the creation of UBPCs and New Type State Farms, and the farmers' markets. This move toward more independent and decentralised farms had huge ramifications for the provincial delegations and enterprises, and in this sense the drivers of change were three-way between the crisis context, the institution and the farmer. Farms required assistance in managing their own financial systems (previously workers were paid by the State, an average salary of $0.2/day). At the same time, farmers started to demand alternative inputs and strategies, which pressured the service provision and research sectors to respond.

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[168] Unpublished research results of university researcher MES/2 had shown an increase in levels of agrochemical usage between 1997-1999.

[169] Within its centralised and top-down nature, there existed multiple channels for interaction with end-users. At national level, MINAG's Council of Ministers met regularly with 13 selected campesino 'advisors' from CCS co-operatives within Havana (MINAG 1998), whilst at the other end, the agricultural enterprises held monthly discussion meetings with each co-operative over production.

Multi-level restructuring of agricultural enterprises

This instigated, in 1995, a reorganisation of the agricultural enterprises,[170] in order to transmit resources more efficiently to the UBPC sector. To enable this, they merged with Acopio to create a “one stop shop” for services and marketing. During this process they lost control over the lands they used to manage and thus their role as direct producers. In 1999, the enterprise system was again overhauled, remodelled on the style of the traditional, relatively successful commodity corporations such as of citrus. There were now 25 different economic commodity types within MINAG at national level, responsible for the production process: renamed the Economic Organisation of Mixed Crops, of Tobacco, Citrus, Livestock, Coffee and so on. Minor commodity strands, for example of Apiculture, Pigs, Poultry, remained as Enterprises or Establishments at national level, still to be converted into Economic Organisations in the future.

At 2000, the provincial enterprises (renamed associations) had two main overall roles: to provide training and services. They retained their assets, such as storehouses and workshops, hiring these out to farmers. They purchased inputs through the Central Enterprise of Agricultural Supply (ECSA) and distributed them to their municipal-level enterprises that had become more numerous.[171] The enterprises also had to take more responsibility for encouraging diversification and developing and testing new technologies, and were selecting farmer leaders from the different farm types to assist. They also provided some support and training courses in related business skills, with some wealthier enterprises even developing business service centres to farmers, offering software, photocopying, training courses, email, and accounting. Income from these services contributed to their institutional goal of financial self-sufficiency.

The intermittent loss of support for the campesino sector

Since the Revolution, ANAP, the membership organisation for all private farmers, had held the official role of distributing inputs and resources to the campesino sector. In 1992, this role was transferred directly to MINAG and specifically to the Campesino Co-operative Sector (SCC), although ANAP continued to play an unofficial, supportive role. Further, somewhat unsuccessful, change took place in 1996/97, when the SCC was merged with the provincial level enterprises that had previously only served the State farms and UBPCs. (This merger was also referred to by farmers in the previous chapter.) ANAP lost its supportive role completely, and refocused to become more socio-political; distributing information on regulations and on management, and developing training courses.

The SCC had previously maintained a national network of staff, distributing the inputs, shoes, clothes, and so on, in collaboration with ANAP. These staff regularly visited campesino farms to discuss plans and bring resources. They effectively acted as champions for campesino farmers. Importantly, the SCC had sufficient resources to continue supplying campesino*s* with chemical inputs right up to 1996 (albeit at a lesser volume than in the 1980s). This had protected the farmers from the worst years of the crisis. All this support stopped when the enterprises took over, and the campesino*s* interpreted this as having lost out by the organisational merger (MA/23). There were regional differences in the extent to which this happened (for example, some enterprises had historically strong links with the campesino sector), but by and large the enterprises did not have the extra resources or motivation to attend to the many thousands of campesino*s* in each province. The campesino*s*’ diversified production did not fit with the specialised production orientation of the enterprises, nor with their rationale for distributing resources. One provincial MINAG staff explained "*The problem is that there are no pure producers - they all have mixed crops.*" (MA/11).

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[170] These Enterprises had started life as large State farms, which were used to provide inputs and services to smaller, surrounding State farms. They reflected the specialisation that was pervasive in the production sector, thus being the Tobacco Enterprise, Livestock Enterprise, and so on.

[171] Because of the high number of different specialisations, MINAG made moves to streamline and co-ordinate municipal level activities, but this met with resistance from the specialised enterprises.

Further problems arose because of a lack of technical staff and the general difficulties in changing institutional customs.

This consequence was particularly significant in the light of the growing realisation of the massive contribution of the campesino sector to domestic food supply.[172] In 1999, MINAG recognised the extent of the problem with a new resolution that instructed the enterprises to integrate campesino farmers into their structures, both by supplying inputs and making production plans.

As for ANAP, after 1996, *"The campesinos lost confidence in ANAP because it could no longer supply their inputs and so on. They were used to going to ANAP to talk about their problems. They still do this."* (ANAP staff MA/23). Even though it could no longer provide a complete service to the campesino*s*, ANAP continued to hold an influence on their decision-making, and encouraged farmers to meet the State plan, even though MINAG inspectors were officially in charge of this. In fact, as the UBPCs emerged, ANAP had seen its membership grow to over 200,000 by 1998, which represented 98% of farmer land-owners (who produced 75% of agricultural output on 22% of total production area).[173] At 2000, ANAP's staff were keen to re-establish its traditional social support role (MA/29). This social collaboration type of relationship gave more purpose to ANAP, and the campesino*s* evidently wanted it. Nevertheless, MINAG officials played down the importance of ANAP's role.

8.3.2 Change in overall research approach

Progress of the SINCITA system

Chapter 5 introduced the SINCITA[174] system, an international programme which in Cuba aimed to reorient the National, Branch and Territorial research programmes under auspices of MINAG and CITMA, and integrate the already-existing national research structure into this. This changed the way in which research priorities were determined. After February 1999, new projects and applications would have to conform to the goals and methods set out in this new initiative. In practical terms, the main changes in approach involved:

- setting research in the context of production chains;
- undertaking a diagnostic assessment and a forecast of the future;
- emphasising decentralisation and diversification.

Starting off with a focus on reforming the Branch programmes of MINAG, successful methodology would then be applied to the National and Territorial programmes of CITMA. In December 1999, a national training workshop was organised for MINAG, MES, and other middle-management institutional and Ministry representatives, on developing capacity in the production chain, participation, strategy, management and facilitation. Training was also given to directors of State agricultural enterprises. According to project staff, Cuba had fared exceptionally well compared to other countries participating in this initiative, maintaining a ministerial commitment to the project, even with changes of senior personnel (whereas, in other partner countries, political changes had resulted in programme changes and delays). The project and State policy shared similar goals of decentralisation, diversification, and efficient and incentivised production. Cuba also benefited from the existence of large numbers of highly trained staff, and, according to staff, farmers who were receptive, both in terms of literacy and ability. The staff working on this project were confident of their influence within MINAG, even though, as they pointed out attitudes would take time to change.

[172] Which, in the light of the stored resources of the SCC, indicates that these played a role in the campesinos' resilience during the crisis period.

[173] One ANAP representative (SN/01) explained the situation of non-members, "*there are parceleros with land of less than 2-3 ha, who are not associated with ANAP. But there is commitment, follow-up and overseeing of non-members also, because everyone who owns land should be producing something if the land is really that of society*."

[174] National System of Agricultural Science and Technological Innovation.

8.3.3 Current policy on production approaches and aims

State policy on sustainable agriculture

There was confusion about the status of status of policy regarding agriculture. While some individuals thought that there was an explicit MINAG decree supporting sustainable agriculture, MINAG HQ staff explained that although there was no specific law for sustainable agriculture (in 2000), the whole sector was aware of this issue. New environmental regulations were being introduced, which affected agriculture. Regulation was one of the ways in which Sanidad Vegetal dealt with pest control and soil health; recent decrees stipulated that *organoponicos* should not use chemical products, and that fines be imposed if recommendations were not followed. Environmental Law 1997 title 9, article 132 was devoted to sustainable agriculture, calling for a more rationalised use of locally-appropriate industrialised and ecological inputs, and IPM measures (Perez & Vásquez, 2002, p. 136-7). A recently established soils law made it possible to fine producers who were not properly protecting their soils. In practice, however, these laws were not fully implemented as MINAG and other inspectors were already overworked (MA/R/31). Monzote et al. (2002) identify sections of MINAG Law 142 on the establishment of UBPCs which encourages farm diversification, self sufficiency and reforestation. For example, Article 60 of Resolution no. 354/93 stated that each UBPC unit "*should work toward the diversification of its production while not affecting its main product line*."

Government mandates and objectives

Overall, and in 2000, the mandate of support institutions was to increase production and yields. Each region had its own specific initiatives to meet these goals. Many were supported by foreign funds and were intensive, for example the Support Programme for the Cultivation of Basic Produce in the east of the country.[175] In this programme, regional research departments provided technical input, training, and basic equipment including 'high quality' seed was supplied. According to a UNDP representative, this project had led to increased availability of grains, a reduction in market prices and new sources of employment (Perez, 2003). As another indicator, the current 10-year plan for banana production aimed to increase consumption from 60-90g/day/capita to 160, i.e. a doubling of consumption, and to allow for excess production for industrial usage. To achieve this, about 60% of production was to be intensive (on 40% of the productive land), and 40% extensive (on 60% of the land) (MA/40). In terms of extension, the policy of the new Agricultural Extension System (discussed later in this chapter) was to take an integrated approach in order to increase yields, but without going back to previously high input levels. Similarly, one of ANAP's three main tasks was to increase yields for campesino farmers (as well as to direct these through the capped price market, *La Placita*).

Research policy

According to CITMA, the 17 national agricultural research centres had reoriented their research programmes toward sustainability (Díaz, 2000). This entailed focusing on sustainable production methods, animal feed production through biotechnology, sustainable tourism, and knowledge intensification on environmental resources. Within this, three approaches were being promoted: giving high priority to biotechnology to obtain required yields, introducing integrated agriculture (rotations and polycultures), and combining the use of bio-inputs and chemicals. The SINCITA system also promoted general sustainable options. At the opening speech of the IV Symposium on Sustainable Agriculture in Havana, November 2000, the Director of CITMA stressed 3 issues: the need for using all available organic techniques (including water conservation and use of all wastes), the need for precision agriculture, and the need to link research with industry. At local levels, some

[175] This was supported by UNDP, SIDA and the Republic of Cyprus.

MINAG delegations had developed strategic plans to combine chemical with ecological inputs. Similarly, in 1998, INISAV's research mission was "*To contribute to the decrease and prevention of production losses caused by plagues with as few risks as possible to the environment and on a sustainable basis*."

Some institutional staff voiced a stronger policy change. For example, the Director of UNAH explained how it was now the policy of Cuba to be organic, so "*it is not just a group of crazy people any more*." He went on, "*Cuba is further along the road than just doing it out of necessity – there is political will and interest and economic necessity. This commitment can be seen by our recent sound environmental legislation*."[176]

8.3.4 Planning and incentivising production

Institutional role in production planning and marketing

Since 1999 it was the agricultural enterprises which oversaw the production plans of the private farmers. Purchase prices were set by the Ministry of Finances and Prices, and varied according to the destination. Food destined for social consumption (the ration, hospitals etc.) received the lowest price. Next came food destined for the domestic processing industry, then the capped price agricultural markets (e.g. *La Placita*), then the farmers' markets, and finally the highest price went for food destined for the internal tourist market.

As well as purchasing for the ration, the enterprises had started competing with Frutas Selectas over purchases for the tourism market. For these purchases, the enterprises had to grade and pack the produce. ANAP also provided assistance in the form of petrol and transport, for farmers to market their produce in *Las Placitas*, the local covered markets. Although lower-priced than in the farmers' markets, ANAP staff MA/24 was certain that "*The farmer will be happy to offer his products at a lower price for the population.*"[177]

Although private farmers were relatively free to choose where to market their surplus, some destinations were made easier than others, and in terms of planting, levels of decision-making varied. In San Antonio, for example, the enterprise was planning to increase horticultural production for tourism; whereas in Holguin, MINAG at national level took the decision to plant more potato (because potato was a nationally important ration crop), and some provincial staff were not so enthusiastic given potato's susceptibility to disease and the restrictions on the choice of other crops grown near it. One banana agronomist clarified the ministry's power and priorities in terms of decision-making over marketing: "*In the future we could get a place in the farmers' market to sell banana, but not this year. We have and want to meet the national demand first - through Acopio and then Fruta Selecta*."

Incentivising production

The main forms of incentivisation were of land and markets. Producers made little use of the credit service offered by the Bank of Credit and Commerce, because their production was limited more the by unavailability of technologies and inputs rather than by their cost, which were relatively low (Ríos, 1999). Notwithstanding the successful State efforts to encourage a return to the land,[178] staff at MINAG headquarters felt that there was still insufficient labour in agriculture.[179]

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[176] As explained in Chapter 5 , it was CITMA, rather than MINAG, which developed agro-environmental regulations.

[177] This interviewee also instructed the author to write down, "*The Cuban farmer hates intermediaries*."

[178] E.g., 60,000 new producers between 1994 and 1997 in Cienfuegos province alone (MA/29).

[179] Martín (2002) points out substantial increases and changes in the rural labour force: an increase in internal heterogeneity through the emergence of new cooperatives, campesinos and joint ventures, an increase in size and diversity of the labour force, increased numbers and economic importance of campesinos, increased numbers of cooperative members, reduction in numbers of less skilled farm workers, and greater differentiation through market linkages and technologies which give rise to increases in income and living standards.

The rise in farmer incomes was put down to increased planting and increased market prices.[180] For example, prices of coffee and meat had doubled between 1998 and 1999, and milk had increased six-fold. In addition non-market forms of competition continued to play a large role within Cuban agriculture, such as contests at various levels for 'best co-operative' or 'best banana producer'. These competitions were taken seriously; as well as the prestige for the workforce, benefits of winning included State investment and crop prioritisation, to enable the farm to serve as a model for others.

8.3.5 Changes in input provision

Coping with fluctuating national imports of agricultural inputs

At the end of the decade, all inputs, including synthetic fertilisers, insecticides, hoses, organic matter and bio-inputs, were distributed by the municipal enterprises. Inputs were designated for the best farmers: those with the highest yields and productivity, whether CCS, CPA, or UBPCs, and also according to the priority crops of the region. Quantities and types were based on analysis of the farm area, conditions and equipment, and arrived with a signed contract. The Soils Institute played a role in deciding which soils were most appropriate for which crops. Concerning farmer selection, enterprise representative MA/22 explained "*Poor producers have to improve their techniques and they receive as much help in this as the others*." Decisions on distribution were taken at provincial level by Sanidad Vegetal, the Soils Institute, CITMA, the university, and regional research centres. All crops for Fruta Selecta and the Seed Enterprise were prioritised. Although inputs were now rationed, this basic distribution process had been in existence since prior to the Special Period; in 1995/6 it had been computerised to increase efficiency. To back up the prioritised distribution of inputs, MINAG ran a monthly evaluation of production techniques and could place fines of $1.5-$5 if farmers violated the laws and recommendations on use of these inputs.

There were regional differences, and continued fluctuations in input supply that hampered planning. Each municipality had different priority crops, and different quantities of petrol dedicated for each crop, this being decided by MINAG. In the Velazco-Holguin region, for example, the following crops were prioritised at October 2000: all potato, 40ha sweetpotato, 416ha cassava, 40ha fruit banana (FHIA18), and also garlic, pumpkin, other banana, tomato (MA/25). In Havana Province, some enterprises were currently able to store a reserve of inputs so as not to run out. Other regions, with only small quantities of designated inputs, encountered more difficulties with planning their distribution, and especially when those inputs did not materialise. In these cases, farmers who had been expecting inputs for planned production but did not receive them, could sell their (diminished) crop to the State for a higher price. In 2000 in Holguin, for example, 80% of producers were not officially in receipt of any inputs (MA/27/B), and enterprises could not supply inputs even for all prioritised crops as the fertilisers they were expecting had not arrived on time. For this reason, some crops were ascribed specific 'protected' areas, where inputs were guaranteed. These areas largely corresponded to those high-yielding producers, and MINAG staff MA/27/B explained "*I only receive a few resources to distribute, so if a producer has water it is better to give him the inputs because there is more security that he will obtain good results*." This agronomist, if able to provide new irrigation systems to farmers, would target first the CCSs, then the CPAs and individual farmers, and lastly the UBPCs.

Industrialised input prices and general availability

Figures show that, between 1993 and 1998, pesticide imports rose steadily from 5,000t to 10,000t (still half of figure for the previous decade) (Perez & Vázquez, 2002), and fertiliser imports from

[180] This relationship between prices and production were the converse of what one might expect in a free market economy. In Cuba, consumers had supported part, but not all, of the price increases.

96,000t in 1999 to 138,000t in 2001 (compared to a figure of 536,000t in 1989) (FAO, 2004).[181] Some interviewees still felt that input levels had little increased over the decade and were still at low levels.

There was some variance of perception on the ease of availability of inputs, and while agrochemicals were sold to farmers in pesos, petrol required dollars. Some felt that chemical products were relatively cheap, and farmers could regain their costs through higher yields achieved. However, this was highly dependent on financial capacity and especially access to dollars. "*Farmers can obtain whatever they want – it depends on their situation as to what they want, and basically it depends on economics, but they can get it if they can afford it.*" Access to irrigation and farm equipment was still controlled by the State - a situation that was likely to continue, and farmers still needed authorisation to obtain chemicals. Affecting this were the institutional challenges in accessing inputs. One banana agronomist who was supporting banana production on UBPCs, explained how total fertiliser inputs for this crop had fallen from 60,000t to 7,000t after the crisis, and although he could now access more inputs, he tried to avoid this because 50% of the costs had to paid back to the State by MINAG in dollars.

Official input recommendations

Recommended input levels tended to vary according to their source. Research institutes tended to recommend higher inputs, because they were promoting specific varieties and hybrids. Generally by 2000, the provincial agricultural enterprises were advocating integrated chemical and ecological inputs. According to one staff member in Holguin, studies from Sanidad Vegetal had proved the effectiveness of this integrated approach. By the end of the decade, some enterprises were coming from the other direction; such as one MINAG staff in Cienfuegos who explained, "*Previously*[182] *we had to rely on bio-inputs, but now we can apply a balanced mixture*." MINAG's technical recommendations for root and tubers crops, for example, stated that "*An attempt has been made to recommend a fertilisation system which is most practical and as adaptable as possible to the real conditions, with an emphasis on minimum quantities of fertiliser to obtain sustainable and acceptable yields*.", and "*Chemical control should only be used when biological control has not been effective or for a very severe attack which is certain to severely reduce yields. As far as possible, use products selectively which have little or no lethal effect on natural enemies. In the case of applying insecticide, it will be necessary to re-establish beneficial fauna through releasing of biological controls*." (MINAG, 1998). Appendix VII lists input recommendations for five different root and tuber crops as instructed by MINAG in 1998, showing this knowledge-based, intensive approach.

Research institutes' recommendations had adapted to the conditions of the 1990s, but were generally more specialised and technically-focused than MINAG's more general guidelines. For the case of banana, in 1998 a new technical bulletin was published on the integrated control of banana nematodes (Fernández et al, 1998). The approach was described to "*include the use of all control alternatives, join armonicaly with an strong basis of knowledge of the ecology and behavior of the pests*." [sic] (p.4). This represented a more ecological approach than earlier technical instructions and changes were seen over the period (e.g., INRA, 1968; CIDA, 1988; Lacasa Mirabel, 1991). For example, chemical input recommendations were currently determined by variations in soil type, soil humidity and other factors, but were approximately 150g/urea per plant, and 360g/potassium. In 1988, recommendations were 1,300g/nitrogen per plant, and 200-700g/potassium (CIDA, 1988), and by 1994 they included lists of alternative sources of nitrogen and potassium, such as organic matter and tobacco wastes respectively (CIDA; 1994; Ramos Marchado et al., 1994). Input recommendations also included the use of organic matter and ash.

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[181] In 2000 in Holguin, MINAG was concerned about the current indiscriminate use of chemicals and was undertaking a study on this issue, along with health professionals.

[182] In the early 1990s. This implies that, with a decade of accrued experience, the enterprises may now be clearer of their approach of choice.

8.3.6 The promotion and distribution of ecological inputs and techniques

The main difference between the promotion of agrochemical and ecological inputs was that the former were rationed and distributed to the farm, whereas the latter could be obtained at will (where available) but had to be sought out. One interviewee recalled that in the early 1990s it had been difficult to raise farmer's interest in these products, but that over the last five years farmers had been approaching MINAG to request them (MA/15).

Some support institutes were more actively promoting ecological techniques than others. San Antonio municipality was gearing its production towards local consumption, especially in roots and tubers, horticultural crops, and animals. Enterprises assisted in the recycling of farm by-products, purchasing livestock manure and other waste organic products - such as maize husks - to return to the land, and transporting waste from crop harvests straight to the livestock production centres for feed. One enterprise in Havana was producing its own compost, made from agricultural wastes collected from across the region, and then making this available to farmers, and another was producing Bioterra, a composted sugarcane residue that was free to collect from certain municipal MINAG offices. Soil regeneration through the use of drainage bunds was being promoted in the hilly region of Pinar del Rio, stabilised by perennials such as Vetiveria, Leucaena or Gliricidia and in conjunction with green manures. In 1993-95, the cost-benefits of this approach were calculated as $161/ha for maize, and $3,985 /ha for tobacco (Instituto de Suelos, 1998). In Holguin, a Mixed Crops Enterprise was recommending the use of sugarcane waste (*cachaza*) and biofertilisers on banana. Because 35% of nutrients were maintained in the leaves and stem of banana, there was a prohibition on State farms and UBPCs in the region from removing the leaves from the plantation (though for the private farmers, only recommendations could be made). In Cienfuegos, banana was being planted in place of sweetpotato, as banana yielded year-round with or without inputs. There were also moves to start planting windbreaks again, this time using productive trees such as avocado and citrus. Nationally-produced biofertilisers included Ecomic, available at $1 per ha coverage.

CREEs, which produced biological pest and disease controls, were numerous in every province and located under a range of institutional jurisdictions. For example, the province of Cienfuegos had 10 CREEs with 5 production lines, whilst in Gibara municipality one CREE was operated by Sanidad Vegetal and pertained to the Livestock Enterprise, and its other CREE fell under the SCC of the Mixed Crops Enterprise. The CREE made recommended dosages according to the crop and explained application procedures to farmers. Farmers could obtain products directly, or through their municipal Sanidad Vegetal, or from the local farmers' shop. In Gibara-Holguin, the CREEs' main clients were the State farms 'Mambisa Division', which ordered in bulk several times a month and used the products on potato, cabbage, tobacco, onion and more. CPAs also used the products to a fair extent, depending on the crops being planted. CCSs, on the other hand, came infrequently and mainly *for Beauvaria bassiana* to control sweetpotato diseases. The most successful CREE products were those that did not require cool storage temperatures. *Trichoderma* had been particularly successful against *Thrips palmi* and yields were currently back to former pre-infestation levels.

Table 8.1 Area treated with biological methods, 1988-1998.

Year	Area treated (ha)
1988	300,000
1992	980,000
1994	410,000
1996	605,000
1998	900,000

Source: MA/R/29

As well as the CREEs, INISAV had developed three biological pest control factories that produced more sophisticated products, and were planning nine more. The changes in area treated with biological control methods between 1988 and 1998 is shown in Table 8.1, and although they have shown to increase, figures in Chapter 7 indicated that their spread was either very thin or concentrated on a few farm types or areas. Generally, CREE staff felt that there was currently sufficient supply to meet demand, and also of sufficient farmer knowledge of these alternatives.

In the irrigation sector, automation in the campesino sector had increased during the Special Period, as more efficient types of irrigation system had been developed, stimulated by the need to maintain production in drought periods and to avoid erosion. The biggest area of development was of domestic electric power, and the more efficient use of petrol. In terms of alternative traction, by 1997, over 2,000 training events had been run on the use of oxen, and new and redesigned farm implements were manufactured in each province, in order to take advantage of local recycled materials and to adapt to local conditions (Ríos, 1999).

Challenges to the promotion of ecological inputs and techniques

Advantages and disadvantages of both types of inputs were acknowledged. Agrochemicals were easier to apply and show a response; whereas organic matter was more transport-dependent and often in short supply, techniques such as green manuring did not fit into current intensive cropping cycles, and on-farm production required a change in farmer mentality. Organic matter did, however, contain the full range of micronutrients, and plant residues could be incorporated. For banana, *Beauvaria bassiana* might combat banana weevil, but there were no bioinputs against crimson spider mite, nor black sigatoka. Suggested production improvements for biological control products focused on product quality, storage times, and wider training availability.

For the agricultural enterprises, it was easier for them to diffuse ready-made, easy-to-apply ecological products and innovations than those that required some on-farm processing. Opinions also varied on the appropriateness of inputs for different farming types. Larger State farms had the equipment and tools to manage agrochemical application, but owing to their frequent changes in management they were less convinced about long-term sustainability issues. Yet the nature of concentrated State farms made them easier to diffuse approaches such as IPM.

CREEs had gone through their own learning process during the Special Period, as they learned to balance supply with demand. In early days, large, surplus quantities of controls had to be destroyed. To avoid this wastage, Sanidad Vegetal now made annual and monthly operational plans based on contracts, with a small reserve for impromptu requests. Only infrequently did they now run out of a product that a farmer had arrived for. The extent of usage of biological pest controls was limited by the conditions of the Special Period. Access to transport was required, as certain products needed application every 4 days and farms did not have appropriate storage facilities.[183]

In terms of soil fertility, the use of micro-organisms such as *Rhizobium* and mycorrhiza increased over the decade, the former by one-third, from 8,300t in 1993 to 11,500t by 1998 (FAO, 2003). Production of worm humus and compost production rose from almost zero prior to 1992, to a peak of 78,000t humus and 701,000t compost in 1994, but then declined to a joint total of 600,000t up to 1998 (Treto et al., 2002).[184] On the one hand, production ran into the common problems of the period. One worm humus production centre, for example, had started the decade with production of around 10,000t/pa of compost, but this declined dramatically with the onset of the Special Period, and by 1998 was recovering to 5,000 t/pa. Cattle manure had been used as food for the Californian redworms, but as cattle were increasingly grazing outside in more extensive systems, so manure was becoming more difficult to obtain and filter cake from the sugar industry was being used to substitute the shortfall. At the same time, and in contrast to biological pest and disease controls that were disseminated through the network of CREEs, the dissemination of organic soil inputs appeared more problematic, without a similar network. Although there were plans to extend the network of provincial Processing Centres for Organic Matter and Vermiculture, it was currently limited. For

[183] Miedema & Trinks (1998) compared these CREEs with the larger biopreparation factories of INISAV. They found the larger factories had the advantage of economy of scale, but were less able to insert into the local production system and less flexible than the smaller cottage-industry CREEs.

[184] Yet according to Sinclair & Thompson (2001), biological fertiliser production had fallen from 3 million tons in 1988 to 1 million in the mid –1990s and was since increasing to 2 million tons by 1998.

the whole province of Cienfuegos, for example, *Rhizobium* was obtainable from only one municipal experimental station in Cumanayagua, at a cost of $0.15/kg. Farmers could access this either through the station's shop, or an enterprise technician could collect it. In Holguin, there were two centres for the production of biological soil inputs (brand named Fosforina and Micofert, the latter being franchised out from a research institute in Havana). Non-local sources were felt to be unstable as they were dependent on transport conditions. There was growing realisation that these research stations required marketing staff to promote the products.

Research institutes were having to try to distribute from their own sites, but marketing and transport proved major limitations to their spread. One institute offered a follow-up service to the farmer, including an evaluation of results. Box 8.3 describes the difficulties encountered by another research institute in attempting to diffuse its organic fertiliser product. These challenges are in the light of the historical State distribution of agrochemicals to a passive end-group, and the general lack of institutional know-how on product commercialisation, or custom of end-user demand.

Box 8.3 Challenges faced in marketing and distributing ecological inputs

One research institute, under CITMA, was encountering difficulties in uptake of its mycorrhizal product. Although foreign interest was proving promising, researchers were less certain of its future in Cuba. Yet the product was cheap - costing $0.58/litre solid – and was easy to keep - at room temperature it would last for up to a year. Only the burgeoning domestic organic citrus industry was showing a guaranteed demand. Staff put the reason down to a lack of support from MINAG. "*Azobacter and Fosforina have been pushed by the Ministry of Agriculture because these products were developed within MINAG institutes. We cannot benefit from the MINAG network because we don't belong to it*." (MST/1). She added "*MINAG should compare the different products available.*" This challenge had been compounded when the institute's production team had separated into two separate departments of production and marketing; sales fell as the marketing team held little stake in the product's successful distribution. Currently, farmers could only obtain the product by telephone ordering and collection and/or by post, but the telephone service was limited, and the postal service unreliable. Even after the product was featured on the national agricultural television programme Sol y Son, only a few farmers made contact to request it.

Ecological techniques included wider management strategies, and these also encountered challenges in their perceived applicability. Again for the case of banana, many strategies were not compatible with intensive high-yielding banana production, for example, rotation and intercropping could not practised with the permanently fixed, drip irrigation systems. Further, some researchers expressed that intercropping would only hinder the development of banana, and others that mulching with banana leaves might attract infection or prevent the rhizomes from growing. That bananas were often prioritised for inputs also meant that it was more difficult to mix with other crops. Further, windbreaks were felt to be ineffective against hurricanes and were traditionally seen as a barrier for the aeroplanes which had needed to spray from overhead. Overall, individual perceptions affected the extent to which ecological inputs were being promoted.

8.3.7 Experiences with changing extension and training provision

Development of experiences over the decade

According to respondents, MINAG had realised in the early 1990s that it had to change its top-down approach to extension, not only because of the crisis and lack of resources, but also because of influences from abroad and the development of a more diverse farming sector (instigated by the creation of UBPCs). Tracing the impact of the SINCITA system, university staff felt it to be compatible with already-existing reorientation of research.

The traditional research had focused on the predetermined needs of the planned economy. In the old national dissemination plan, State farms were forced to adopt a technology. According to staff in MINAG's Direction of Science and Technology (MA/33) "*Researchers used to select those farmers who produced the highest yields and who had leadership characteristics but who were not representative of the majority of farmers*." Of the old approach, all that was required in terms of farmer acceptance was, as researcher MA/R/21 explained "*proof from the beneficiaries that the technology has worked, such as a pile of letters*." Nevertheless, the previous top-down approach had some positive aspects. Some mechanisms for a localised approach had historically been in place: the provincial agricultural enterprises had been able to present projects - research or otherwise - for funding from MINAG, either at a provincial or national level, and undertaken through local institutes.

Methods in particular had to change in order to reflect new realities, and the time lag between testing and implementing research findings needed to be reduced. Moreover, provincial research results could now focus on local problems and be disseminated without the need for national authorisation. Researchers were expected to change their approach to a demand-driven one, and to increase applied science in a real context. The new approach would be to identify farmer groups and then select according to type of project, eventually including and working with all groups. Researchers noted that farmers would also need to be made aware of this new approach.

Influences midway into the decade were the SINCITA system, a collaborative French extension project in Holguin Province, and a home-grown integrated development project in Pinar del Rio. These pioneering and innovative projects throughout the decade were unable to make inroads into widespread change but at least served as references for the future and generated a lot of learning experience, the main points of which are summarised in Box 8.4 and 8.5.

Box 8.4 The pioneering 'French' research-extension project at ETIAH, Holguin

At ETIAH, Holguin, from 1994-1997, an innovative extension project was organised in collaboration with the University of Guadeloupe and supported by CIRAD, Montpellier. The main principles of this new extension initiative were: a systems' approach, identification and dissemination of local knowledge, and producer-led. The foreign facilitator, KI/10, selected to work with CCS and private producers, as "*They were more serious about looking after the land, and the management structure in the other forms of cooperative was too strong and with few decision-makers*". Yet he found that owing to the previous extension approach, field-level results were a long way off. He explained "*My main objective was to show the researchers how to understand the farmers' situation through rural appraisals, so the main impact has been within the research group rather than on the production system.*" Because the project only trained up a discrete research team, so these individual later encountered challenges in trying to pass on their new-found experiences to the rest of the institute. As one such researcher explained "*Especially the older ones find it difficult to change*."

The project culminated in a national workshop that brought together the country's more progressive and participatory research groups.[185] After this project had finished, in 1997, ETIAH continued to receive technologies from the national research centres in Havana, which it would test on-station and then in farmers' fields. However, it applied the methodology it had learned to identify the needs of the farmers, and attempted to base projects around these findings. On some occasions, there was a positive correlation between farmers' problems and the technologies received from Havana. Researcher MAR/8 explained "*We know this approach is not participatory enough, but it's better than the old system and takes time to change. We realise that mass-diffusion is impossible, but we can't change the mentality overnight.*" Others had a different understanding of the new methodology, such as his colleague MAR/9, "*There is no problem of conflict with the system or with mass diffusion, the only problem is that the needs have to come from the producer and not from the researcher*."

The new methodology had also been picked up by other local institutes. The university felt it had benefited through awareness of a new set of new farmer beneficiaries: the private campesino sector. In one plant breeding station MA/R/11 described what she had learned "*When we want to diffuse a variety, we now provide 4 to 5 varieties for the producers to choose from, instead of only one*." At this plant breeding station, staff focused on evaluating 42 varieties of maize sent to the region from Havana, MA/R/11 found it difficult to work with farmers on maize, because the farmers would mix the varieties whereas she would recommend planting at least 200m distance.

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[185] For summaries of this workshop, see ETIAH/MDAE/MINAG, 1997.

Box 8.5 Experiences of an early, home-grown integrated R&D project

In 1995, one of the very few home-grown attempts at introducing new methodologies came up against local-level challenges. The integrated rural development project – inspired by the work of Roland Bunch and Paulo Friere, had emerged from a research institute and aimed to work with little project funding so as to ensure genuine interest. Although it had won over the local Enterprises, the local MINAG delegation was less enthusiastic about this new competition with their own extension service. This led to the poaching of staff, as MA/R/6 explained "*We trained but then lost 23 extensionists, and now we have only 3 left there*." Further, because the project played a facilitatory role, so it was not locally recognised and as such "*our role did not show up in results and we had no proof of the value of our work*." Finally, the project had focused on short-term yield improvements, which on reflection, had not been possible under the circumstances, and other indicators could have been chosen. Therefore no concrete results emerged, and MINAG withdrew its funding as the project was, according to MA/R/6, "*making changes that affected structure and authority*." However, the project had established a clear vision on the role of the 'new extensionist' "*The main input necessary is knowledge, and to integrate this with indigenous knowledge. Therefore the extensionist is a knowledge promoter. Graduates are not necessary because personality and local acceptability are more important characteristics, and the ability to listen rather than speak, and not make assumptions. Young extensionists are particularly successful – because the farmers then feel paternalistic and the relationship works.*" [186]

Current situation for technical assistance

Overall, the extension system was one of technology dissemination and training; a combination of providing technical advice and demonstrations. This system was seen as strong; it was able to spread technologies quickly and obligatory. For example, one task of MINAG's provincial Information and Communication departments was to pass on warnings and advice concerning agroclimatic changes, as they related to, for example, pest control or silage making. This advice was fed to them from analyses of meteorological data by crop, soils and pest control specialists, and one outcome of this system was that potential crises could be averted (such as the nationwide *Thrips palmi* outbreak which had been controlled within 3 years).

Within this, there were various means of interaction with farmers, both top-down and more collaboratively oriented, and although some had historical origins, there was more recent awareness on being sensitive to the nature and needs of private farmers, including on how to reach farmers who were too busy to attend meetings. MINAG's central Agricultural Information Centre (CIDA) was, in 1998, renamed AGRINFOR and refocused to facilitate the flow and accessibility of information to a wider range of end-users through MINAG's provincial offices. This change included a move to computerised systems, in order to reduce the use of scarce paper resources. MINAG's provincial Information Departments synthesised a range of technical information coming to them from specialist groups, translating this into a more farmer-friendly form. Other forms of extension tools used were videos, posters and pamphlets, and whilst previously these materials had been produced in-house, this system was changing. One Mixed Crops Enterprise interviewee explained how, since 1996, they had been tendering this job out to research institutes. The development of technical recommendations was partly a collaborative effort. Discussion meetings would be held with farmers, researchers and other stakeholders, and from these recommendations were drawn up in the form of a technical bulletin which was then checked by farmer groups at municipal level. According to some interviewees, a more inclusive approach was generally found for crops that were being researched into by various institutions (such as banana), as they had historically had to collaborate.

In the field, there were also an array of methods used by MINAG. Manpower for technical assistance was relatively strong and backed up by on-farm technicians. Technical assistance teams

[186] Caballero et al. (1998) discuss their experiences at IIHLD in a transition from the 'institutional extension' approaches of 1980-1990, through 'technical assistance for specific localities and objectives' (multidisciplinary groups) of 1989-1997, to 'local agricultural development projects' from 1996 to the present. For the latter approach, the authors identified three main challenges: clashing with conventional agricultural concepts and methods, incongruency with the centralisation of decision-making, and insufficient support by enterprise authorities who challenged or showed indifference to the project.

within the enterprises varied in number; San Antonio-Havana, for example, was well endowed with 5 technicians for the municipality. State farms had their own production technicians who were the first port of call for dissemination. On private farms (the UBPCs, campesinos and including individual smallholders), Sanidad Vegetal operated through training up campesinos and farm workers as on-farm extensionists; in Cienfuegos Province were 340 such ‘plant health activists’, backed up by 13 training centres across the province (MA/31).

Current situation for research dissemination

In many respects, the traditional research approach also pervaded, and research was very closely linked with State technical assistance, given that several major institutes undertook both roles, such as the Soils Institute and Sanidad Vegetal. One soils researcher described their current 4-step research process as: first, identifying the problem; second, establishing plant nutrient requirements; third, evaluating soil/plant nutritional status; and fourth, research on problem solving through the use of soil amendments (MES/R/4). In this process, research results would start to involve farmers in year 4 of the 5-year process, and demonstration farms would be selected according to their receptivity and interest. A soils researcher explained, “*We don’t do participatory trials – we do research and then diffuse it through our services group which introduces the results to farmers and participates in different scientific councils*.” (MA/R/17). At the same time, it was acknowledged that demand to introduce a technology often came ‘from below’. Similarly for plant breeding, an agronomist described his role in their activities, “*When our breeders produce a variety, we have to research into its agronomic management, but the breeder has already by that time decided upon the objectives of the breeding programme*.” (MA/R/21). CREEs were used as an intermediary to undertake evaluation experiments with farmers.

The traditional approach was still felt to be relevant in certain situations. Researcher MA/R/3 felt that there were differences in technology introduction according to type of co-operative: if demonstrated well, the CPAs tended to absorb technologies more quickly than the UBPCs. Yet technology adoption "*was not just a doctor's prescription*." As MA/R/3 explained that they took this opportunity to explain about ecology. This researcher went on to explain his own learning experiences of working with farmers. This is described in Box 8.6.

Box 8.6 Experiences with an improved transfer-of-technology approach

Researcher MA/R/3 had learned about participation from experience. In 1985-87 they had produced 2000 farm implements and attempted to enforce farmers to use them, with no training or demonstration. Approximately 15% of farmers took up the idea, 30% caught half the idea, and the rest rejected it and destroyed the equipment. "*But at that time, we did not know the transfer of technology steps*." After this experience, the institute developed a better version of the equipment that was accepted and purchased by MINAZ. Institute staff then undertook a demonstration campaign during which they spent six months living with the UBPC and CPA farmers. One hundred models were accepted. This campaign was influenced by staff participation in an FAO-supported extension training course.

Yet at the end of the 1990s, researchers were at least aware of the need to re-evaluate their methods, to undertake projects with a social impact and based on surveys and interviews, to work more closely with producers and to provide more training. One institute, for example, now required that 60% of its work be undertaken under production conditions. Now and with the change in farming types, if a technology was found to be useful, it would be mass-disseminated to all farms with the same conditions as those involved in the experiment and which had already decided to adopt. Research and enterprise institutes worked jointly on this. It had become the duty of all researchers to diffuse technologies and results, and each research institute had an extension group or department.[187]

[187] Although in the case of at least one institute, this thematic group was treated as a separate discipline rather than a cross-cutting or a farmer-researcher liaison channel.

Researchers with an involvement in developing innovations also showed concern for their uptake and especially in terms of their accessibility for the farming community. One research group which had developed a high protein forage which would lead to increased livestock production, explained that they would only disseminate this technology to farmers who guaranteed to pass on the benefits of this increased production to the population, by ensuring that the meat produce would sell at an affordable market price.

Experiences with participation and farmer inclusion

The degree of participation varied between institutes and projects, and was understood and interpreted in various ways. For many, there was little difference from past methods, such as researcher MA/R/16 who explained that "*It is a pleasure to teach*.", or soils specialist (MA/3) who explained that they had developed a participatory extension programme, "*where producers attend forums and see results being presented*." When asked whether Ministry staff had learned about participation, one enterprise interviewee (MA/25) responded "*Yes of course! Everyone has to participate*." Researcher MA/R/31 pointed out that *"Scientists have the know-how but we don't know how to transfer it*." Some researchers felt that it would be too much of a risk for farmers to experiment when they had to meet State plans. Because of this, university researcher MES/2 explained that, instead of the previous mass dissemination approach, they preferred to use the term 'adoption of technologies' but it was much the same thing. In some cases, techniques would first be taken to State farms and then extended to the private sector. For example, the technique of stabilising soil through planting Vertiver grass was demonstrated on a State farm, and invited, interested farmers from the private sector could then make an agreement with the Mixed Crops Enterprise to sow a certain area of their own farm with Vertiver (MA/R/31). On the other hand, some felt that participatory approaches worked better in Cuba than in other countries, as MES/2 explained, because "*we have a good infrastructure and a lack of individuality*."

In contrast to the opinion of individuals involved in the more innovative participatory projects, the majority of MINAG staff felt the private farming sector to be more difficult to work with. These farmers needed to see results to be convinced, and they did not trust MINAG because of the way they had previously operated (MA/R/11). Yet it was widely acknowledged that once a private farmer was convinced, no more effort was required and dissemination was relatively easy. MA/R/31 explained "*the campesino farmers are slower to uptake but at least it lasts*." State farms, on the other hand, were obliged to uptake a technology, but they may drop it at a later date. In this respect, the UBPCs were a difficult category, being classified as private and having to pay for services, but still with the State farm mentality, being manned by farm workers (*obreros*) who held less farming knowledge and were not accustomed to take decisions.

Some researchers had learned through experience that encouraging farmers to participate in research, or to take up a technique, meant proving a reduction in costs or offering a financial incentive, and if not directly then by including commercialisation as one of the research themes (MA/R/18). This was felt to be more important to private farmers than increased yields, apart from for UBPC farms which were still driven by yields. Because of this, researcher MA/R/3 saw the development process as a spiral, with each region having different specificities according to soil type and land size and so on.

In order to work more closely with farmers, methodologies also had to change, and specifically around the identification and classification of farmer groups and issues in the expanded private sector. Methods such as stratified probability sampling (described in Rojas et al., 2000) were therefore introduced. In one research group (Holguin), farmers were classified into one of five types, based on specific criteria such as irrigation, inputs, horticultural crops, yields, planting dates, destiny of harvest, and planting distance. Based on this, the group could identify which farmer category would be most appropriate for their research theme. Conversely, another institute would interview farmers and then select the common issues of relevance to all farmer types. In this respect, systems research approaches were increasing, such as the emphasis on crop-livestock interaction by the Pastures and Forages Research Institute. The introduction of GIS technology from the mid-1990s onwards enabled a more integrated approach. Dealing with a broader range of farmer problems held implications for the team skills required, such as for handling social issues. Political issues might arise from a PRA, and these, according to MES/2 could be taken to the regional level MINAG without problem. This researcher recounted testing out participatory approaches in CPAs, "*It worked well - it touched delicate themes, but then it had to, because there was more than anything a lack of communication between the administration and management staff and so they also had to change*."

Changes in training provision

ANAP as a major gateway for training

Agriculturally-related training was provided by most support entities, ranging from the enterprises, to research institutes and ANAP, and often in collaboration with one another. As introduced in Chapter 5, ANAP was historically the main training provider for private farmers, and in this sense its role had increased dramatically with the inclusion of UBPCs under its remit, although it had less of an influence over training content than on organisation. This also meant an increase in its collaboration with other entities over specific courses or to reach specific farming groups. In 2000, for example, one municipal Mixed Crops Enterprise was providing training through ANAP on 'Best Practice in Accounting and Financial Control' which was open to all economists, accountants and financial specialists of the Enterprise, its State production units, and CPAs and CCSs. ANAP also assisted with management training on the mechanism of 'linking man to the land', and on ecological techniques through the farmer-to-farmer extension model.

Training was generally for the administrators, heads of production, presidents and so on, who were then assumed to diffuse this knowledge into their co-operatives in an advisory fashion. Trainees were selected by the co-operative, who were themselves paying for the training. Each farm had a 'capacity matrix' of each worker's potential, with training being provided for the high-potential workers, and training of a different kind to the low-potential workers in order to increase their capacity. The procedure was seen as a fair one, with the President not normally attending more than one course himself (although in the UBPCs and CPAs more of the committee members went on courses than the farm workers).

The farmer-to-farmer approach was more of a participatory extension model than training. It had been introduced into Cuba in 1998, with strategic inputs from ACAO, and rather than the international model which was used as a tool to improve livelihoods, this one focused on promoting ecological techniques. ANAP identified innovative farmers, but also those "*who have received less benefits and who have less potential, to show that if these farmers can achieve success then anyone can.*" They worked with these farmers to develop innovations and to act as references points for workshops. ANAP also linked up promising innovators with research institutes. ANAP representative MA/37 described how "*One farmer had constructed a vertical framework of layered garlic beds which he watered from the top down to save on water. We invited the head of INIFAT to see this innovation as a possibility for use in urban agriculture*."

Training could sometimes meet with challenges, for example one intent to promote a drought-resistant variety of chickpea in Holguin encountered problems with seed supply from the Seed Enterprise which had not been prepared for such increased demand. ANAP did not undertake evaluation of the success of training, but training could be evaluated through yield performance For example, in order to check that technologies were being applied, MINAG would send a provincial multidisciplinary inspection team every two months to undertake a 'systematic control'. This team had the authority to penalise farmers who were not using a particular technique that had been disseminated. At the same time, co-operatives could, in theory, 'throw out' any farmer who was not achieving the yields required.

Other types of training

Other changes had been made in the responsiveness of courses to current conditions. One Mixed Crops Enterprise interviewee (MA/25) explained how their 76 provincial field staff would feedback the needs of the farmers on a daily basis. This had led, for example, to them running a training course on vermiculture, to which 72 farmers had attended. In Havana province, enterprises were looking at ways to disseminate the successful experiences of urban agriculture to conventional rural agriculture, starting with training the management of the CPAs, CCSs and UBPCs (MA/22). Some training strategies had not changed but were seen to still be effective. Acopio, for example, ran short, intensive training courses 'on a mass technical transfer basis and at high cost' just before the planting season and for each and every crop. For these particular courses, farmers were selected on the basis of whether they were linked to that crop (in the case of UBPCs/State farms) or whether it was their major crop. The CREEs also ran training courses where they would explain to farmers how to use the products.

Research institutes were also tasked with training of farmers, and universities in teaching at postgraduate level and short courses. For example, the Soils Institute provided training on on-farm compost production. In training, researchers tended to continue their historical linkages with State farms and UBPCs, and to some extent CPAs, with less attention to or inclusion of CCSs.

Continued development of higher education on agro-ecology

At the end of the decade, teaching on ecological agriculture, although still specialised, was expanding and supported by the State. The CEAS group of the National Agricultural University of Havana (introduced in Chapter 5) was taking on more staff to develop their diploma in agro-ecology and their new PhD programme. By early 2000 it had run 3 long distance diploma courses in Cuba - in 11 of the 14 provinces and with over 600 graduates. It ran such programmes in conjunction with ANAP, and through this the relations of the two groups were strengthened. Its continued aim was to train not only producers but also mid-level technicians, researchers and teachers and mainly from within the Ministry of Agriculture (MES/4). According to CEAS staff member MES/4, "*In the recent crisis, continued financial support for training was the key to helping the country survive*."[188]

The emerging National Extension System

Throughout the decade, and historically, extension efforts had been unco-ordinated. In 2000, MINAG was starting to implement plans for a new national Agricultural Extension System, based on linking up current, diverse extension efforts to create a unified system operating in every province, with a wide complexity and diversity of different approaches and experiences. The overall aim would be for high yields with low inputs (MA/R/6), and to pass on more decision-making responsibility to farmers whilst maintaining balance with State production plans. Because farmers would first need proof that the system was useful to them, so it would at first be funded by the State, but with a gradual change toward farmers paying for these services. The new system would also incorporate the extension group of each research institute. The degree of participation with farmers would depend on the type of production system, crop, whether undertaken at municipal or national level, and so on, and therefore would only partly adhere to the recommendations of the SINCITA system.

Full advantage was taken of foreign collaborators to provide the material and technical resources. Several existing extension projects would form the backbone for this system. One was the continuation of the French-backed extension project in Holguin, extending this westwards to Camaguey (an important province for livestock) and Havana. This would commence in 2001. In parallel, projects would be developed in Granma and Cienfuegos, these supported by the FAO and

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[188] Plans of CEAS are ambitious. As Garcia (2002 p. 93-94) writes "*It is impossible to attain sustainable development of society without a sustainable agricultural sector and the safe food system it produces, and vice versa. In this light it is evident that training of traditional target groups is not enough. …a comprehensive quantitative determination of training needs would include almost all of the 11 million Cubans*." He estimates that approximately 100,000 people attend some form of agro-ecology training each year. He also notes that the teaching of agro-ecology requires a different methodology from that of conventional agriculture, for a more interdisciplinary, holistic and systematic approach.

using the farmer-to-farmer extension model of ANAP. MINAG extension departments in other provinces were also hoping to collaborate and were already making lists of the resources – especially new vehicles - they hoped would be provided.

8.3.8 Changes in specific research themes and structures

Development of research focus over the decade

Agricultural research themes had changed over the 1990s to include more non-chemical technologies. This was only partly a response to make research more appropriate to field conditions; the inability of researchers to obtain inputs for their own trials was equally a factor. Personal observations at conferences in Cuba suggested that, at the mid-1990s, research was focused on ways to recycle and reuse agro-industrial wastes[189] and some testing of more radical approaches (such as permaculture). Toward the end of the decade, however, the focus had moved on to a more sophisticated experimentation with ecological inputs and integrated strategies.[190] Researchers were also looking at approaches that had multiple uses, such as rotations and intercropping, which could benefit both soil fertility and pest control. Box 8.7 gives an overview of research themes presented at a national agricultural science conference at the end of 2000. More specialised conferences, such as on prioritised crops, would, no doubt, show different tendencies.

Box 8.7 Summary of research themes at major agricultural conference in Havana, 2000

The XII Scientific Seminar at INCA, Havana, in 2000, had, amongst its eight major disciplinary themes, sustainable agriculture, tropical bio-fertilisation and IPM. Sustainable research projects included family home gardens in rural areas, methodologies for regional sustainable development, socio-psychological appraisal of the livestock sector at municipal level, and sustainable agrarian management. Sustainable crop research included work on allelopathy, the use of microbes and bioactive substances, electrotherapy, hydro-thermal treatment, and insect colour traps. Considerable research was being undertaken on resistant crop varieties. Such proactively sustainable research was separated from the mainstream which was tending toward increasing the efficiency of chemical use and integrating organic inputs for those crops prioritised for agrochemicals by the State. Biotechnology had a strong presence.

Source: INCA, 2000

Soil fertility research

Three major challenges were identified as currently affecting Cuban soils: decreased soil fertility owing to previous use of inappropriate technologies, a rapid change in rainfall patterns because of El Nino, and soil compaction and erosion owning to previous high level of mechanisation. The Soils Institute's current objective was to increase use of alternative technologies whilst lowering the use of agrochemical inputs, in order to achieve a balance of the two approaches. "*Anyone who knows about soils can see that it improves with the addition of organic matter"* (MA/R/17). Staff were also aware of the differing crop growth impacts of organic versus synthetic nitrogen sources.

A wide range of strategies for soil fertility improvement was currently being researched including: bio-fertilisers (including nitrogen fixing, and phosphorus, iron and aluminium dissolving inputs), bio-stimulators (plant growth substances), green manures, mineral fertilisers, and industrial by-products.[191] Researchers highlighted some interesting emerging results, such as identification of

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[189] A typical research project was, for example 'Mango peels as a new tropical fibre: preparation and characterisation." (Larrauri et al., 1996).

[190] Here, a typical research project was 'Herbicide-resistant sugarcane (*Saccharum officinarum* L.) plants by agrobacterium-mediated transformation' (Enriquez-Obregon et al., 1998).

[191] While much experimentation was being done on alternative sources of soil fertility, one possible approach, that of using human waste as a fertiliser, was not being explored, "*There are lots of ways of stopping direct nutrient leaks without recourse to recycling human waste. For example, lots of biomass is still being burned, and also city waste. We can better increase efficiency of our nutrient recycling*." (MES/5).

a bio-input (‘sosperin’) which could work for sugarcane (MA/R/26), and proof that combining two biofertilisers worked to further increase yields (MES/R/4). Biofertilisers were showing capable of providing up to 80% of nitrogen needs and up to 100% of potassium needs for a range of major crops (Martínez Viera & Hernández, 1995; Riera et al., 1998). Yield increases of 4 t/ha of potato and 3.5 t/ha of squash were obtained through the incorporation of green manure crops (García, 1998). Based on the success of the Agro-ecological Lighthouse project (described in Chapter 6), there were plans in Havana to set up six more. Notwithstanding these results, different researchers provided different accounts of the importance attached to sustainability and to maximising yields. Box 8.8 contains comments from one senior organic soil researcher about the overriding priority accorded to maximising yields.

Box 8.8 Impacts of policy priority on the quality acceptance of research results.

“We recently ran trials of a new agrochemical compound fertiliser for potato, which came from Mexico. The formula contains specific minerals, and we found that potatoes yielded very well with this. But to achieve such high yields we exceeded the sustainable limit in terms of dosage, and the potato harvest contained over the legal limit of nitrate levels. Production costs were also higher. But this country’s policy is to obtain the highest yields whatever the costs, and we in the research sector are not in charge of what happens with our results. I had wanted to use green manure in the trial as a sustainable comparison, but we were given only short notice to undertake these trials and had no seed available.”

Source: MES/R/3

Researchers with a more industrialised background felt that fertility requirements of Cuba’s depleted tropical soils, and the need for increased productivity, meant that ecological treatments could not completely substitute for chemical fertilisers, even if in lower quantities than before (e.g. 15kg/ha N for maize). Other crucial soil improvement strategies were the use of the multi-plough (to avoid inverting the topsoil), and enforcement of laws on soil protection by MINAZ, MINAG and ANAP. Some expressed that the soils sector was relatively slow in its uptake of ecological approaches. Researcher MA/R/31 explained, “*Soil conservation measures have been slower to change than other technologies since the 1980s. We can use associate crops or use anti-erosion measures but this is not widespread. There are only 2 alternatives: the use of organic manure or of green manure. Composting is alright for small areas but it is not customary, and manure is expensive because production is not integrated*.”

Overall, researchers at several institutes felt that there were situations in which organic inputs could provide higher yields than agrochemicals, and other situations where there could be used as complements. However, they felt that it would take a long time to completely change farmer attitudes towards using ecological soil fertility strategies, and also that there was insufficient organic matter to return to the soil. As one researcher explained “*Farmers prefer not to use rotations and green manures because they have conventional thinking, so we cannot be revolutionary in our recommendations because it will not work in practice – farmers’ won’t accept it*.” (MA/R/31). In relation to this, farmers required training to both increase and correct their knowledge. According to researcher MES/1 “*Farmers think that weeds can grow from applying manure. They should know that the manure’s own process of fermentation will kill them*.”

As well as consideration of farmer acceptance of a technology, another important factor was the degree of control that could be handed over, and in relation to this, perceptions on farmers’ capabilities. This reflected other institutional support staffs’ similar concerns. Biofertiliser production was felt to be difficult to decentralise or put in the hands of farmers due to the need for high quality production conditions. While some researchers felt that production of simpler products, such as mycorrhiza, could be decentralised, others, in several soils departments, still maintained that mycorrhiza production required too high quality standards for this to happen and instead were setting up their own regional bio-fertiliser production centres. Similarly, soil researcher MES/R/20 felt that farmers could produce their own *Rhizobium*, whilst another researcher from the same institute (MES/R/4) disagreed, explaining “*It is difficult to break the farming traditions of old farmers, and also of the State enterprises. It has even been easier to introduce these products outside Cuba, for example export them to Bolivia, Colombia, Venezuela or Mexico*.” Some of the hesitation in decentralising technologies was also likely due to the opportunity for institutes to generate income through the commercial development of these technologies (described in Box 8.1).

Pest and disease control research

INISAV, the National Plant Health Research Institute, was advocating control mainly through IPM rather than purely chemical means. Given the lack of chemicals, IPM offered the opportunity to increase production, meet demand, and ensure quality and economic viability. IPM could take several forms, including the use of biopesticides, chemicals, entomopathogens and the conservation of natural enemies. Other techniques being advocated included crop rotation, intercropping, and the use of resistant varieties.[192] According to Perez & Vázquez (2002 p.112) *"Biological control is the cornerstone of the methodology. The greatest successes have been obtained in the mass rearing and release of natural enemies and in the development, mass production and application of insect pathogens*." Biopesticides had the advantage of leaving no residue in the crops (MA/R/27). Further, they were more economical and there was the potential to produce them domestically. Maura (1994) calculated the total cost of using bio-controls as 1,172,495 pesos (or $58,625), compared with US$6,175,345 required for importing chemicals to do the same job. New bio-products were proven effective in controlling *Spodoptera*, *Apius* and *Helicorerpa* in maize (Estrada & Lopez, 1998). Yet some researchers considered pest control as the biggest hindrance to becoming ecological, as there were often no solutions to specific pest problems. Several, for example, felt it impossible to control *Thrips palmi* only through biological methods.

Included in bio-pesticide research was investigation of plant extracts, the use of which as a pest control had not been considered until 1990.[193] Main species used were neem, paradise tree (*Melia azedarach*), tobacco, sunflower (*Solanum mammosum*) and marigold (*Tagetes patula*). [194] INIFAT had, since 1989, been investigating neem (*Azadirachta indica*) and had an on-site pilot-scale neem processing plant. Neem seeds were obtained from Ecuador and the Dominican Republic. The research programme included the establishment of plantations on degraded, marginal lands, and over 50,000 trees were planted nationwide; farmer groups propagating and planting, and INIFAT processing the seeds. Perez & Vázquez (2002, p. 24) point out, "*One of the advantages of neem extract is that complex extraction techniques are not necessary, therefore small-scale cottage industry production can be introduced to farmers and co-operatives*."

On the other hand, black sigatoka in banana was traditionally currently controlled through manipulating local humidity and airflow, and through the use of systemic fungicides, which currently cost the country $1 million per year.[195] Overall, pest and disease control costs accounted for 50% of the production costs (MA/45). A control method for black sigatoka was a domestically produced preventative biological control agent – 'sodomona floreza glutica' which showed in research conditions to achieve 40% control. However a recent study showed that banana IPM was currently less cost effective than chemical control measures.

Plant genetic resource research

Mainstream research into plant genetic resources, and plant breeding, had appeared, from Chapter 6, to be in little accord with the conditions on farmers' fields. Some plant breeders were aware of

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[192] Although the Institute avoided focusing on just one or two resistant crop varieties, because, "*often a pest will eventually emerge – for example in 1979 we lost 60% of our national sugar harvest in this way*." (MA/45).

[193] Although livestock health issues were not covered in this research, similar alternatives have been developed for the livestock sector. At the National Centre for Livestock Health (CENSA), for example, two products have been developed: 'Udertan' – a natural disinfectant to prevent mastitis in cattle, and 'Cikron' – an natural antiseptic for treating lesions (Boletín Alerta Informativa, 1997). Other uses of plant extracts included substituting for petroleum-based ingredients for cosmetics (MA/R/25).

[194] Fifteen plantations of neem and paradise tree and four processing plants with a capacity of 200 t/pa each were established (Perez & Vázquez, 2002).

[195] Black sigatoka is controlled in other countries through up to 40 sprayings of fungicide per year and comprising a quarter of production costs (INIBAP, 2003)

the poor quality of seeds from the Seed Enterprise and would not recommend them, although they understood the constraints. These researchers found themselves "*caught in the middle between the campesinos and the Enterprise. Last year there was a drought and many varieties suffered, even criollos, but the campesinos blamed the Enterprise for it.*"

Because of lack of resources, Cuba was only recently undertaking more hybrid production. It continued to send promising germplasm abroad for the development of stable commercial varieties. Nevertheless, strategic changes were seen at provincial level and showed differences from Havana. One grain research station in Holguin had shifted its main tasks to seed production, training provision, and maintaining contacts with national centres. Its selection criteria had also shifted, from high-input to low-input responses. As maize in this region exhibited more natural resistance to leaf borer, so MINAG was strategically upscaling maize seed production from this region. The station's technical brochures recommended integrated management, although its scientists held differing opinions; some bearing in mind farmers' preferences for the infrequent use of chemicals, and others concerned of the need for integrated soil management in this severely degraded region. In this region, according to one plant breeder (MA/R/12), farmers' knowledge levels were higher, with many farmers successfully crossing hybrid maize and managing their own seeds.[196]

Banana breeding, on the other hand, tended to focus on breeding for farmers who had irrigation systems, and switching to the new, more resistant, FHIA clones. For those farmers without irrigation, they were shown how to grow bananas in the presence of black sigatoka, how to 'live with it' (*convivir ajuntos*) by being aware of the main risk months, and how to introduce the application of manure which would strengthen the roots against attack. Farmers were obliged to drop their traditional 'burro' for the new FHIA 03 'burrito', and to new fruit varieties including FHIA 21. Popular traditional but vulnerable fruiting varieties such as 'Manzano' were now only allowed to be cultivated in home gardens. Replanting after Hurricane Lily also prioritised several FHIA varieties. Banana breeders were particularly pleased with the FHIA 18 as being tolerant to low water availability and to pests and diseases. Yet these varieties were, as seen in the previous chapter, not so popular with farmers – for example, FHIA 18 was tall and therefore susceptible to hurricane damage, and researchers were less clear of farmers' preferences or reasons for these.

As well as the PPB Project described in Chapter 6, there were a handful of other innovative genetic resources projects. One underway at INIFAT focused on '*the contribution of home gardens to the in-situ conservation of plant genetic resources and farming systems*', Similarly foreign-funded[197] and aimed at increasing household food self-sufficiency, its multidisciplinary team included plant breeders, geographer, anthropologist, biodiversity and training specialists, all from different institutes.

Research on agricultural water usage

There had traditionally been a low guaranteed water supply (to only 30% of agricultural land), and poor distribution of rainfall (80% falling in May and droughts in the eastern provinces), and the State had historically focused on water storage through massive dam construction programmes. Within this, and into the 1990s, research on water management was focused on improving the efficiency of irrigation systems and on the technological problem of transporting water to where it was needed under the resource-restricted conditions.[198]

The mandate of the Research Institute for Irrigation was to investigate methods to reduce petrol use, to make fieldwork efficient and easier, and to save on water (such as the use of grey water). Yet more ecological water management strategies were not generally favoured. Agroforestry was not

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[196] This compares to Havana Province where farmers did not generally know this.

[197] Donors for this multi-country project made special exception for Cuba to participate in terms of resource allocation; Cuba was the only participant to receive a project car, due to its recognised transport difficulties (MA/R/18).

[198] The majority of available water was being used by a few crops: sugar used 39% of irrigation water, roots, tubers and grains 21%, and rice 16%. Other users were citrus, pastures and forages, and tobacco. Several crops were not prioritised for irrigation, maize in particular as it was considered to have too many pests and diseases and was anyway a low-value crop.

considered as a viable option for encouraging water retention because of perceptions that crops would not receive sufficient sunlight, and good irrigation was required to achieve high yields. Techniques such as mulching were considered inappropriate for large farms. One ecological technique was widespread: all livestock farms had a wind pump to bring up water.[199]

Research on farm traction and machinery

Because only 15-20% of the Cuban population lived in rural areas, so a dependency on machinery was seen as obligatory (MES/5), although "*this is done in a rational way, combining animal traction and minimum tillage*." The Research Institute for Agricultural Mechanisation, IIMA, starting researching into alternative forms of tillage as early as 1982, as it saw it was more economical. With post crisis declines in the availability of fuel and spare parts, the Institute reduced its promotion of traditional, fuel-dependent tillage practices and refocused toward the following:

- productive instruments with lower petrol requirements,
- animal traction implements,
- promotion of traditional knowledge,
- promotion of integrated management,
- conservation of the soil, flora, fauna and organic matter.

The most costly farm activity in terms of petrol consumption, was soil preparation. In an attempt to reduce topsoil inversion, IIMA identified an old technique of horizontal cutting, using a multi-plough (*multi-arado*). This technique required less energy (40-50% of previous petrol use) and was more economic. The horizontal cut left residues on the soil surface for a milder decomposition, which meant that land could be used sooner after ploughing (7-15 days compared to 45-90 days), and there was less compaction and a lower incidence of weeds. Further research was underway to conserve soil humidity (and therefore irrigation), and to adapt the plough to stoney soils.

Farm equipment was also being adapted for use with oxen. While some researchers thought that this approach had enormous nationwide potential (e.g., Sotto Batista et al., undated), other reports were less optimistic about its potential. Tending oxen was seen as a hard job in which "*the* campesino *has to be a slave to the animals, looking after and feeding them daily even on non-work days'* (Espinosa la Rosa et al., 2000). Especially in the central region of Cuba, animal traction covered almost a quarter of the total cultivated area; this generated an unmet need for blacksmiths and yoke producers, as well as fodder production and increasing awareness of health requirements. In addition, most ox-handlers were approaching retirement age and training of younger replacements would therefore be required. Finally it was felt that the fuel savings were not that great (*ibid*). Theft of oxen and the need to maintain constant vigilance added to the ox handlers' worries and workloads. In general it was found that many producers tended to use tractors for soil preparation and oxen for subsequent husbandry activities (Ponce Ceballos et al., 2000; this research study, Chapter 7). Oxen were a complement, but not an alternative to, mechanical approaches.

Other innovative and sustainable research issues

Although this study did not include other husbandry issues, it acknowledges the substantial research on intercropping and rotations, and on crop-livestock interactions. Based on the Land Equivalent Ratio, all common intercrop associations were proven to be more efficient than monocultures, and polycultures shown to provide huge benefits in modifying the extremes of the physical environment of the agro-ecosystem (Casanova et al., 2002). The integration of previously separate crop and livestock units, on small units managed on an agro-ecological basis, showed to equal or surpass previous milk yields, improve energy efficiency and increase biodiversity, whilst decreasing labour

[199] In terms of alternative energy, pilot projects indicated that Cuba could meet all its electricity needs from sugarcane bagasse. Cubasol, a national NGO, was researching and developing renewable energy projects (Montanaro, 2000). One UBPC in Holguin was experimenting with solar-powered microjet irrigation.

intensity over time (Monzote et al., 2002). That these techniques were not widespread denotes the gap between successful research innovation and practice. This was likely to be at least partly because of the physical difficulties in widespread promotion, but also due to levels of farmer acceptance, and possibly acceptance within the wider institutional framework.

A burgeoning number of ‘sustainable’ research projects were developing across the country. The most longstanding was that of the Sustainable Agriculture Studies Centre (CEAS) of UNAH in Havana, which apart from its Agro-ecological Lighthouse project was also running a conversion project. Their research was conducted in a participatory fashion, and on-farm, and their work team was multi-disciplinary. In Cienfuegos, a university department of agriculture was operating three specifically sustainable agricultural projects amongst its range. The first was on sugarcane production, featuring sustainable technologies that included the precision application of chemical fertilisers as well as sugarcane by-products. The other two projects were the sustainable production of proteins, which attempted to promote the use of local feeds for animal protein production, and the sustainable development of tropical livestock. Here then, sustainability meant integrated approaches, and those that increased self-reliance.

In Holguin, another university Department of Agriculture was running an experimental/demonstration agro-ecological *finca* (linked to those in Havana) for the development of alternative methods of integration (financed by CITMA rather than MINAG). The farm itself was a working New Type State Farm with a State production plan, and with workers linked to the land. Experimental issues around sustainability included increasing efficiency of sprinkler irrigation pipes, and regionalising plant genetic resources. The project had attempted to avoid using agrochemicals, but yields dropped too much and alternatives were, for them, too slow and labour consuming. Participatory research was too costly, and generally farm workers resisted on-farm experimentation because of the potentially lower yields. On-station trial results showed far higher performance than results on-farm, and researchers put this down to both the lack of farm resources and of proper linking of man to the land. *"The key word is 'technological discipline' which is lacking*." (MES/R/2). Here, applying sustainable production techniques appeared to be incompatible with wider farm conditions.

Biotechnology research: the GM debate in Cuba

In the early part of the 1990s, the State invested some $100 million into the Biotechnology Research Centre (MST/R/2), for both agricultural and medicinal advancements. This was seen as a major potential source of foreign revenue (Nash, 1996). The main research centre was the Institute of Genetic Engineering and Biotechnology, with 1,132 personnel (The Royal Society, 2001). In 2000, the Institute was experimentally developing transgenic varieties of sugarcane, banana, citrus, tomato, maize, papaya, rice, cassava, dasheen (taro), pineapple, livestock and fish. Objectives of such experimentation included enhanced resistance to insects, fungi, viruses and herbicides, control of maturation, animal nutrition, and food and industrial quality. They were not permitted to work on tobacco because *“the clients would not like it and our tobacco industry is export oriented.”* (MST/R/2), thus indicating awareness of international concerns.

Yet biotechnology in Cuba was broad ranging and, as Rosset & Cunningham point out (1994) it also included the ‘cutting-edge’, locally-controlled approaches of mass production of naturally occurring organisms used as biopesticides and biofertilisers. This approach showed that biotechnology *“does not have to rely on multi-million dollar infrastructure and super-specialised scientists, but rather can be grasped and put into production even on peasant cooperatives*” (p. 5). Nevertheless, Cuba’s relative isolation meant that scientists were cut-off from the ongoing international public debate on transgenes. Amongst the wider scientific community, there appeared to be limited knowledge about the scope of the debate in other parts of the world, and the main concern was that the technology was costly (MH/R/3; MES/R/4). The organic movement highlighted some of the concerns being expressed from abroad. Fernández et al. (1999), for example, pointed out some the environmental and social risks involved, and raised the question of the appropriateness of biotechnology. Such expressions of concern forced the biotechnology sector, toward the end of the decade, to start defending its position.

Given the pre-decided investment in genetic engineering, for the Cuban biotechnology sector it was not so much a question of "if" such development should go ahead but "under what circumstances". It was considered more a matter of checking for safety. Advantages and disadvantages were put forward by the industry (although the author did not encounter the full raft of disadvantage). Some of those involved in promoting GM technology also supported ecological agriculture, arguing that GM technology could play a role in promoting more sustainable agriculture, as well as increasing the nutritional content and shelve life of food. Just as the international organic movement had promoted its interests in Cuba, the international biotech industry was doing the same. For example, Monsanto was pushing, through the US Grains Council, for food sales to Cuba and has participated in biotechnology events in the country. Reporting on this, Keesey (2001) notes "*it remains to be seen whether Cuba… can turn down the engineered crops and protect the integrity of its biotechnology industry*."

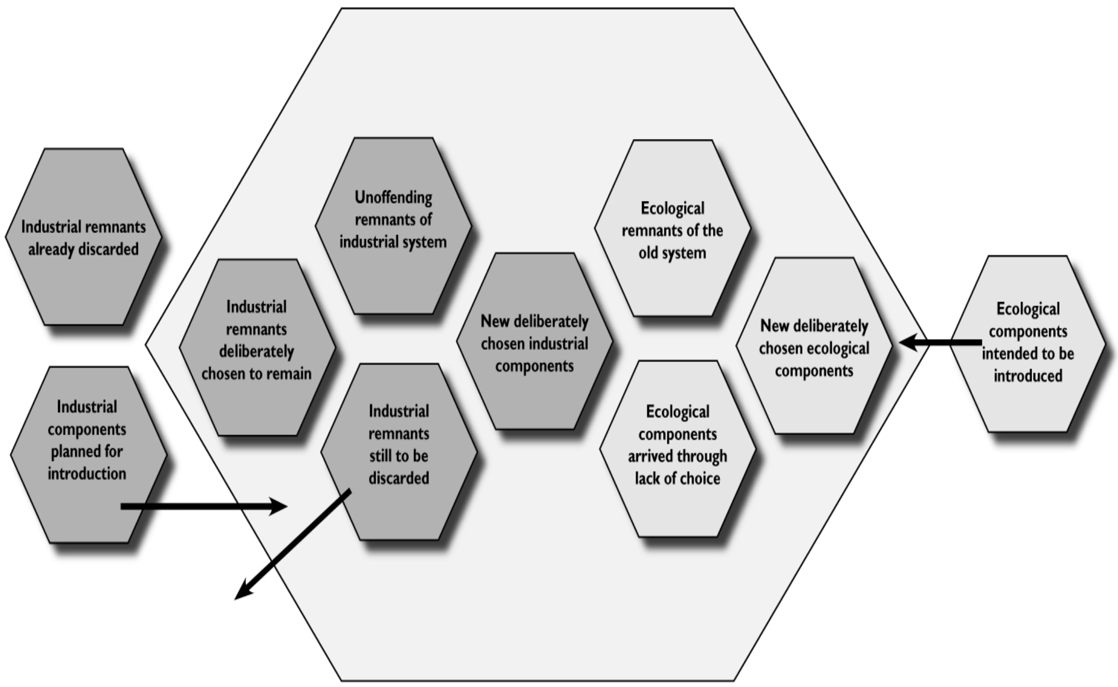
8.4 DISCUSSION ON INSTITUTIONAL CHANGE

8.4.1 Co-existing, contradictory components of a new type of agricultural system

A model of co-existence

Some evidence shows that the State was planning some sustainable reorientation of production prior to 1989. Yet an alternative explanation is that the crisis had been foreseen, but for political reasons more overt mitigation actions were not taken until the buffer reserves were depleted in the early 1990s. In this sense, changes were made largely in response to external circumstances, only when no alternative existed, rather than because of a change in collective or political attitude.

Figure 8.2 Coexisting components of the emerging agricultural system in Cuba



At the end of the 1990s, it was possible to distinguish co-existing yet apparently contradictory approaches within Cuba's institutional support system for agriculture. On the one hand, there were large tranches of the system which still adhered to an industrialised approach, yet these co-existed alongside more ecologically-oriented approaches. The structure of the present institutional support system is schematised in Figure 8.2. It is one that contains industrialised components that were left over from the old regime, some of which were harmless and would remain undisturbed, others which were still present but recognised as requiring change, and more still which had been deliberately chosen to remain. Similarly, some ecological components had been adopted prior to the Special Period, others were present by default as the only option possible, and others had been deliberately chosen as part of a new system. This model is useful in that it helps to clearly identify the factors influencing the complex mixture of components. It also indicates potential areas of future change. These include: a) whether (and how) to discard the unwanted industrialised components (given that "attitudes take time to change"); b) whether the ecological components which arrived through lack of choice in the Special Period would be chosen to remain (e.g. there were already signs that the use of oxen would diminish); and c) how to strengthen/revitalise existing components and introduce further new ones. Key examples and features of this melange are listed in Table 8.2, and an example of their interplay, or lack of, for the case of banana production in Box 8.9.

Table 8.2 Key examples of the industrialised and ecological components

Examples of existing industrialised components	Examples of existing ecological components
• Prioritised support for the distribution and use of agrochemicals, the use of which was increasing again. Evidence of this included the doubling of pesticide use since 1993, MINAG input recommendations of NPK at rates up to 1t/ha and a cocktail of chemical controls. • Continued research strategy of top-down technology development and dissemination • Continued main research strands on use of mineral fertilisers and pesticides. • Mainstream mono-disciplinary, technical and reductionist research approach, with results evaluated largely in quantitative, agronomic terms. • Highly industrialised seed sector, dependent on Havana and international sources for stock. Narrow range of seed available through official channels. • Industrialised outlook of the water sector, seeking to transport water from existing collection points (rainwater reservoirs) to where it was required.	• Research and development of a range of ecological soil fertility and pest and disease control inputs (wider uptake to some extent constrained by resources shortages). • Reorientation of research mandates to be more applied and farmer demand-driven. • Proposed development of six new agro-ecological demonstration farms in Havana Province. • Establishment of provincial Processing Centres for Organic Matter and Vermiculture. • Commercial production of ecological soil fertility and pest control products. • Area treated with biological pest control methods increased from 300,000 in 1988 to 900,000 in 1998. • Continued training provision in agro-ecology. • Stronger farmer tenure of land, and increasing number of smaller farmers and farms • Decentralisation for self-sufficiency at farm and provincial levels. • Policy for diversification and integration. • Emerging multi-disciplinary research perspectives. • Promotion of drip irrigation to avoid soil erosion. • Research on farm mechanisation focused on innovative equipment (the multi-plough), and fuel and labour saving approaches as well as the promotion of traditional knowledge.

Box 8.9 Banana production: ecological, industrialised or somewhere between?

Only 27% of banana production was earmarked for receipt of agrochemicals, and mineral fertiliser use for this crop had dropped by more than 90% since the late 1980s, from 60,000t to 7,000t in 1999. There were regional differences in use of fertilisers. They were used in Havana Province if they were available, in conjunction with microjet irrigation. Other areas, however, were relying on on-farm and local resources. Yet despite this, banana was often perceived as a prioritised, high-investment mono-cultural crop.

Yet there were complex dynamics at play, influencing the extent to which banana production had become ecological. The crop also received high doses of manure: up to 22t/ha, and technical bulletins for banana in the 1990s promoted an integrated approach with relatively low mineral fertiliser inputs (1.5 t/ha), some chemical pesticides, and organic fertilisers (particularly potassium from e.g. tobacco, algae, potato skins). Outside Havana, producers (see chapter 7) were intercropping banana with other crops, both trees and, in the early years, ground-crops, and this was shown to be beneficial economically and in terms of soil fertility (Cuadra Molina et al., 1993). Yet other research advised against intercropping as it hindered growth and was thought to encourage nematodes. Farmers were also using manure, bio-fertilisers, and mulching with fallen leaves, even though there was legislation against this due to potential disease spread. Windbreaks had been used in the past, but these been found to ineffective against hurricanes and an impediment to aerial spraying. Yet windbreaks were now being reintroduced in some places, often using other productive tree crops, such as avocado or citrus.

A nationwide planting programme had been instigated, replacing traditional Cavendish and burro varieties with the new FHIA varieties both fruit (18 and 21) and plantain (03 'burrito')- from Honduras. This was largely a response to the lack of chemicals to deal with the threats of sigatoka and weevil. Some recent research showed that a biological control product, *sodomona floreza glutica* (a by-product of the sugarcane industry), was able to achieve 40% control of black sigatoka. Some agronomists felt that FHIA varieties were more resistant to pests, and less susceptible to lodging. The varieties were now quite widespread but were found to require higher input levels especially of water and some were still hit by hurricanes. Farmers had, meanwhile, been rejecting these varieties (and reverting to the older ones) because of their higher input requirements and their watery texture and lack of flavour. FHIA fruit varieties were yielding 80t/ha under drip irrigation in Havana province, yet low and zero input production were achieving the same yields in some other places.

The State's 10-year plan for banana was to double production to meet rising consumption rates, through a mixture of intensive and extensive approaches. The plan also mentioned organic banana production, for export. Overall, the strategy for banana production was haphazard, quite unlike the previous planned approach yet with some common features also.

Clues to future directions

Because of the integrated approach that Cuba was developing, so these features existed, together, at varying proportions in different sectors and regions. In terms of the future, on the one hand, there was also a pervading perception that it would take a long time to make any further moves away from traditional institutional mindsets and linkages, and there was also a pervading priority to increase yields. On the other hand, the work of pioneering individuals during the early and mid parts of the decade had led on to more institutionalised reforms in the latter part, such as the New Paradigms Initiative and the nationwide Agricultural Extension Service, and although these were still policy rather than practice, they may, together with the continuation of farmer empowerment (through land tenure and market provision) and educational opportunities, gather momentum to lead to further and more widespread practical changes in the new millennium.

8.4.2 Defining the causes and results of change

Transitional change in the institutional sector

The changes in the institutional sector are variegated, and although the only large steps were taken by institutional pioneers (such as of the R&D projects of the mid 1990s), smaller changes amongst other actors may be more significant depending on their starting point.[200] For example, those sectors which have had an embeddedness of industrialisation, such as the Seed sector, and be at the first stage of a transition process, may take more effort to reach stage two – of letting go of industrialised processes, than sectors further along the transition process such as the longstanding IPM approach of the plant health sector. The farm mechanisation sector, in this respect made massive changes from a dependency on large scale machinery and petrol to one of appropriate, locally produced technology, local knowledge, environmental soundness and animal traction, and this overshadows the use, or non-use, of other renewable energy sources in the sector. Compare this with the irrigation sector which moved only a short pace forward. Therefore, it may be argued that transition is relative, and possibly with some plateaux phases where a new insight (into a new paradigm) is required in order to progress. Another interesting observation is that some of the biggest leaps forward emerged out of the most industrialised sectors: the PPB Project out of the seed sector, and the UBPCs out of the State farms.

Changes in structures and orientation

The Special Period certainly caused much change in the agricultural sector, not only in terms of farmers' access to inputs but also the way in which institutions were able to operate and the priorities that they adopted in response to the new situations that they faced. These responses were in turn influenced by the country's existing structures and its political ideology. In the first place, institutions were restricted in the type of work that could continue or initiate. Lack of fuel constrained the ability to reach field sites, and a shortage of other inputs meant experiments, trials and extension work dependent on intensive approaches could no longer be pursued. Equally there were fewer materials available to publish or exchange research findings.[201] Some ecological initiatives were also disrupted by these changes; for example the development of bio-fertilisers was restricted by a lack of substrate material.

At the same time, subsidies to the agricultural sector were significantly reduced. Institutions such as MINAG had to generate at least some of their income and some of this in US dollars. These restrictions led to an increase in institutional accountability, and work becoming valued in terms of application. All research institutes were attempting to commercialise products (such as machinery or bio-inputs) and services, although most did not have the relevant training in business management or marketing. Universities had introduced fees for research services even though the fees covered only 10% of their real costs. Some agricultural enterprises extended the remit for self-provisioning by producing crops for sale. Many institutions struggled with this change as they lacked the know-how and resources to initiate successful responses. Equally the economic situation was not favourable for setting up new initiatives, as everybody's purchasing power was diminished. In this situation, institutions looked abroad for financing, for developing agribusiness partnerships and participatory and ecological projects.

These factors occurred against a background of, and contributed to, a significant level of organisational restructuring. Research was more focused on applied (and often more inter-disciplinary) techniques, which could be commercialised and disseminated rapidly. There was also more research on regionally specific questions. There was a general trend towards decentralisation of research units, which coincided with the merging at provincial level of previously separate support institutes. As a result of these changes, staff were obliged to carry out extra tasks at their institutes, producing food, developing more applicable results or taking on other responsibilities (such as security work). Accompanying changes on-farm were the strengthening of the campesino sector, increased revenues including in dollars, more financial responsibility, higher demand for ecological inputs, increased automation of irrigation, downscaling and diversification, and a general increase in focus of the support sector on campesino agriculture.

[200] Since then, staff at CEAS have provided more clarity on direction. "*The Cuban model of conversion has been marked by an initial phase of input substitution, replacing chemical inputs with biological ones*" (Perez & Vászquez, 2002).

[201] As a result many research findings from this period continue to lay unread in desk drawers.

It was in short an unsettling period, with people having to take on new responsibilities, often outside their disciplinary and professional training. Yet it was one in which new opportunities also emerged that some were able to take advantage of.

Degrees of decentralisation, representation and autonomy

Simultaneous processes of institutional centralisation also occurred during this period. For example, MINAG had incorporated other agencies under its wing, including the State Enterprises and Acopio, as well as some of ANAPs' tasks. By contrast, at the end of the 1990s, responsibility for seed certification passed from the Seed Enterprise to Sanidad Vegetal and responsibility for supplying seed to the Mixed Crops Enterprise. Seed production was transferred from State farms to the more productive private farming sector.

The previously paternalistic approach of the State meant that agricultural support personnel still strongly influenced production strategies. Their opinions remained important because they could still be interpreted as indicative of State policy, and especially those ex-State farmers took their views as prescriptive and were slow to make production choices for themselves. Perhaps because of this, there was also some institutional hesitance about farmer capacity and the degree to which they could be given autonomy, not only in relation to markets and the dangers of increasing wealth inequalities, but also over the degree to which activities such as biofertiliser production or seed saving could be put into farmers' hands.

Overall, the production sector was relatively very well supported. Institutions had high, and educated, staffing levels, and the State continued to subsidise the sector albeit at lower levels than previously. This high level of support also meant that the State was able to drive through policy rapidly and extensively. Notwithstanding the centralisation and the transport shortages, by the end of the decade there were numerous official mechanisms for farmer-institutional interaction, and especially around the occasions of planning production. Further, there was a mutual respect, private farmers being acknowledged as difficult to persuade and as holding a key to the future for domestic production; and yet still desiring institutional back-up (such as from ANAP). Degrees of participation varied however. Older farmers, for example, were reticent about their 'old fashioned' knowledge, and CCS farmers about their actual production potential.

Institutional and individual coping strategies

Various coping strategies emerged, detected through individuals' attitudes towards their situation as well as through institutional policy. Those observed are described as follows:

- Business as usual: some institutions, departments and individuals carried on using the same approaches, and blaming externalities (such as farmers, the weather or policy) when these approaches did not work. They were waiting for the external conditions to change.
- Try something different: some actors and institutions, in fact many, were at least to some extent taking up the offers of change and alternatives, whether it be different methodological approaches inspired from external influences or promoting the new diversification options of Raul Castro.
- Focus attention on those who can continue industrialised: some recognised that external conditions were different, but they chose to focus on the pockets which had remained the same, such as on the well-endowed and prioritised farmers or on the old State farms, and inputs were rationed to these.
- Institutional bravado: some interviewees were adamant that they had not experienced difficulties through the Special Period and thus had not overtly responded to such difficulties in any meaningful way.
- Opportunity to flourish: some who had previously been working on unpopular topics found that they suddenly had something useful to contribute, and used this opportunity to promote their interests into the mainstream.

Institutional experiential learning from the Special Period

Aside from reactions to the conditions of the Special Period, some specific learning experiences took place which resulted in interesting innovations and mechanisms. These included a recognition of farmers' capacity to innovate as well as their ability to reject technologies, more nuanced and ecologically-based agronomic strategies, the application of local resource use in other sectors (such as the cosmetics industry, or plant based medicines), cost savings of ecological approaches, and awareness of the need for a mental shift (although the finger always pointed at some other group or individual requiring change). These learning experiences to some extent related to the transition process.

Cost savings were of particular interest during the period, as economic factors became a greater concern. Green manures were shown to save between 623 and 1,503 pesos/ha ($31 to $75), according to the crops and species used, through higher crop yields and reduced use of purchased chemical fertilisers.[202] Other economic benefits of ecological production methods include lower milk production figures of 4.3c/litre for no-external-input systems compared with 5.5-6.0c/litre for systems purchasing feedstuffs. In mountainous regions of Pinar del Rio, cost-benefits of constructing drainage bunds and use of green manures were calculated at $161/ha for maize and $3,985 for tobacco over 3 years. In addition, some interesting findings were emerging which would otherwise have not been encountered if the research sector had not been forced to reorient. These included:

- Inoculating tree seedlings was found to save substantial costs on nursery activities through doubling of germination rates (Garcia Ramirez, 1999).
- Some biological controls (e.g., *Telenomus sp*. and *E. plathyjpenae)* were proving more effective in controlling maize leaf borer than chemical insecticides.
- Neem extract was showing potential not only as a crop pest control agent, but also in the control of ectoparasites in livestock and domestic animals (Pérez & Vázquez, 2002).
- The success of molasses traps in encouraging the lion ant (*Pheidole megacephala*), a predator of sweetpotato weevil (Perez et al., 1998).
- Identification of 53 crop varieties resistant to nematodes and with a potential for incorporation in rotations (Pérez & Vázquez, 2002).
- Increased resistance to pests and to drought amongst *Rhizobium*-innoculated plants.
- Success with using Trichoderma to control *Thrips palmi,* helping bring yields back to pre-infestation levels (MA/16).

8.4.3 Nuanced features characterising Cuba's current way

The Cuban interpretation of the ecological perspective

Cuban visions of ecological production placed more focus on the need for more crop-livestock interaction (given their previous specialised farm units) and on energy, fuel and land efficiency rather than on the avoidance of agrochemicals or on straight economic efficiency – partly because they were not operating in a neo-classical market economy, and also because of their key constraints. As one interviewee described "*Cuba talks about ecological agriculture which is one step beyond organic agriculture – it has to show sufficient yields to solve the food crisis… The conventional model can't solve the problem, but the agro-ecological model can, through a slow but steady process of increasing yields and quality*."(MES/5). In addition, many equated organic agriculture with prohibitions, and saw it as the flip side of the green revolution.

Notwithstanding the industrial components, there was a relatively pronounced mainstream presence, or awareness of, an ecological knowledge base. Cuba's interpretation of low-input terminology was also notable, since it often consisted in practice of zero inputs rather than low dosages. It was research groups, rather than farmers or support staff, who appeared to have more of

[202] These savings do not take into consideration the additional benefits of improved soil properties.

a holistic perspective and to include social and economic aspects.[203] Notwithstanding their relative isolation from the international arena, the Cuban perspective on sustainability was both cutting edge and pragmatic, demonstrating an understanding of the role of ecological science, of natural processes and equilibrium, of social and economic considerations, of reductionism versus holism.

The patchwork effect of input usage and availability

Agrochemical input distribution and usage was uneven between regions, farms and crops. In this sense, there was a national patchwork effect of more and less intensive production. Although this was caused largely by resource constraints, it was also affected by production plans, by urban and peri-urban production, by areas where a local variety was particularly robust or a particular ecological input easily available, or by innovative individuals and institutional projects. For example, Havana was more intensive than Pinar del Rio, sugar received more agrochemicals than maize, crops destined for the Seed Enterprise were prioritised, high-performing farmers received more inputs again.

Although the prioritisation system systematically valued agrochemical farming and undervalued ecological farming, it was an arguably successful strategy for maintaining production levels during critical years; higher-potential farms served as models for other farmers, and morale and hope were sustained. Particularly the campesino farmers had depended on these inputs (from the SCC) at least up till 1996.

The vanguard top-down agricultural bio-input services

One area in which Cuba had acted a world leader has been in the development of an extensive and wide-ranging biological input service network. This has potential transferability to other countries / situations. Pragmatically it is an approach that is entirely congruent with an agribusiness-led support structure, and in fact much of the institutional support sector has taken up the commercial production of ecological inputs as a means toward financial self-sufficiency. Because of its substitutive nature, there was little need for attitude change, at least at the outset of the transition towards a more ecological approach.

Specific features of the CREEs stand out: that they were diverse in nature, output and location, that they received back-up from both upstream (certain ingredients from provincial levels and support from the research centres) and downstream (they could tap into the distribution network of INISAV's on-farm technicians and agricultural supply shops), that they undertook direct feasibility trials with farmers, that the simplest products worked the best and simple instructions were provided with the product, that they met up to exchange experiences, and that they were incentivised by internal competition.

It was evident that there were huge costs savings involved in using these products. A 1994 study showed the production cost of biological controls was less than 1% of importing agrochemicals to do the same job, and the money spent stayed in Cuba and helped build up local enterprises. This calculation did not take into account longer-term savings in public health costs.

Relatively high community awareness

The equality-based system in Cuba worked not only through legislation, but also because of some degree of co-operation or compliance. This was seen at farm level, where producers went along with the notion selling in capped price markets (assisted by free transport) or diverting surplus produce to areas of shortfall. This relatively altruistic (as opposed to individualistic) mindset was also seen in the research sector, where researchers ensured that benefits of innovations were passed

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[203] Monzote et al. (2002 p.207) describe crop-livestock integration "*This concept has implications which go beyond the technological-productive sphere, directly or indirectly influencing the economic, social and cultural conditions of farming families, by reinforcing their ability to sustain themselves*."

on to civil society, and where institutional expansion would not take place at the expense of unemployment in other regions.

Pluralistic research and extension approaches

Extension services were historically well developed – and included not only traditional means but also use of national media channels (including TV and radio) to disseminate farming news and techniques. Nevertheless, there had not been a joined-up, nationwide extension service.[204] The extension service was therefore reorganised, largely to adapt to the change from State to non-State production. Researchers had the responsibility to ensure that their results were practicable and to diffuse them, through State enterprises. This required greater awareness on the part of researchers about end beneficiaries, yet methods for approaching this were not well known. One researcher explained that "*Scientists have the know-how but we don't know how to transfer it.*" yet, despite this the traditional extension model, of diffusing a technology in year 4 of a 5 year research project, was still widely practised.

There appeared to be a close alignment between ecological agricultural projects and more participatory, multidisciplinary and systems approaches. It was not immediately evident whether this was primarily due to ecological groups in Cuba being more familiar with foreign approaches in general, or because learning and teaching about ecological agriculture inherently promoted holism and inclusiveness. Whatever the case, the new innovative approaches to extension largely came to Cuba from abroad.

Attempts to promote participation and other new approaches have been slow to be widely adopted and have raised some challenges: including inter-generational conflicts, limited understanding of the purpose of facilitatory approaches (and social science), mistrust by farmers of extensionists (based on previous experiences), experimental limitations of planned production, and difficulties receiving recognition as background facilitator. Nevertheless, some interesting outcomes included the realisation that private farmers were motivated by profit over yield increases, and the exposure to new methodologies such as for farmer typologising. Interesting future developments included the introduction of the fee-paying extension service. Mass dissemination did appear to work to a reasonable extent in Cuba, and the participatory approach was itself broadcast in a mass-diffusive manner rather than adapting the principles to the Cuban situation.

Level of adaptability and speed of change

The experiences of the Special Period illustrated differing degrees of adaptability to opportunities for change. Non-regulated policy changes were slow, such as of implementing the New Paradigms Initiative, yet overnight changes were seen in the following:

- Not only were farmers able to immediately take advantage of the new farmers' markets without any training in entrepreneurship, but the State also demonstrated speed in setting these up overnight.
- Rapid reactions to food security manoeuvres, such as to the bulletin which ordered surplus produce to be redirected to another province, which was instigated throughout the province on the same day.
- Researchers had to adapt to the resource poor conditions and also to externalities, such as after banana trial plots were destroyed by Hurricane Lily, the reoriented their research to compare the resilience of different varieties to hurricane damage (Diaz Barroso et al., 1998).

[204] A useful picture was painted in an analysis of the Agricultural Knowledge System in Cuba in 2000/01 which concluded that "*The AKS developed by Cuba is one in which farmers, extension services, educational centers, and research institutes interact together in a logical and coordinated manner. Such a model might appropriately be called a centrally coordinated agricultural knowledge and information system*." (Carrasco & Acker, 2002).

8.4.4 Agricultural policy and visions for the future

Current policy: increased yields over longer-term sustainability

The main aims of agriculture: to increase yields and increase sustainability, were somewhat at odds with each other. While the environmental policy in place was well-meaning and sought to tighten environmental criteria, it was not sufficient to establish a systematic direction for agriculture, to help all the actors move in the same direction and to gel together the components of the sector. Overall, the lack of petroleum and drive for self sufficiency have acted as the gelling factors throughout the country – stimulating a wave of localisation, diversification, and resource streamlining and substitution.

Cuba has shown that moves towards more participatory and holistic methodologies are useful but not essential for a move toward more sustainable agricultural techniques. The CREEs provide an example of a viable top-down alternative input service. Not all people are innovators and Cuba's example highlights the trade-offs to be made between benevolent paternalism and individual entrepreneurship.

Within the overall policy framework, institutional initiatives were diverse and promoted different forms of agriculture. Clearly lower-level policy makers were striving to find a balance (sometimes ill-defined) between increasing yields, and sustainable approaches to production, the latter informed by the negative experiences arising from agricultural modernisation and industrialisation as well as from international feedback. Yet on balance priority remained with increasing yields and increasing production. "*This country's policy is to obtain the highest yields whatever the costs, and we in the research sector are not in charge of what happens with our results*."

Two major influencing factors were the notion that "attitudes take time to change", and the variety of individual perceptions, and therefore desired actions. There was widespread perception that attitudes and habits were a major constraint to change. It was felt to take too long to completely change farmer attitudes. Because of this, some potential innovations were not promoted because of a perception that farmers would not be interested. In addition, individual perceptions varied widely on different farming strategies and their usefulness for different farm types. These in turn were influenced by the subsidies that continued to exist on chemical inputs and the transport to the farm.

Future trajectories

"*Everyone asks what will become of ecological pest management in Cuba, as we emerge from the economic crisis of the early 1990s. As more foreign exchange becomes available for the purchase of pesticides on the international market, it seems logical to some that Cuba will return to an intensive dependence on chemical inputs. Moreover, some think the current programme of accelerated reduction of pesticide use is simply a short-term, stop-gap answer to maintain production until pesticide imports are affordable once again. But others – and they are more than a few – have a very different analysis, looking seriously at economic, social, health, and environmental factors, and conclude that the agro-ecological IPM model developed to date is simply a better model.*" Pérez & Vázquez, 2002, p.136.

Two potential trajectories could be discerned from the institutional responses:

i) A return to agrochemicals and a 'less-industrialised' model,

ii) A slight return to agrochemicals and a 'smart', knowledge-based agro-ecological model.

Backing the former trajectory were those who felt that ecological techniques could not perform in terms of yields. Backing the second were those who felt that the experiences of the Special Period, and levels of education and knowledge would mean a long-term development of an ecological system. Yet this would require continuation of "*a deep-rooted paradigm shift, already underway, allowing agronomists and farmers to view the soil as a living subsystem of an agricultural ecosystem that operates according to the laws of nature.*" (Treto et al., 2002, p. 184.) In a sense, those who saw the potential of ecological processes were able to harness these, whilst those who did not share this vision were unable to harness such unless as a group of adopters.

8.5 RECAPPING ON FIELD WORK AND METHODOLOGY

8.5.1 Wrapping up two research questions

This chapter and the preceding one set out to move on from a normative analysis of agricultural systems to deduce the interplay between the crisis and institutional and farmer coping strategies. On the one hand, improving knowledge and communication channels did not necessary mean that knowledge on ecological agriculture would flow (e.g. the farmer who had learned that merits of mono-cropping), and on the other, normative models were not necessarily applicable in Cuba where, for example, ecological inputs were being disseminated according to 'industrialised', top-down mechanisms. This chapter, along with chapters 6 and 7, have addressed the first two research questions of this enquiry; that is, defining the mainstream agricultural production system operating in Cuba, and identifying the coping strategies involved in developing and supporting this system. These chapters have also gone some way to identifying the factors involved in shaping an ecological production system. More on this will be provided in Chapter 10. Prior to that, however, the following Chapter 9 moves on to discuss the fourth research question, on Cuba's strategies for achieving food security over the decade.

9 FROM DEPENDENCY TO SOVEREIGNTY: FOOD SYSTEM TRANSFORMATION IN THE 1990s

"*Food sufficiency is closely linked to a country's food sovereignty and its political and economic independence*."

Republica de Cuba, 1994 p.71

9.1 INTRODUCTION AND METHODS

9.1.1 Food systems and security as a follow-on from farming systems

This research examines the transformation in rural Cuba in the 1990s from an petroleum-scarce, ecological perspective. This perspective extends beyond issues of production and related support, to embrace concerns over food quality and health, access to nutritious food, and localised and regional production-consumption links. The fourth research question of this thesis is concerned with the way in which the rural transformation in Cuba affected the food system in relation to food security, and Chapter 3 described food system concerns in more detail. These concerns resonate with the international food security debate, where civil society groups recognise that alternative models for agriculture are a key element to ending hunger and malnutrition, and advocate a rights-based approach to ensuring food availability, accessibility and adequacy for all. In terms of food sovereignty, Cuba is in an interesting situation, as it has not fully entered the global free market system and yet had a policy of prioritising the human right to food.

This chapter examines food security issues in Cuba, in the context of the rural transformation of the 1990s. Specifically, it looks at the changes in the availability, access and adequacy of food that have occurred as Cuba has striven to maintain its socialist values. Through this analysis, the following cross-cutting themes emerge:

- the resilience of the Cuban food system as it attempts to achieve food security through greater self-reliance,
- the role and effectiveness of the State in this regard,
- the relationship between farming approach and food security, and
- the degree of compatibility between a socialist approach to food security and an ecological food system.

9.1.2 Methods

Some of the primary data for this chapter was gathered on an ongoing basis between 1999 and 2001 throughout the field work activities of research themes 1 and 2. This was supplemented by other individual farm visits, interviews with and informal meetings with urban and rural householders, agricultural research and extension agents, and representatives of municipal, provincial[205] and national departments of the Ministries of Agriculture, of Science and Technology, and of Public

[205] As well as the three study provinces of Havana, Cienfuegos and Holguin, these additional interviews extended to include the provinces of Villa Clara and Las Tunas.

Health.[206] Much of the secondary data came from literature only available in-country. A fuller discussion of methodology is given in Chapter 4, suffice to say that the exploratory approach enabled a purposeful sampling to pull in a rich set of primary and secondary information around the thematic concern of this chapter.

9.2 FOOD AVAILABILITY

9.2.1 Overall food prioritisation

The Cuban socialist government has always placed a high political priority on ensuring national level food availability. Because of this, and notwithstanding the acknowledged "*gap between expectations and results*" (Nieto & Delgado, 2002), the experience and achievements of the 1990s may provide an example to other countries grappling with food security problems. The 1990s saw three main national strategies to promote food security. The first was the further development of their early warning monitoring system: SISVAN. The second was the fostering of domestic food production in terms of both quantity and nutritional content. The third aimed to guarantee equitable access to the available food. Key to supporting these strategies was implementation of a new National Nutritional Action Plan, commitment to importing necessary food, and backing this up with humanitarian aid. As a result, and as will be argued in this chapter, Cuba managed to ensure a subsistence level of food availability during the 1990s.

9.2.2 The politico-economic context

The economic struggle of the 1990s

Cuba faced a dire economic situation in the first half of the 1990s due to the collapse of its main trading partners and the ever-strengthening sanctions from the USA[207]. In 1992 and 1993 Cuba experienced a strong recession with negative GNP growth rates in excess of –10% (Garfield, 1999). Sinclair & Thompson (2001) point out that neither the World Bank nor the International Monetary Fund came to Cuba's immediate aid. Because of this, Cuba had to undertake a range of economic reforms: reducing expenditures across the board, re-orientating its trade relations (mostly towards Latin America and Canada), diversifying the economy (through developing biotechnology, pharmaceutical and tourist industries[208]), decentralising and increasing efficiency of national entities, attracting foreign investment through joint ventures, and allowing for the free circulation of the dollar including remittances from abroad (Alepuz Llansana, 1996).

The decline in GNP levelled out in 1994, and Government figures show a 7.8% increase in 1996. By 1999 the positive trend was continuing with a growth rate of 4.2%, and the Cuban peso, which had been operating at a dollar rate of 150:1 in 1994, was revalued at 20:1 by 1999. The budget deficit had reduced from $38.28 million in 1995 to $13.4 million in 1998[209],[210] (Nieto & Delgado, 2002).

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[206] Attempts were made to contact other Ministries related to the food sector, such as of Exterior and Interior Trade, and of Food Industry, but bureaucratic procedures prevented this.

[207] To compound the Torricelli Act of 1992, the Helms-Burton Act of 1996 set punitive measures against third country companies investing in property in Cuba which was previously owned by US citizens (Giles, 1997).

[208] At 1999, tourism provided 50% of foreign income (Figueroa, 1999[b]).

[209] Although the Economist Intelligence Unit estimates hard currency external debt to have continually risen over this period (EIU, 1997).

[210] In addition, Cuba appears to have outstanding arrears with the International Fund for Agricultural Development (IFAD), standing at $14.21 million in 2000 (IFAD, 2000).

Economic policy impacts on food strategies

State economic policy directed its food strategy. Castro (1996) explained that measures were implemented to "*Devote priority attention to those activities that produced export items, replaced imports or fostered sales in hard currency of exports and services on the domestic dollar market, both for the development of tourism and for the presence of foreign capital*;" and that measures were also taken to "*assign a priority to food production*". In terms of specific measures (Castro, 1996; Nieto & Delgado, 2002), certain of them appeared similar to "restructuring programmes" of other developing countries, such as:

- continued development of different forms of organisation and of mixed private and public property,
- the provision of agricultural credit,
- alternative employment programmes instituted,
- development of the internal pharmaceutical and biotechnological industries.

Others were placed in a distinctly non-mainstream context, such as:

- priority to support of agriculture,
- the recovery of sugarcane production,
- the development of national food production to reduce food imports 'by significantly reducing the weight they represent',
- support for Territorial Food Groups which are in charge of setting policies and making decisions over the production of food for local consumption,
- the recovery of the food processing industry based on the resources available,
- social policy reoriented to adapt to the new distribution flows of incomes of the population,
- energy savings and restriction of usage.

As Nieto and Delgado note, the overall goal remained that of "*perfecting the socialist system, while balancing the introduction of new market mechanisms with sustained planning via foresight and anticipation of needs*." (Nieto & Delagado, 2002 p. 56). This included the 'Introduction of Perfecting the Wholesale Price System', which aimed to increase efficiency and put the agricultural economy in line with international market prices. This involved using world market prices as the basis for internal business. Goods and services sold within-country had to reflect the real costs of imported raw materials and other production costs. Although centralised control was maintained, domestic wholesale prices were destabilised.

Easing of population growth

Perhaps easing the situation was the decrease in population growth rate. Although the Cuban population had reached 11 million by 1996 (Castro, 1996), annual growth rates had reduced dramatically: from 11.1 per thousand in 1990 to 3.5 in 1995, and these are predicted to stabilise at 3.4 between 2002-2010 (Pedroso & González, 1996). There was an average of 2 children per couple. This fall in rates was attributed to several factors: lack of restriction on family size, accessibility of family planning, and female education and professional opportunities.[211]

9.2.3 Imported foodstuffs and the impact of sanctions

Between 1989 and 1993, the value of imports fell by 80% to $1,700 million. Food imports, which previously accounted for 10-12% of total imports, rose to a 25% share, as a result of State prioritisation. In the early part of the decade it was spending $400-500 million on imports (ODCI,

[211] Mirroring this trend, the population of Havana City had been predicted to rise only gently, from 2,107 000 in 1990 (representing 20% of total population), to 2,284 000 in 2000, and up to 2,376 000 by 2010 (Zulueta & Rego, 1996).

1996), mostly grains,[212] milk powder and cooking oil (FAO stats, 2004). Their role was vital: Casanova (1994) estimates that 85% of consumed food products included imported items. Between 1994 and 1997, dwindling foreign exchange reserves meant a continued decrease in overall imports by 40%, but spending increased substantially towards the end of the decade when food imports accounted for $700 million (Sinclair & Thompson, 2001).

Tighter sanctions also affected access to food at national level: according to Garfield (1999) and Kirkpatrick (1996), sanctions added a 'virtual tax' of 30% as imported goods had to come from more distant and expensive markets.[213] Less direct impacts of sanctions included the cancellation of favourable trade agreements and reduced access to world markets. Further, they affected national production: sanctions-related lost production was valued at $2 billion in 1996.[214]

9.2.4 Humanitarian and development aid, and political agendas

Humanitarian aid also played a vital role in ensuring food availability during the 1990s. In 1995, $17 million of food aid was received (Castro, 1996), and by the late 1990s humanitarian assistance (including medical aid) was valued at $1 billion (Garfield, 1999). The FAO remained active in technical co-operation, while Oxfam America supported Cuban farmers as a humanitarian response to the food crisis.[215] Yet the delivery of such assistance, and other forms of development co-operation, encountered problems as some sections of the international community (notably the USA) sought, under the justification of sanctions, to avoid working with government institutes and instead searched out grassroots and religious groups less closely aligned with the State. In response to this, the State has created a raft of 'non-government organisations' in order to attract such collaboration and prevent these groups from being used for political purposes.[216]

This political agenda continued to the end of the decade. After the Cuban drought of 1998, the US made an offer to the WFP's appeal for emergency food relief, providing that Cuba meet certain conditions: allowing international monitoring of food distribution; USAID markings on donated foodstuffs, and the involvement of NGOs in the distribution process. Cuba's centralised food distribution and rationing system made these conditions difficult to comply with, and the government was also cautious of the USA's motivations in developing close links with NGOs. Political capital was made out of this impasse; a statement from a US State Department Spokesman read "*We regret that the Cuban Government has decided to put politics ahead of the basic needs of the Cuban people*." (USIA, 1998).[217]

[212] In the case of maize, for example, all that which was processed within the country was externally sourced, because of the low and fluctuating level of national production (MIA/1).

[213] Sources at the Bureau of Inter-American Affairs of the U.S. Department of State put this figure much lower at only 2-3% (USIA, 1998).

[214] Garfield (1999) explains the deeper, more devastating impact of sanctions: "*Trade embargoes cause macroeconomic shocks and economic and social disruption on a scale that cannot be mitigated by humanitarian aid, and which affects the well-being of a population well beyond their state of health*."

[215] OXFAM's lesson in avoiding dependency was described by Sinclair & Thompson (2001, p.25) "*As a response to the food crisis, Oxfam International provided free fertiliser to Cuban farmers in Guantánemo province. The result? Agricultural production spiked up for three months – and then collapsed again in the next harvest without the subsidy. Instead of donating fertiliser during short term cycles, Oxfam now looks to provide long term investment, which means support for the training programme of the National Association of Small Producers (ANAP).*"

[216] During the latter part of the decade, a number of Cuban 'NGOs' strengthened their intention toward achieving food security, including the Cuban Animal Production Association (ACPA), the National Association of Small Farmers (ANAP), the Cuban Association of Agricultural and Forestry Technicians (ACTAF), the Cuban Council of Churches (CIC), and the Cuban Association of Sugarcane Technicians (ATAC) (Nieto & Delgado, 2002). These NGOs have the advantage of providing more attractive collaboration opportunities for foreign donors.

[217] This notwithstanding, in 1998 the US was still the largest donor of humanitarian assistance to Cuba (USIA, 1998).

9.2.5 The Nutritional Action Plan and the drive for increased self-sufficiency

The National Nutritional Action Plan

Cuba, like most countries, had never fed itself since the industrialised era. Castro (1996) himself recognises this *"During the years of full economic stability and development of agricultural production the country reached considerably high levels but not enough to satisfy the needs."* Chapter 2 related how the crisis curtailed progressive moves in the late 1980s toward a National Food Plan (Republica de Cuba, 1994). The legacy of this gave rise, in 1994, to the formulation of a National Nutritional Action Plan, based on FAO guidelines. This Plan covered all aspects of food security and had three strategic objectives as follows:

i) Increase and diversify national food production with the dual purpose of achieving the best possible food self sufficiency and obtaining foods in the most economical way and with adequate nutritional content;
ii) Import those foods which are still required to complement national efforts and satisfy the demand of the population;
iii) Incorporate the people as activists in this action plan, promoting self provisioning in all regions of the country and, through this, raising food cultural awareness.

The specific objectives of the Action Plan are shown in Box 9.1.

Box 9.1 Objectives of the National Nutritional Action Plan

- consolidate the UBPCs, CPAs and CCSs as the principle productive bases of Cuban agriculture
- improve the Agricultural Extension System
- achieve self-sufficiency in rice production
- increase the self-sufficiency of farm co-operatives
- combine diversified and quality food production with sustainable agriculture
- combine alternative agricultural practices with those of the industrialised model
- avoid any decrease in cultivable area per capita and attempt to incorporate saline and other marginal areas
- support community and family home-gardens and *organoponicos*
- Continue the introduction of appropriate poultry production in rural areas
- Reduce post harvest losses in the marketing chain
- Identify and develop the potential of dryland areas according to their soils and microclimates.

Source: Republica de Cuba, 1994

This plan, approved by the State Executive Committee, was put together by a multi-sector ministerial committee, and thus covered a broad-based range of reforms in economics, public health, agriculture, fisheries, the food industry, education, social security, and food quality and standards. It set up two levels of monitoring, with each sector establishing its own vertical, independent monitoring mechanism, and with the Ministry of Economics establishing and co-ordinating an overall monitoring mechanism (Republica de Cuba, 1994). Annual progress reports would be circulated to all the entities involved, the UN and other donors. [218]

Plans for production increases embraced the short, medium and long term. Short-term plans involved increasing production of bean, maize, banana, tree crops, and tubers including potato.[219] Medium-term plans involved increasing production of wheat, bean and other legumes, citrus (including for export), vegetables, fruit, tree crops, dryland crops, pork, eggs and poultry, vegetable oil crops and *organoponicos* as well as decreasing postharvest losses. In the long term, rice, pork, eggs and poultry, milk and beef production were to be increased, the first of these with the aim of achieving self sufficiency.

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[218] Official progress reports of the Plan were unavailable to the author.

[219] In the case of maize, for example, cultivated land was to be substantially increased and planting and harvesting plans improved. For banana, as well as an increase in land area, more irrigation was to be made available.

Pursuing these objectives involved a number of strategies: strengthening agrarian policy through decentralisation of land and decision-making, diversification and change in land tenure; participation of the population through community and family home gardens, distribution of small (½ ha) plots of land, community tree planting, and distribution of poultry stock; participation of educational centres and other institutions in self provisioning; reduction of postharvest losses through the increase of small processing plants to conserve surplus fresh produce and the organisation of an adequate labour force for harvesting; inclusion of nutritional considerations in agricultural development programmes, these would follow on from the Food Plan of 1989 with the long term aim of supplying all nutrients from the diet rather than from vitamin supplements.[220]

The armed forces (Revolutionary Armed Forces (FAR), and also the Youth Labour Army) were also called in to help out (Lage, 1995). Murphy (1999) notes that *"At the closing speech to the army congress in 1995, the Minister of the Armed Forces affirmed that 'food production is our principal task'. The military would no longer take any food from civilian sources, but rather contribute by producing beyond their own food needs."* Other strategies to increase national production have been described in previous chapters and relate to stimulating farmers through increasing salaries, the 'linking of man to the land' to stimulate interest and responsibility, improving farm management, encouraging migration to rural areas, and increasing market prices and outlets including direct marketing (Republica de Cuba, 1994; Murphy, 1999; Nieto & Delgado, 2002).

Improving rural agricultural conditions

Already touched on in previous chapters, the improvement of rural conditions had a crucial impact on increasing domestic food availability. Two major land tenureship changes encouraged this: the distribution of land in perpetuity, which led to a wider sector of the population becoming involved in self-provisioning;[221] and the transformation of old State farms into UBPCs, specifically in order to encourage production. By 1999, almost 3,000 UBPCs had been formed, and just over two thirds of agricultural land was in the private sector.[222]

Throughout the greater part of the Revolution, the State had encouraged rural to urban migration.[223] Reversing this process in the early part of the 1990s was not so easy, so agricultural work groups were first formed to undertake permanent activities, mainly in plantations,[224] while city dwellers were mobilised to work for 15 days in the field, and longer-term urban contingents for up to two years with the provision of attractive living conditions and pay.[225] New hostels were built to house all these workers. Young people became obliged to undertake agricultural rather than military service, with perks offered to them to stay on afterwards.

Meanwhile, long-term incentivisation strategies were put into place, including a rise in farm gate prices of up to 50% since 1997, a rise in the basic farm worker’s salary (which in the late 1980s was significantly below the national average (Deere et al., 1995)), and provision of permanent housing (Oliveros Blet et al., 1998; Pesticides Trust, 1998). Community improvement programmes included attention to housing and general community welfare, based on a new policy document "The Dignity of Farming Life" (La Dignidad Agropecuaria) (MINAG, 1999[b]). In Cienfuegos, for example, the Ministry was encouraging low-income groups to grow crops that could yield good economic returns (MA/10). A further programme, the Plan Turquino, was offering support to repopulate and improve living conditions in marginalised mountainous zones, and to aid export-oriented coffee production

[220] However, the Plan of 1994 assumed that "If the macronutrient needs are covered, that is, proteins, fats and carbohydrates, it is almost certain that vitamin and mineral needs are also achieved." (Republica de Cuba, 1994, p. 77). This may not be so, given the discussion on food quality in Chapter 3.
[221] In Cienfuegos, for example, a Mixed Crops Enterprise staff described how the number of individual farmers had increased because of both the ability to legally obtain land and the strong need to feed themselves and the wider population.
[222] In addition, approximately one third of CCS co-operatives had been ‘strengthened’ (Sinclair & Thompson, 2001).
[223] From 1956 to 1989, the rural population had fallen from 56% to 28% of the total (land (Pérez Marín & Muñoz Baños, 1992).
[224] These comprised of 8 million workers in 1992 (Oliveros Blet et al., 1998)
[225] In 1991, 146,000 residents of Havana participated in some form of agricultural work (Deere et al., 1994).

(MINCIN, 2001). Through these programmes the State was addressing issues of inequality within rural areas, and as a consequence of these efforts, even with the increases in farm efficiency, the permanent agricultural labour force remained fairly static during the decade.

By the end of the 1990s there was a strong trend of urban-rural migration which was occurring spontaneously as many professionals returned to family land and especially that of the CCS co-operatives, largely because of the good living that could now be made out of farming. Although the State had initially encouraged such a move, this was no longer necessary (MA/25). By 2000, ANAP "*would not hand out further resources for such and had no official plan to help those returning*" (MA/24).[226] As a result of these efforts, and of increases in market efficiency, farmers, and especially individuals, were able, in the space of little more than a decade, to move from being a relatively underpaid section of the labour force to becoming one of the wealthiest social groups in the country (Deere, 1997).

9.2.6 Achievements in production increases

Main production achievements

The overriding aim of the aforementioned strategies was to increase domestic production. Figures show that this was achieved to a certain degree. Statistics released by the Cuban government indicate that production in the early 1990s fell by no more than 30% for most crops, compared to the previous decade. According to official figures, quantities appear to have been increasing after the low dip of 1993-94, and since that date some have regained and even surpassed the 1989 levels (Miedema and Trinks, 1998; ONE, 1999), with average growth rates between 1992-1997 of 4.6% (and for mixed crops, 8.4%). However, the validity of these early statistics has been questioned. Figures sourced from FAO country statistics, for example, show a much more erratic production trend, with generally lower quantities. Mesa-Lago (1998) assesses that reporting over this period did not reflect the continued real decline in productive output. The figures are skewed by the process of land redistribution that occurred during this time – those of the newly formed UBPCs being merged into the same category as of the longstanding campesino farmers - and therefore do not reflect the degree to which campesinos were affected by, and recovered from, the crisis, nor the performance of these new types of co-operative. On the other hand, Miedema and Trinks (1998) point out that figures are based on official statistics for production plans and disregard surpluses to these plans produced by campesino farmers and co-operative farms. Castro (1996) also stressed that figures did not include the significant production coming from "lots, gardens and other pieces of land".

Nevertheless, by 2000, a combination of State and FAO statistics were showing huge production increases since 1994, including a tripling of roots and tubers, a quadrupling of vegetables, almost doubling of potato and cereals, doubling of citrus, and bean production up by 60% (Sinclair & Thompson, 2001). Strategies and results varied, and trends in production are clearer toward the end of the decade. Rice, roots and tubers were prioritised early on for increased domestic production. Root and tuber production increased by more than 80% from 1995 to the end of the decade. This was partly because yields of these crops only fell by 10% during the crisis years, partly because of the significant priority given to the potato crop in the 1990s, and partly because volume requirements of Acopio made these attractive crops to grow in order to fulfil production plans. For rice, the increase in rice production was largely due to the development and growth of 'popular' (people's) rice production as described in Box 9.2. This production approach was considered akin to organic (Funes, 2002).

[226] Although FAO statistics indicate that the agricultural labour force dropped from an annual average of 868,000 in 1989-91, to 785,000 by 2000 (FAO, 2004).

For certain other staple crops, production started to show an upturn after 1995,[227] and specifically horticultural vegetables, pulses, and milk, while citrus production was greatly helped by foreign investment. Figure 9.1 and Table 9.1 show these figures. According to production trends toward the end of the 1990s, State farms remained the major producer of citrus, and private farms of maize and legumes. During this period, State farms overtook private production of horticultural crops, while private producers took over State as major producers of roots and tubers, bananas, rice and other fruits. In the urban production sector, production rose to provide 70% of daily individual vegetable requirements by 2000, and about 60% of all vegetables consumed in the country (Sinclair & Thompson, 2001).

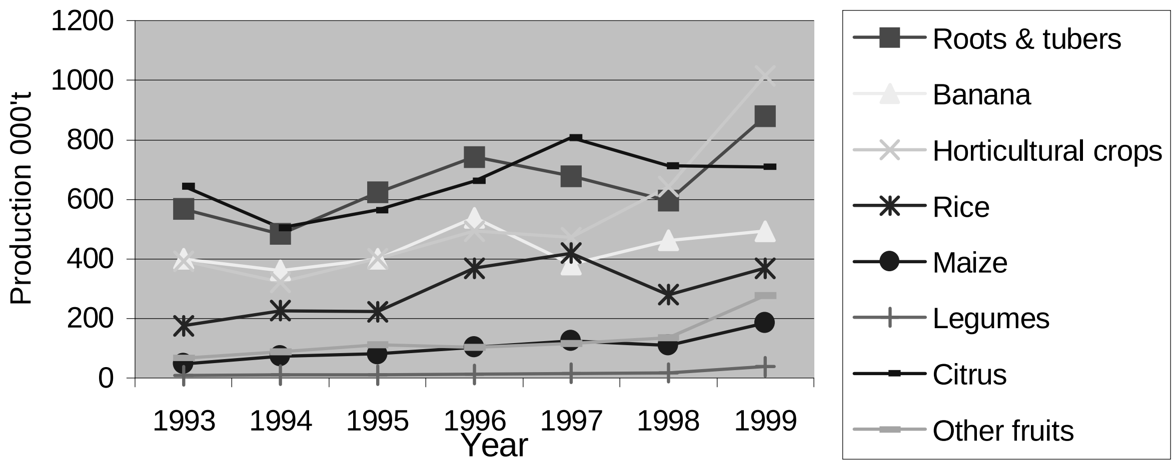
Box 9.2 The Growth of the Popular Rice Programme

State rice production had operated through large scale, flood irrigated systems that were hard hit during the crisis. Production of wet rice fell from 507,600t/year between 1986 to 1990, to 147,600t in 1993. Yet although rice was a traditional staple of the Cuban diet, especially amongst the rural population, Cuba had, even in peak production years, imported approximately 40% of national consumption. Although the Nutritional Action Plan of 1994 stressed a high-input approach for a new national rice programme (Republica de Cuba, 1994), it also introduced a Popular Rice Programme in 1992, based on experiences of small farmer, low-input, rice production. This Programme entailed local control of production and marketing destinations at the level of Popular Council, and offering land in perpetuity for such production. In 1996, the Rice Research Institute was commissioned to develop more appropriate low-technology and small-scale approaches to feed into this Programme, and by the late 1990s approximately 40% of Popular cultivation was rainfed only. There were other innovations: certain varieties were found to be more appropriate to this dry cultivation, and specific regions more suitable for growing rice out of season. Transplanting of seedlings was found to be more practical than the previous approach of direct sowing. Further experimental improvements were the introduction of nitrogen-fixing trees *Sesbania rostrata*, and the use of animal traction in the Asian style. Even postharvest processing was undertaken through low-technology, locally based approaches.

The aim was for local self-sufficiency. As well as campesino production, State enterprises started to use the same low-input and small-scale rice approach on their self-provisioning plots. By the end of the decade, at least half of the country's rice was supplied through this Popular production method, although the production approach and informal and direct marketing destinations means that actual quantities are difficult to measure. The approach is seen as having the potential to expand to a far wider cropping area, once external financial restrictions are lifted.

Source: Socorro et al., 2002

Figure 9.1 Selected Crop Production Indicators, 1993-1999



Source: ONE, 2001

[227] Farmer responses from the field surveys, described in Chapters 6 and 7, indicate a more overwhelmingly positive perception of an increase in domestic production, and consequently of food availability, since 1995. That this increase was felt more greatly on the farm co-operatives and in the farming sector than national figures imply, may be because of the positive farm-level impact of efforts for self provisioning.

Table 9.1 Selected Livestock Production Indicators, 1986-1998

Livestock Products	Mean Annual Production		
	1986-90	1991-95	1998
Milk (ML)	905.9	651.7	697.7
Beef (000T)	289.1	143.1	137.3
Pork (000T)	104.5	85.5	N/a
Poultry (000T)	122.8	61.6	37.4

Source: ONE, 1997; Nieto & Delgado, 2002

Even according to State figures, the main area where productivity remained depressed was for livestock products. For most livestock products such as poultry, eggs and beef, which had depended on imported fodder, production in the late 1990s was still lower than a decade previously. There was also little differentiation between farming type except for a clear increase in milk production by the CCS co-operatives (Statistical bulletins, MINAG, cited in Mozote et al., 2002).

As a result of this, and combined with the lower levels of food imports, calorific consumption per capita in the late 1990s was still below the recommended daily intake of 2,400 calories.[228] Overall calorie availability had decreased from 3100 kcal/person/day in 1992 to 1860 in 1996, although it had since risen to 2200 kcal/person/day by 2000.[229] Annual production increases for domestic consumption continued as a priority for the agricultural sector (SEDAGRI, 1998). State targets aimed to close the production gap: even in 1996 (a year of record yields), national production of horticultural and root vegetables fell half a million tons (22%) short of national demand.[230]

Yet this needs to be viewed in the light that, despite the support given for domestic agricultural expansion, the extent of State financial subsidy has declined dramatically; according to one source, a fall of 96%, from 1.8bn pesos to 6.9m pesos ($9m to $0.35m equivalent), between 1993 and 1996 (Paneque, 1996).[231] In terms of land area, by 1998 there had been little overall change in the proportion of land dedicated for domestic consumption as opposed to export.[232] According to FAO statistics, total farmed land rose only slightly from 4,060,000ha to 4,465,000 ha during the period. At 1998, agricultural items – raw sugar, rolled tobacco, rum, coffee, bottled honey and citrus juice – were still the main Cuban exports over, for example, biotechnology products. Although fluctuations in their production performance continued, due to a combination of adverse climatic events, falling global prices and the continuing US economic embargo (MINCIN, 2001), nevertheless, certain private-sector export crops have shown full recovery, specifically tobacco, coffee cocoa and citrus.

Ongoing challenges to increasing production

Despite all these beneficial changes, a number of challenges remained, many of which were initially identified by Nova (1995). These included the inefficient use of resources on State farms and UBPCs, insufficient autonomy on certain UBPCs, prohibition of certain rationed produce from entering the market (e.g. beef, coffee, potato, milk), general scarcity of resources, high delivery agreements to Acopio, tax increases, and the higher profit levels disincentivising some farmers from further increasing production volumes. Other commentaries on the continued low yields in some crop sectors identified the cause as remnants of the previous industrialised system (Rosset, 1996), and continued loss from the food distribution system (Wroe, 1996) At the same time, large areas of

[228] Although Nieto & Delgado (2002) note that with the increase in range of food sources it has become more difficult to monitor actual intake and official figures are likely to be underestimates.

[229] The FAO provides a higher figure of 2,610 kcal/day for the period 1999-2001 (FAO, 2004).

[230] This figure did not include the demand for social feeding and for exports, and the shortfall was therefore likely to be much higher (Paneque, 1997).

[231] In 1994 alone, State subsidies to farming fell to 2.7 billion pesos (current equivalent of $ 13.5 million), half of previous levels (Nova, 1995).

[232] Sugarcane accounted for 49% of permanent cropping land, and coffee and citrus for a further 6% (Rodriguez, 1999).

co-operative land remained in a state of neglect.[233] Lower yields in some years could be directly attributed to combinations of drought and hurricane. In October 1996, for example, Hurricane Lily struck the centre of the island causing approximately $800 million worth of damage, including the decimation of more than 22,000t of banana, 264,000t citrus, 17,000t rice, 22,000t coffee, and 523,000ha of the sugar crop (Mesa-Lago, 1998). Similarly, the outbreak of *Thrips Palmi*[234] affected 45,000t of potato as well as other root crops.

In 1998, an evaluation of agricultural growth in the country (SEDAGRI, 1998) concluded that MINAG could create the conditions to increase production through further transformations in structure and organisation, and through improving infertile lands, enlarging the State farm programme, transforming the payment system, linking remuneration to work results, and creating more GENTS. Deere (1997) adds that future increased agricultural performance would require a supportive free market for agricultural inputs, as during Cuba's previous experiments with farmers' markets in the 1980s, when inputs were controlled, "*Resources were simply diverted from planned to market production, leading to a decline in private sector deliveries to the state in addition to the pilfering of supplies from state enterprises*." (p. 667). Deere (and also Rodriguez, 1998) also points to the need for further reform of the ration system, introducing a dual price structure whereby lower-income households could access cheaper produce (and possibly remove upper income households from the system completely). This would help producers who could receive a better price for their planned production and therefore would be more likely to maintain their commitments to it.

9.2.7 Import, export and investment strategies

In Cuba, State control over food imports and exports was a major tool for ensuring food availability. Overall responsibility for deciding whether specific food stuffs should be sourced from abroad or domestically rested with the Ministry of Economics, while the administration of imports and exports was the responsibility of CATEC (MA/12). As a general rule of thumb, exports could be undertaken when there was just about sufficient of the crop to cover basic national needs. The internal tourist market was also considered to be an export market as it generated dollar revenue, and this market was served through Acopio under the brand name 'Isla Azul', and through Frutas Selectas. Private producers were not permitted to sell direct to tourists but had to trade through the relevant State Agricultural Enterprise or Frutas Selectas (MA/8). Practices about passing a percentage of dollars earned back to the producers varied significantly between these organisations (KI/2, MA/12).

The drive for self-sufficiency was for many crops undertaken in a pragmatic way. For example, it was accepted as easier to import rice rather than to attempt to produce all the rice nationally (MA/1). Much rice was imported from China, where its production was subsidised, thus it cost less than domestic production and could guarantee a reliable and consistent supply for the ration (MA/2, MH/R/1, MA/3, MA/4). Meanwhile domestically-produced rice was channelled through the farmers' markets. Other crops, such as onion and garlic, were imported due to their relatively high production and storage costs. Yet potato, also considerably more costly to produce nationally and store than to import, was home grown for political (paternal) reasons. For other crops, such as banana, there was an explicit policy for achieving self-sufficiency before developing an export market. Yet some interviewees (such as KI/2) suggested that this was more because the industry was insufficiently organised to meet export quality standards rather than for any ideological reason. Regarding organic produce, it was seen as almost counter-revolutionary to contemplate the exportation of organic crops while there was a national deficit (MA/R/3) (although this argument

[233] In 1999, the author worked on one farm co-operative which covered over 1,000 hectares of fertile soil but was cultivating only 411 hectares, the remainder comprising fields of weeds and extensive outbuildings. On the same co-operative, working hours and the approach to work were leisurely.

[234] This was seen in Cuba as an external factor. Cuba filed a complaint against Washington under the UN International Convention on Biological Weapons, for introducing this pest that had never before existed in the country. It was verified that a US crop-dusting plane did fly over Cuba on the date in question. (Also see Zilinskas, 1999).

did not hold for other crops such as rice). Overall, different criteria applied to different crops, reflecting differing degrees of pragmatism, political ideology and some degree of disorganisation.

At 1999, companies from at least 40 countries were investing in Cuba, the majority from Canada, Italy, Spain, France, the Netherlands and the UK. Regulations aimed to reconcile national and foreign interests. Foreign investors had to satisfy at least two of the following three conditions:

- to contribute with new technologies,
- to contribute with new markets or new tourist avenues,
- to contribute with financial capital and resources.

Investment in education, public health or the armed forces was not permitted, nor was privatisation (Ferradaz, 1999). Land was not permitted to enter foreign hands, and agricultural collaboration consisted of foreign contributions of working capital, technology and external market provision (Fernandez, 1998). According to Ritchie (1998), the State ensured that for every dollar invested in Havana, one third went to rebuild the city, and another third to sustain the social services.

9.2.8 An ecological production approach and national food availability

Land tenureship and farm organisation – more important than input availability?

In the early 1990s yields in general dropped – by between 15-50%. Decreases in petrol and inputs were undoubtedly a major factor, though there were others; some farmers were forced to switch to more hardy, but lower yielding crops; and climatic conditions also played a role. There were some exceptions to this norm: the yields of some farmers had started to increase early on, particularly for prioritised crops for which inputs were available.

The most important factors affecting the general upturn in productivity in the late 1990s - according to survey and interview respondents, and to yield figures comparing State with private farms - were the changes in land tenureship and organisation. There was also now greater farm efficiency, more care and attention, and better support from MINAG. These changes had nevertheless been accompanied by the adoption of integrated and improved techniques, and a steady rise in the availability of agrochemical inputs.[235]

Much of the increase in production was put down to the move to private ownership. By 1998, the campesino sector was producing 86% of tobacco, 68% of maize, 73% of beans and 47% of roots and tubers (ONE, 2000). Yet although these campesino farmers were recognised as being able to both feed themselves and outproduce the State farms, some in the support sector found it hard to envisage that small farmers could provide the basis of an agricultural system that could feed the country. As one extensionist from Holguin explained *"…even though I have heard that Europe is feeding itself in this manner, it can't happen here"*.

At the same time, there was a clear yet ill-defined link between farm organisation, production approach and output. Campesino farmers were not necessarily the most 'ecological', as seen in Chapter 7 where it was the UBPCs which were using a higher percentage of cheap organic inputs (owing to their lack of access to dollars). At the same time, the lower rates of productivity on the industrialised State farms was related more to their organisational features than to production approach, and some still defended their previous performance (Carlos Lage, quoted by Martín, 2002).

Nevertheless, even outside ecological social circles, there was some recognition that the industrialised approach to food production in Cuba had not been completely successful. According to a Cuban NGO staff (MST/2) "*The country is producing more now than it was 10 years ago – industrialised agriculture never worked here properly – even when supported by the USSR – it only produced less than 50% of food needs.*"

[235] It was more difficult to chart fluctuations in fuel availability over this period, with levels varying over different provinces and being more urgently required in periods of drought (to drive irrigation pumps) for example.

Ambiguous State food security strategies in relation to ecological agriculture

As over 70% of Cuba's agricultural land was dedicated to permanent crops (e.g. sugar, citrus, pasture), production of short cycle food crops had to be increased through land intensification and improved rotations (Republica de Cuba, 1994). The Nutritional Action Plan specified the desired strategy of *"sustainable development combining alternative with industrialised models: including agroforestry, low input approaches, yet with a focus on intensification"* (p.68). This Action Plan rather ambiguously enlarged upon this strategy for sustainable development, to the extent that it appears to have been formulated by contributors with differing opinions. At one point a very specific 'Alternative Model' (ecological) of agriculture was described, and favourably compared to the industrialised 'Classic Model'. Figure 9.2 displays this comparison of models, providing an interesting example of a positive Cuban perspective on ecological agriculture. The conclusions of the report also pulled in very different directions, finally stating that *"Given the conditions of the country, it should be maintained wherever possible, the application of high external and internal inputs on the basis of intensive practices, in others alternative practices, and ultimately an appropriate combination of the two models."*

Figure 9.2 Characteristics (including advantages and disadvantages) of the Classic Model and the Alternative Model for rural development programmes (theoretical, with Alternative Model based on small-scale production)

Classic Model (principally from developed countries)	Alternative Model
• External dependency - of the country on other countries - of the province on the country - of the region on the province and the country • Cutting-edge technology, especially of expensive inputs and from outside - imported primary materials for feedstock - wide use of chemical biocides and fertilisers - use of modern irrigation systems - fuel and lubricant consumption in main agricultural activities • Close interrelation between credit and production processes; increase in interest rates • Preference for high mechanisation • Introduction of new crops at the expense of native ones • Efficiency through intensification and mechanisation • Potential for investment in production and marketing • Pressure on non-renewable resources • Accelerates rural out-migration • Incremental negative consequences for the environment	• Maximum advantage taken of: - the soil - local human resources - wide community participation - cutting edge technology, but regionally appropriate - use of organic manures and crop rotations - use of biological control - application of staggered harvests, permanent production and biological cycles, - natural energy - water, air and sun - animal traction and other more economic energy sources - rational use of pastures and forage areas • Crop diversification and indigenous production on the basis of accumulated knowledge • Introduction of scientific advances relevant to the region • Environmental conservation • Need for systems training (in management, nutrition and technical) • Introduction of systems support • Marketing difficulties because of the number of intermediaries. Need to control the markets.[a] • Poverty of campesinos[a] • Distance between market and urban centres [a] • Illiteracy [a] • Promote co-operation between farming community and others.

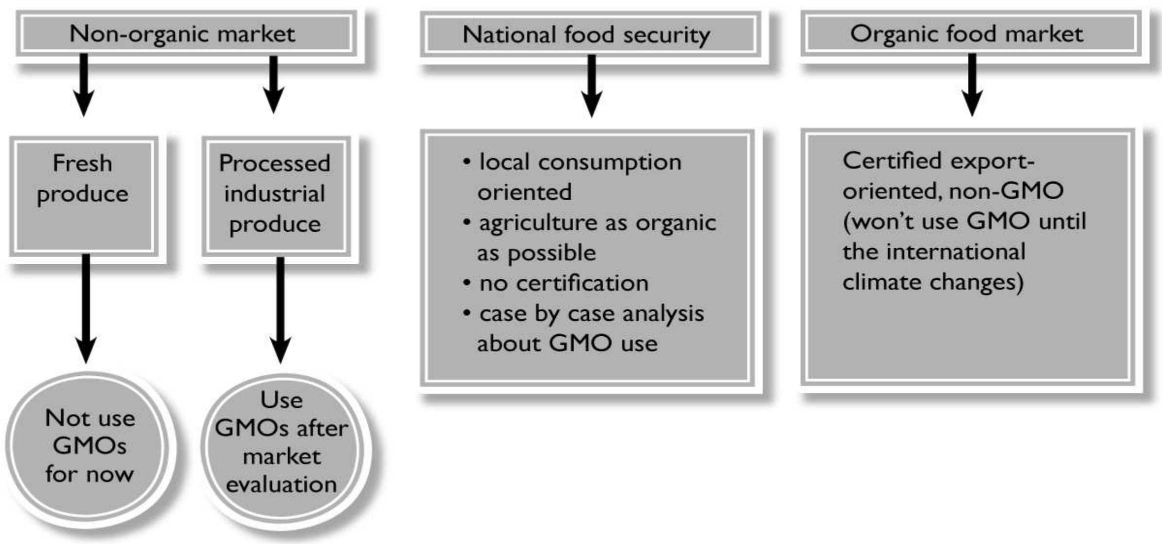
[a] In Cuba these issues have been overcome.

Source: Republica de Cuba, 1994 p. 73.

Biotechnology and food supply

In 2000, the Biotechnology Research Centre had plans to develop transgenic crops in Cuba over the next 2-3 years. These crops would not be used for the tourist sector but would enter the national ration supply for the Cuban population (without differentiation) and also be used in processed (but not fresh) export products. Figure 9.3 sets out this plan. At 2000, there were no genetically modified crops on the market, even though some foreign transgenic foodstuffs (such as GMO soya from Argentina) were cheaper, none were yet being imported owing to food safety concerns. Any imported transgenic crops for research had to go through a laborious registration process, and none were being grown on commercial scale. The Centre for Genetic Engineering, for example, had submitted a proposal on the use of GM in Cuba, but in 2001 this had not been approved (MST/R/2). They were currently undertaking tests on the safety of GM crops on human health and the environment.

Figure 9.3 Plan of the Biotechnology Research Centre for the use of GM crops in Cuba



9.3 FOOD ACCESSIBILITY

9.3.1 Overall strategy for food accessibility

Since the Revolution, Cuba has paid great attention to maintaining an equitable society, in terms of income differentials. While strategies for food security in many other developing countries centre around food availability, at a macro level, in Cuba as much attention had been paid to accessibility at the micro level and specifically on efficiency of distribution mechanisms to guarantee equality (Oliveros Blet et al., 1998). There had been a guaranteed and highly subsidised supply of food for the whole population, through the ration system (Rosset & Moore, 1997), and further supplies for public institutions such as schools and hospitals (MSP, 1988). This food system which developed in the wake of the Revolution had successfully met the needs of the population. Calorie consumption had increased from 2,500 to 2,834 kcal/person/day between 1965 and 1988/89, while protein consumption increased from 66 to 76 g/person/day over the same period (Ríos Labrada, 2000).

During the crisis, the State maintained the priority for ensuring food accessibility. In reviewing the food security situation in the late 1990s, Castro explained that *"The priority assigned to this issue, together with centralised planning, have made it possible to devote adequate attention to the objectives of satisfying the food needs of the population…"* (Castro, 1996). He continued *"We can* *proudly say that despite the difficult circumstances, we were able to ensure equal access opportunities for the entire population to the available food, health and education".*

The two strategies adopted to promote food accessibility were: diversifying food distribution channels, and increasing and diversifying the sources of income available for the population. New sources of income included self-employment, hard currency remittances from relatives abroad, State labour incentive schemes, and the tourist industry. The percentage of population with access to hard currency rose from 8% in 1993 to 40-50% by 1997 (Castro, 1996). Despite this, there was a need for the State to provide assistance in obtaining certain food supplies to those without sufficient income or hard currency. The mechanisms used to achieve this are described below.

9.3.2 Overview of the food collection and distribution system and food social security

The food distribution network

The structure of networks and flows within the food system in Cuba were controlled by the State, the main organisations responsible for this being:

- Acopio (Unión Nacional de Acopio, National Collection Unit), the State collection and distribution agency for domestic farm produce. Divided into 14 provincial enterprises, and also had over 3,700 municipal sales points (Pérez Villanueva, 2000) as well as supplying the MINCIN ration stores.
- Frutas Selectas (Enterprise of), in charge of supplying produce for tourism and related activities.
- Other national level Enterprises and Unions, usually commodity based, such as those for pigs, tobacco and mixed horticulture.
- The Ministry for Internal Trade (MINCIN), which had a nationwide network of wholesale and retail stores and gastronomic centres. (MINCIN, 2001). Specifically, MINCIN administered the ration system through its provincial, municipal and local networks. The ration stores channelled both imported and locally produced (and processed) foodstuffs, through *La Bodega* (the storehouse - for food products) and *Las Placitas* (the agricultural sales points – for fruit and vegetables). These ration stores also sold non-rationed, subsidised items.

Within this structure, the National Nutritional Action Plan specified four types of destination for agricultural produce (other than self-provisioning):

i) the ration, organised by MINCIN,
ii) social feeding such as to hospitals,
iii) industry and processing, and
iv) tourism.

In addition, domestically produced goods also found their way onto the black market.

The ration system and social security

The Social Security System[236] and the ration system (established in 1979 and 1962 respectively) provided a solid internal social base during the challenging years of the early 1990s. During this period, the only market that the State was able to maintain was rationed food distribution through this equitable distribution of produce and controlled sale through the 'basic food basket' (*canasta basica*) of the ration. An increasing number of food products became rationed: 19 rationed items in the 1980s increased to virtually all food items in the early 1990s (Murphy, 1999). However, this basket could not cover all food needs. Throughout the crisis its protein content was reduced and the its composition changed to include more vegetable protein and high-calorie foods (Felipe, 1995).

During this period, the State maintained its purchase contracts with farmers so as to guarantee the availability of rationed products. At least 80% of the main crops produced would be contracted in this way (Rodríguez, 1998). Agricultural products would be collected by Acopio at the farm, or

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[236] The Social Security System included assistance components for the most vulnerable and specifically old people, disabled, single mothers, children and youth.

delivered by the farmer to the local Acopio centre, and then transported to centralised urban markets from where the goods would be transferred to neighbourhood distribution centres (specialised for crops, meat or dairy) (Enríquez, 1994).

Institutional mechanisms for meeting provincial food needs

Each Provincial Agricultural Delegation was responsible, through Acopio, for meeting local demand as far as possible with local supply (MA/12). In 1996, Castro stated, at the World Food Summit "*Food production here* [in the country's four mountain ranges], *as well as for the rest of the country, is approached from the point of view of viable crops to attain self reliance, with the aim of cutting down the food supplement they require*". This illustrates the change in emphasis being made from a centralised distribution system to one of partial provincial self-sufficiency and localised production-consumption chains. *Tiro directo* and the farmers' markets were the two main mechanisms for achieving this, as well as the increase in on-farm and household self-provisioning as described in Box 9.2.

Box 9.2 The growth of self-provisioning

The setting aside of land for self-provisioning on all farms was discussed in Chapter 7. On State farms, UBPCs, and CPAs, the goal was to bring into production unused land for annual and perennial food crops and livestock 'modules'. CCSs already had a self-provisioning strategy and this was extended to provide individual plots for farm workers, which became a large huge incentive to retain labour. The same strategy was later adopted for individuals on State farms (Deere et al., 1994). Non-farm workers were also provided with land if they could demonstrate a justifiable cause, although the State continued to ensure that collective production outweighed individual. Land parcels of up to 0.5ha – too small for incorporation into co-operatives, was distributed to retired persons or others outside the production sector interested in self-provisioning, with the opportunity to sell any surplus. By 1998, perpetuity rights for almost 11,000 ha of land had been given to 45,800 people or *parceleros* (Enríquez, 2000). This also diminished dependency on the ration system in rural areas.

Institutional organisation for supplying the ration was hierarchical. The Ministries/Institutes of Commercialisation, of Public Health and of Internal Demand drew up the provincial production plans, based on quantity and nutritional balance needs. The Institute for Internal Demand determined how much of each crop would go to each destination, each municipality having a department to calculate food availability in its area on a monthly basis, and how it should be distributed. Acopio was then responsible for sourcing produce from other provinces to fill any deficit. Generally, Acopio buyers advised farmers as to which markets they might best sell to. However, at some periods, certain crops had to be sold to Acopio and not elsewhere: for example, one UBPC in Batabanó-Havana had received a circular from MINAG announcing that all banana, potato and sweet potato crops had to go to Acopio, so that for the moment, even private farmers could not sell these crops on the farmers' market (F/U/1). Similarly, the demand by Acopio for bananas was such that, in one municipality of Havana Province at least, farmers were unable to retain enough to meet their own needs (MA/20).

If a province could not supply its own food needs, it looked to the neighbouring provinces to assist (KI/4). For example, during a field work period (October 2000), Holguin Province was looking to fill a shortfall in supply of roots and tubers, Yet it had a surplus of potatoes which were to be transported to Havana (potato distribution was still dealt with at national level, given its importance in the Cuban ration). Surpluses destined for the processing industry also crossed provincial borders, for example, a seasonal surplus of mangoes in Cienfuegos was being sent to a processing plant in Ciego de Avila province. National meetings were held on provincial and municipal self-sufficiency; in 1998 the meeting convened in Cienfuegos where one municipality was held up as a national model for achieving self-sufficiency. Topics of concern at the meeting included ways to improve efficiency, to reclaim degraded lands, to organise cottage industry for food conservation, and preparedness for climatic and other disturbances (SEDAGRI, 1998).

Yet opinions from the field study agreed that complete self-sufficiency at a provincial scale was not appropriate due to the varied climate of each municipality and the advantages of each to grow specific crops. Maize and bean were well suited to Holguin, for example, whilst 30% of total domestic production came from Havana province (MA/12). Nevertheless, it was agreed that basic staple crops could be produced at the local level, and most provinces were self-sufficient in some products. Cienfuegos, for example, was seasonally self-sufficient in vegetables and fruits, and was working to increase sufficiency in lowland rice.

The Food and Nutrition Surveillance System (SISVAN)

Shortfalls in supply were identified and addressed by the Food and Nutrition Surveillance System. This system, which aimed to monitor the population's nutritional status and thereby improve decision-making, was set up in 1977.[237] Its responsibilities included food availability, accessibility and adequacy. This system, the most advanced of its kind in Latin America, was co-ordinated through the national network of INHA centres.[238] The head of each of INHA's provincial centres was a nutrition specialist, who obtained knowledge of regional needs through regular nutritional surveys by public health teams of the Institute for Internal Demand. The mandate of these centres was to bring together the provincial government with representatives from the agricultural, commercial, educational and public health sectors, every three months. At these meetings, the agricultural representative would present production figures, (actual and forecast), and strategies were adopted for making good any shortfall either from a neighbouring province or by importing through the Ministry of Exterior Trade. In the east of the country, where food security problems were more severe,[239] such meetings were held more frequently, and, when there was insufficient national purchasing power to satisfy needs, the WFP assisted with food donations. The surveillance system included an early warning system (Alerta Accíon) to identify when interventions might be needed and to organise advance back up. In 1999/2000, a major intention was to create a reserve of basic food supplies to cover short-term emergencies.

State food collection

Acopio, the State marketing enterprise, purchased agricultural produce from both State and private production sectors, which were then destined for national consumption through various State-run channels including the preparation of processed products for distribution to workers and schools canteens, hospitals, old people's homes, etc. Previously a highly centralised, collection, distribution and marketing organisation, Acopio was merged, in 1993, with the Mixed Crops Enterprise to form a marketing, production and service provision entity (MA/6, MA/12). This merger was partly in order to increase efficiency - Acopio became decentralised and would use the collection and distribution points of the Enterprise, but was also as a response to the formation of the UBPCs in the same year. These took over responsibility for approximately half of the land that the Mixed Crops Enterprise had previously been managing, and thus a large proportion of its activities. After the merger, the Enterprise retained its installations: storehouses, machinery workshops and irrigation equipment etc., providing these as a service to farmers. Despite the merger, the Enterprise and Acopio were still often thought of, and referred to, as separate institutions.

Acopio established contracts with farmers; specifying annual production plans and monthly delivery plans (*plan de entregar*). In the private sector, the plans were agreed between farmers, the National Association for Small Farmers (ANAP), and Acopio. In general, Acopio purchased between 50-80% of total farm production (Oliveros Blet et al., 1998). Failure to sell could lead to

[237] With the support of the United Nations Children's Fund and the Pan American Health Organisation.

[238] Gay et al. (1986) identify the reason for as due to the sectoral nature of institutions involved with food systems issues at national, provincial and municipal levels.

[239] The decrease in food availability hit the east of the country harder because there production was more geared toward export cash crops and the move to increase self-provisioning was slower (MH/1).

confiscation of land (Enríquez, 2000). Prices paid were low, but any surplus may receive double that basic price, if the producer chose not to sell at other agricultural markets. Sinclair & Thompson (2001) note that this option of selling surplus contributed to farmers' doubling or tripling their production. In the State production sector, delivery plans were discussed with MINAG and the managers of the State farms. Almost 100% of this production was marketed through Acopio, with only a small part being destined for self-provisioning and for restocking seed. From 1994 onwards, the State production sector was able to sell some of its products through the agricultural markets.

There were, at 2000, five price levels paid to farmers by Acopio: the lowest price was paid for produce destined for social consumption, to hospitals, schools etc,[240]; then for State food processing (parallel market); then a capped price for the agricultural markets of MINAG (e.g. *La Placita*); then a free price for sale direct to the farmers' markets, and the highest price for the international dollar market (MA/7). Acopio might improve the produce (grading, cleaning, etc.) before it was distributed.

As an organisation, Acopio had to become more efficient. In particular it was now obliged to provide a stable food supply, covering any periods of shortfall without recourse to imports. This meant greater recourse to domestic processing[241]. In 1993, a new procurement process was introduced, focusing on creating multiple rural collection points (*Puntas de Acopio*), with campesino*s* bringing their produce to a predetermined point at a particular day and time, where they would hand over to Acopio and receive payment on the spot. In Havana, the number of Acopio staff was increased to one for each co-operative in the region. In practice however, "*the probability of an Acopio representative, a truck and a campesino all converging at the same point at the same time was highly unlikely*" (Deere et al., 1994). Produce could also be taken straight from the farms to the sales points in Acopio transport, and this direct delivery cut down warehouse storage losses by more than 10%.

As the number of producers had increased, Acopio had to increase its transport network. In one municipality of Havana Province, the number of lorries had increased from 14 to 25 (MA/12). The impact of fuel shortages on food transport around the country is discussed in Box 9.3. Operations were being undertaken on a timely basis: around Havana city, Acopio collected perishable salad crops very early in the morning to reach Havana in time for the agricultural markets the same day. For most of the 1990s, storage of produce was a problem, due to lack of financial resources for maintenance.[242]

Box 9.3 The transport connection

Fuel shortages were a major driving force for a more regional approach to food accessibility. This stimulated a resurgence in rail cargo, at least for those products which had been historically transported in this way, e.g. sugar, honey, petrol, minerals, carbon (Alepuz Llansana, 1996). However, studies showed that the much investment was required to improve the basic rail infrastructure and facilities and over short distances road freight was more competitive (Ruíz González, 1996). Over longer distances trains were found to be more economically beneficial (Henríquez Menoyo, 1996). Efforts were made to increase the efficiency of road transport through standardising transport schedules, improving information sharing between storehouses and suppliers and upgrading containers and other equipment. The merger between Acopio and the Mixed Crops Enterprise was intended to improve transport of products to the market, but Ruiz González (1998) observed that this merger did not result in the hoped for results, due to poor maintenance of vehicles and poor hand-over of statistical and accounting mechanisms.

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[240] One showpiece farm in Holguin explained how some of their milk production went to supply local children, who paid only 25c/litre, with the remaining costs covered by the State (F/P/1).

[241] Producers are being contracted to co-operate with processing plants to ensure a steady quantity of raw material throughout the year (Castro, 1996).

[242] In an analysis of rice and grain conservation in Havana City. Méndez Núnez et al. (1998) identify a long list of such storage problems, including, leaking roofs, lack of ventilation and lack of knowledge by quality controllers.

Frutas Selectas, the State tourist food delivery organisation, was formed in 1976 to provide a direct link between fruit producers and tourist centres (MA/39). It was able to purchase directly from the farmer rather than through Acopio. For many years a loss-making subsidiary of Acopio, the enterprise was transferred, in 2001, to the Citrus Corporation which had a history of successful export production (KI/7). Whether related to this change or not, more recently farmers have become aware of supplying a higher quality product for this destination. Frutas Selectas could purchase up to 80% of a farmer's products for tourist destinations, with the rest for non-tourist destinations. It paid a better price than Acopio, generally paying the farmer in pesos but also providing imported dollar inputs and tools. Frutas Selectas also co-operated with MINAG to produce out-of-season fruits.

State food distribution

Prior to 1989, Acopio controlled the food distribution channel, through the ration book, and, on a macro level, was relatively efficient at this task. During the Special Period, production fell and there was less to distribute, and so the focus changed to micro-level. Petrol shortages created transport difficulties and food would often rot before it could reach the consumer (Murphy, 1999). The emergence of urban agriculture as a new supply source, and the liberalisation of agricultural markets made centralised food distribution far more difficult to organise. In one municipality in Havana Province, for example, three *organoponicos* started to supply vegetable crops in their localities, creating better access for these foodstuffs for people living nearby. The local Acopio, with its centralised, approach, found it difficult to deal with this imbalance and went through a difficult period in the mid 1990s. With decentralisation at municipal level and a more diverse range of food outlets, the difficult period subsequently stabilised to some extent (MA/12).

9.3.4 Changes to the marketing system over the 1990s

The early re-instatement of the parallel market

Although processed food products had traditionally been imported, in the 1980s Acopio had organised a ‘parallel market’ of domestically-processed foodstuffs to supply various social destinations. In 1989, this parallel market had given way - many of its constituent ingredients had been imported. In 1992, this 'parallel market' was re-instated, with outlets selling preserved meat products, dairy and conserved fruit and vegetables. Unlike food from the ration system, these products were not subsidised and so prices were much higher, but they were in more abundant supply. These parallel markets stimulated the growth of domestic processing, and, according to Oliveros Blet et al. (1998), products reappeared that had not been seen since before the Revolution. Benefits also included the strengthening of the production sector to provide raw materials, a boom in the food industry, and the wider availability of food products for the population.

***Tiro directo* or direct marketing**

In addition to this, a number of significant changes were made early in the 1990s, to the marketing structures, circuits and transportation arrangements, by MINAG. These included:

- the creation of regional ‘concentrated’ centres to receive, improve (by grading, cleaning, etc.) and distribute produce to large urban conglomerations (these centres subsequently changed to focus on agricultural processing);
- the creation of municipal agricultural markets. Prices remained capped under State control but were higher than for products available through the ration stores. Products were received directly from the regional ‘concentrated’ centres, or directly from the farmers themselves, a mechanism termed *tiro directo* (Enríquez, 1994);
- linking private and State producers with their own transportation to the rationed sales points (warehouses – *La Bodega*, and rationed agricultural markets *La Placita*);

- the creation of refrigerated warehouses to conserve agricultural produce, mainly potato (which the State guaranteed to supply all year round).

The mechanism *tiro directo* ('direct throw' or direct marketing) in particular was a major move toward a more localised production-distribution system, where supply agreements were made between a specific co-operative and a regional State market, without the involvement of Acopio. It was of particular benefit for perishable products, which had previously often languished for several days before being collected by Acopio. Transport was variably covered by the co-operative or the market. According to Enríquez (2000) it was very popular with producers who were rapidly coming to see their co-operatives as business enterprises and calculated the benefits of delivering their produce rather than waiting for it to be collected or having to guard it against theft. Enríquez (p. 7) cites one analyst who predicted that *"with the sub-division of state farms into UBPCs and the overall trend toward smaller-scale production, farmers would be increasingly encouraged to do this because Acopio would be unable to attend to the growing numbers of producers, each of whom has a limited amount of produce."* In some regions, *tiro directo* was the main supply channel. Yet the State was not willing to encourage a more widespread usage of this strategy and toward the end of the 1990s attempted to replace it with others, perhaps, as Enríquez suggests, because they did not want to eliminate their control through Acopio which was in charge of the capped price markets.

Yet these early changes were still not sufficient to resolve the shortfall in food supply in the early part of the decade. Even with rapid State measures to provide more food outlets, food prices continued to rise, even in the State ration system. At one point it was reported that some campesinos were refusing to accept pesos for their produce but demanded dollars or scarce consumer goods (Deere et al., 1994). Not only had the production sector declined in the early part of the decade, but also the food industry had practically ceased to exist, and with it the networks of workers' cafeterias. There was just not sufficient food to be purchased – at the most critical time, in 1993, people held on average 15 months' salary in hand with nothing in the shops to purchase (Nieto & Delgado, 2002).

Inevitably under such conditions the black market thrived, offering food but at extremely high prices. It sold the excess from the campesino sector, together with poor quality produce and, during 1990-93, the incidence of thefts from fields and warehouses rose to supply this market. The main products available were meat and dairy produce, grains, and roots and tubers. One hundredweight of garlic, which the State would purchase for 130 pesos ($6.5) would sell on the black market for 1,000 pesos ($50) (Enríquez, 1994). To reduce the hold of black marketeers, in mid 1994 the State permitted circulation of the US$ and allowed access to the dollar shops by the Cuban population.

Creation of 'free' farmers' markets and private food businesses

Legislation permitting 'free' farmers' markets was passed in September 1994, and within two weeks 121 such markets had been established all over the country.[243] They were created by MINCIN to stimulate production and increase efficiency, to complement the food basket, thus increasing access to fresh produce, and to reduce the power of the black market. All farmers were eligible to sell at these markets provided that they had met their production quotas. Some price regulation was maintained to prevent a recurrence of the problems experienced with the campesino farmers' markets of the 1980s.[244] Prices were self-regulating to reflect supply and demand (as opposed to State dictate), a mechanism which had not previously been permitted. It resulted in increased

[243] This rapid process of putting into operation State decisions is typical of the speed at which it acts when the political will is in place. Farmers immediately made use of these markets, showing their entrepreneurship and capacity to respond to better price opportunities.

[244] In 1994, Deere et al (p.229) had suggested that "*It is doubtful, however, whether the defamed Free Peasant Markets of the 1980-86 period will be re-opened*;" The recreation of farmers' markets shows the flexibility of the Cuban government, given its previous negative experience with them in the 1980s, and the political will for experimentation and pragmatism, even over ideological considerations.

competition between producers/sellers and contributed to a slow reduction in food prices. The State collected a sales tax and levied charges for the services that the market provided.[245] Prices varied between markets, being some 20% higher in Havana city than in the provinces (Nova, 1998), which provided farmers with an incentive to make the longer journey. Lower taxes were also applied at markets where there was a need to enhance supply (Murphy 1999).

These markets came to play a critical role in enhancing food access, by making excess goods available to more people at regular times, locations and prices. This also benefited the producers, who in turn did reduce their black market activities. There was some differentiation between crop quality. For example, Acopio purchased maize by quantity, whereas in the farmers' markets cob size was the most crucial factor. Another feature of the markets was the sale of processed foodstuffs, from sweets and drinks to meals, the prices of which also fell between 1995 and 1997 (Deere, 1997).

Farmers were thus faced with a range of obligatory and non-obligatory outlets for their produce. They were obliged to satisfy their own needs, those of the State plan, their social responsibilities to hospitals or nurseries, and then for export markets, tourism, industry, and seed supply. All these commitments vied with supplying the farmers' market, and market officials checked that farmers had first met their production quotas for Acopio before permitting sale in the farmers' market. One extensionist explained "*In the future we could get a place on the farmers' market to sell banana, but not this year. We have and want to meet the national demand first - through Acopio and then Frutas Selectas*." The farmers' market did not guarantee sales, unlike the lower priced alternatives. These restrictions aside, anyone who worked the land could sell there, either directly or through a 'sales representative'.[246] Access to these markets was further aided by the decentralisation of the transport structure, enabling free contracting of vehicles. Four years after their establishment, over 90% of produce sold at these markets came from State farms and the private sector (CCS and individual farmers), and only 10% from UBPCs and CPAs (see Table 9.2), although another contemporary evaluations indicated that individual farmers came to account for 78% of sales values (Deere, 1997). Around the mid 1990s, the farmers' markets were channelling nearly all the grains and fruits (non-citrus) and were also a major contributor to the supply of roots and tubers (Oliveros Blet et al., 1998).

Table 9.2 Participation in the supply of crops to the farmers' markets, by farm type (%)

Farm type	1994	1995	1996	1997
State	24	21	36	41
UBPC	15	7	6	5
CPA	19	8	4	4
Private	42	64	54	50

Source: Nova González, 2000

A further change was the permission to sell prepared foods by the private sector. Up till that time, this had been undertaken by the State, but the majority of the 11,416 State establishments had virtually disappeared between 1990-93. By August 1995, 36,864 licenses had been granted for such private business (Granma, 1995). Again, a substantial degree of control and regulation was implemented, with, for example, a maximum limit on the size of privately run restaurants, and high tax rates. Control levels fluctuated as the State attempted to prevent inequitable individual gain.[247]

[245] Further indirect control was also made: product prices were analysed on a monthly basis, and if market prices of particular crops were seen to be too high for average consumers the State would flood the controlled agricultural markets with the same crop at a much lower price, bringing down the price in the farmers' market.

[246] According to Oliveros Blet et al. (1998), the main problem facing the farmers' markets were the elimination of middle men. The State had proposed mechanisms to reduce speculation on basic food products, by improving distribution mechanisms and the production-consumption food chain. Various experiments had been tried, to concentrate marketing in the hands of officially designated sales representatives.

[247] In 1996 for example, new taxes drove down the number of legally registered self-employed workers from 208,000 to 180,000 (ODCI, 1996).

Subsequent trends and challenges to the marketing system

The impact of all these changes were dramatic, according to Oliveros Blet et al. (1998). Food supply increased, and the influence of the black market was diminished, with black market prices falling by some 40% between 1990 and 1994. Urban agriculture also had a significant effect. It provided competition to the farmers' markets, where prices decreased by 30% between 1994 and 1997 (Deere, 1997). Although urban agriculture supplied only 9% of volume of total marketed produce, this produce constituted a nutritionally-important, if small, part of the Cuban diet which had previously all but disappeared from the market; including a variety of vegetables and salads, fruits and some grains. Approximately 30% of vegetables consumed in Havana were supplied by urban agriculture (MA/43). Overall, food prices remained fairly stable during the second half of the decade, dropping only slightly between 1996 to 1998 (Nova et al., 1999).

Yet toward the end of the decade, prices in the farmers' markets of MINCIN were still often out of reach of a large sector of the population.[248] Prices of produce from urban *parceleros* were some 20% less, as were the controlled markets of MINAG, and this difference was exacerbated in Havana; in 1999 there were 2,383 State controlled markets and 332 farmers’ markets throughout the country, but in the capital this ratio was reversed, with 70 farmers’ markets and only 13 under State control. In the first quarter of 1999, for example, sweetpotato was priced at comparative units of 1.11 in the farmers’ market compared to 0.47 in the controlled markets. For banana (fruit) the difference was 1.53 to 0.28, for onion 4.63 to 2.66, and for rice 4.43 to 3.31 (Recio & Jiménez, 1999).[249] Poorer segments of the population were also unable to access the dollar stores which were, by the end of the 1990s the only suppliers of some basic staple products outside the ration, such as cooking oil. The black market was still important, although its dominance and the extreme prices were less than in the early years of the crisis.

In the late 1990s, changes were occurring in the ration system. At provincial level, the system was being computerised (MA/12). The role of the ration was diminishing significantly- in 1996 around 40% of food needs were supplied through the ration, and according to Nova González (2000), at 1997 the ration in Havana City was supplying approximately 61% of daily calorific requirements, 36% of animal protein, 65% of vegetable protein, and 38% of fats required. Yet by the end of the decade only 10% of food needs were being supplied by the ration (KI/4).[250] The State was aiming to eliminate the ration book completely,[251] although recognised that many families still depended on it until food supplies could be stabilised.[252] Instead, contracted produce was being increasingly channelled through capped markets such as the State retail network (*commercio minorista*) and also at the agricultural sales points (*Las Placitas*). At the end of the 1990s, new types of sales points were being developed, with *Las Placitas* being incorporated into a new system of *'Placitas del Nuevo Tipo'* which did not sell through the ration book.

There were also challenges to be overcome in terms of farmers' marketing of products. For example, even on CCS co-operatives which had been ‘strengthened’ at least in part, in order to improve market access, several CCS respondents claimed that they had received no training in marketing produce, or on how to create or access the local agricultural sales point (F/C/4).[253] Such training was generally less available in more remote regions with poorer access to transport (MA/12).

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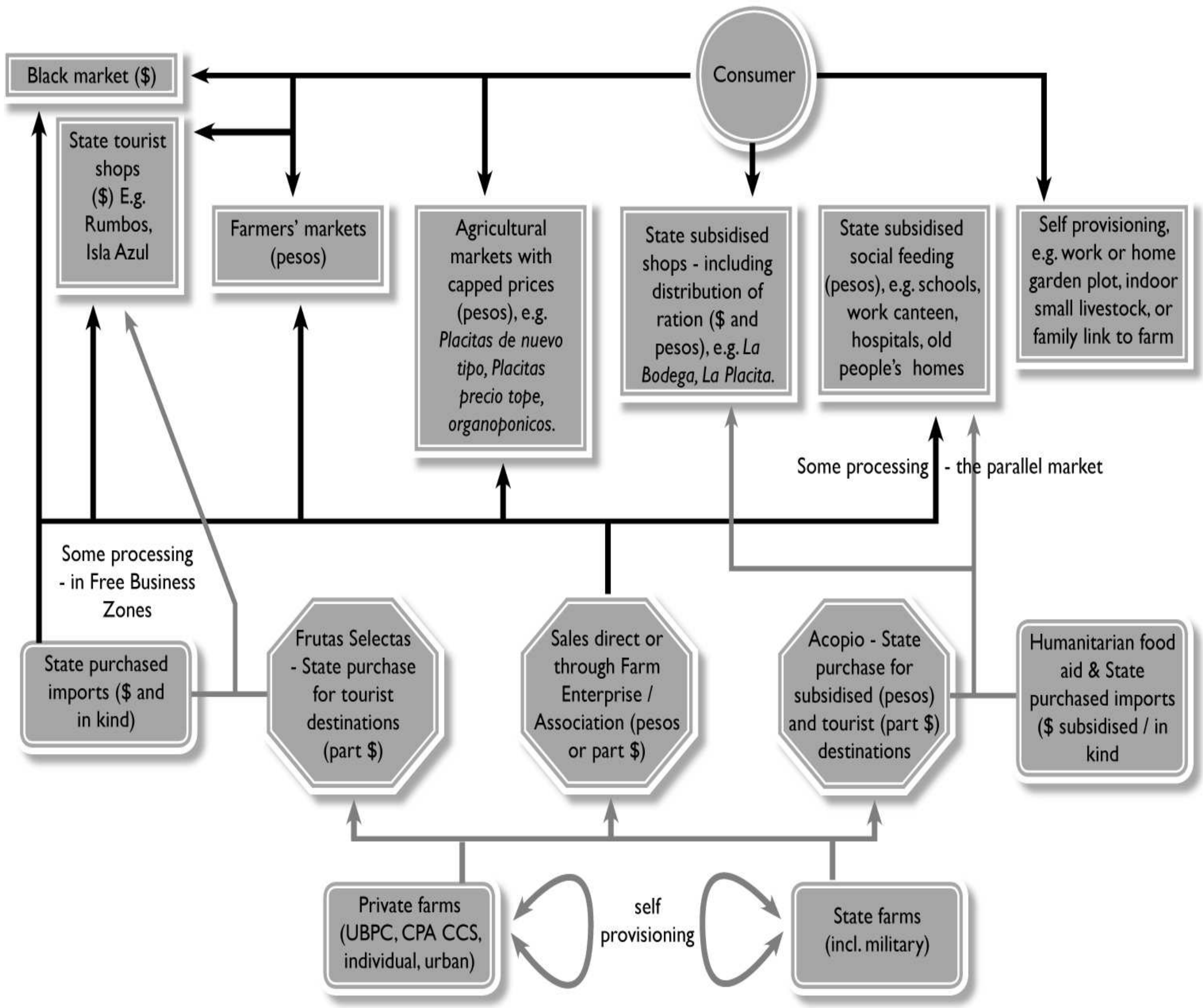
[248] Though Deere (1997) suggests that although inequality continued to grow, it would grow faster without farmers’ markets.
[249] Analysing reasons for the price immobility in the farmers’ markets, Nova (2000) identifies that supply was restricted by the high profits and organised cartel-type approaches of the private farm sector.
[250] For example, in Cumanayagua-Cienfuegos in 2000, Acopio was channelling only potato through the State ration supply; the other crops it collected and distributed through *Las Placitas.*
[251] Ironically, in the 1980s it almost lost its role because of the overabundance of food (MH/R/2).
[252] In the late 1990s, the Social Security System was benefiting over 1.5 million, or 14% of the population.
[253] Chapter 8 noted that one of the roles of ANAP was to assist the producer to market his/her own produce through the price-capped market (MA/37).

The restructuring of the Cuban economy therefore required further adjustment to improve food accessibility, an ongoing process which Castro (1996) explained "*The changes comprising, on the one hand, the introduction of market mechanisms and the adjustment of their instruments to our objective reality and, on the other hand, staying within the sphere of planning for anticipation and forecasting, will continue to be aimed at improving socialism".*

9.3.5 State and private co-ordination of the food production-distribution network at the end of the 1990s

Based on the field data, the current model of institutional relationships of the food system has been put together in Figure 9.4. This figure indicates the range of food supplies available to the consumer – some of which are provided almost free, and others which require purchasing. The figure also shows how domestic production forms the foundation of the food system. A useful analysis of the organisation of food supply in one municipality of Havana has been made by Palet Rabaza et al. (1998), who attempted to differentiate and evaluate the relationship between locally managed components and external, more centralised, ones. A summarised translation of this analysis is given in Box 9.4, and this analysis shows the complementary and positive interactions between a semi-decentralised State and private sector.

Figure 9.4 Schematic summary of food system linkages in Cuba, at 2000



Box 9.4 The organisation of food supply in one municipality of Havana City

Plaza de la Revolucíon is one of 15 municipalities in Havana City. Covering12.3 km^2, it is subdivided into eight administrative units - Popular Councils. Although the official number of inhabitants is 164,000, unofficially this number is much larger. With 18 Ministries and approximately 500 institutions, enterprises and companies it has a working population of 97,000, which it has to feed during the working day. In addition, it has to support 16 hospitals, 116 schools with over 12,000 pupils, the University of Havana and five other higher educational centres.

Palet Rabaza et al. divide the food chain components within the municipality into those that are under local management and those that are not. Those with less local management or participation play a greater role in guaranteeing basic food stuffs for the population. These and their roles are as follows:

- Provincial wholesale enterprises – which decide on the supply strategy (quantity per capita, frequency of delivery, transport, etc) according to product availability.
- Production enterprises with a national range – specifically of roast coffee, meat, poultry, dairy, drinks and liqueurs, and fish, all of which have their own methods of direct distribution to the retail network.
- Municipal enterprises of marketing and collection of agricultural products – intermediaries for the control and organisation of distribution to the population.
- Establishments of the commercial retail network – direct contact points with consumers, consisting of agricultural sales points (*placitas*), supermarkets, storehouses (*bodegas*), dairy, and fishmongers and butchers.
- School canteens –social feeding in schools is undertaken in a centralised way through the Provincial Food Production Enterprise.

Those components of the food chain with a higher level of local management are more recently established, and comprise the following:

- Gastronomic network – decentralised and outside the official supply system, this includes restaurants[254], cafeterias, nightclubs, icecream parlours, and Basic Supply Units (UBAs). This network uses hired private transport.
- Basic Supply Units – created to reduce prices in the private sector, these units facilitate the buying, selling and manufacturing of food products, and also organise a network of mobile (bicycle) food points, again in competition with the private entities.
- Workers' canteens – almost all work places have these. As it has been difficult to maintain these based on only traditional state food suppliers, management has been put in the private hands of each work place.
- Self-provisioning areas – related to the workers canteens, in the Municipality of Plaza productive land is scarce, and only 18 of the Enterprises or Ministries have been able to develop such areas toward the outskirts of the city, with surplus produce going to schools, nurseries and retirement homes.
- Farmers' markets – Plaza contains only 3 of the capital's 49 markets, but these turn over 15% of the total volume, and include on-site UBAs, whose meals use ingredients from the market.

In addition, Palet Rabaza et al. recognise three other, new components which are also under local decentralised management:

- Commercial and gastronomic network emerging from the economic recovery– created with foreign investment and consisting of hotel chains and commercial businesses operating restaurants, cafeterias, snack bars and shops. These are only accessible to dollar customers but supply some essential products to the private sector,
- Private sector gastronomic outlets – self-employed, legal individual and family initiatives which both create employment and increase food availability, especially to the local workforce. The main forms are: privately run restaurants (*paladares*), sales from home or from a fixed sales point,
- Urban agriculture – though restricted by land availability in Plaza, 79 horticulturalists receive support from the Popular Councils, with 9 *organoponicos* in operation. Products are destined firstly for workers canteens, then sales to workers and other local centres, and then direct sales to the population.

The authors noted that the while strict centralisation of the retail network was necessary to ensure equity, decentralisation of certain components had improved management, even given the lack of financial and legislative resources. Farmers' markets and UBAs were considered good examples of local management, and the expanding tourist service sector was achieving its objectives of obtaining foreign exchange and creating

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[254] As well as restaurants under the municipality, a large number also exist under the Provincial Enterprise of Luxury Restaurants.

local employment. Meanwhile, the rapid rise of private sector gastronomic outlets provided an example of the local capacity to take initiative even without formal organisation or proper resources. Even with increasing decentralisation and local management, local government and Popular Councils continued to play an important role in facilitating the diverse range of actors involved in the local food system.

Source: Palet Rabaza et al., 1998

The Acopio offices in Havana province have two main functions: to distribute produce through the retail market, and to supply Havana City with the ration. Box 9.5 describes the marketing strategies used by Acopio in Havana Province for maize and banana and Figure 9.5 displays the variety of market destinations for banana at provincial level.

Box 9.5 The postharvest marketing and distribution of maize and banana in Havana Province

Maize

Maize produced for the State plan was marketed largely through Acopio. In Havana Province, maize was sold through the following municipal outlets:

- the Placita - for 0.025c/cob
- the new-type Placita - for 1.25c/cob
- the farmers' market - for 2.5c/cob

Different varieties were sold, according to season, but overall local demand was not satisfied. Occasionally Frutas Selectas required maize for hotels that were putting on traditional events for tourists and especially those from other Latin American countries. The hotels and restaurants also bought direct. They selected 1st grade maize, paying 2c/cob, and purchase approximately 10,000 cobs per week. These purchasers had started asking for chemical-free products, indicating a potential organic market, but at the time there was no supply.

Banana

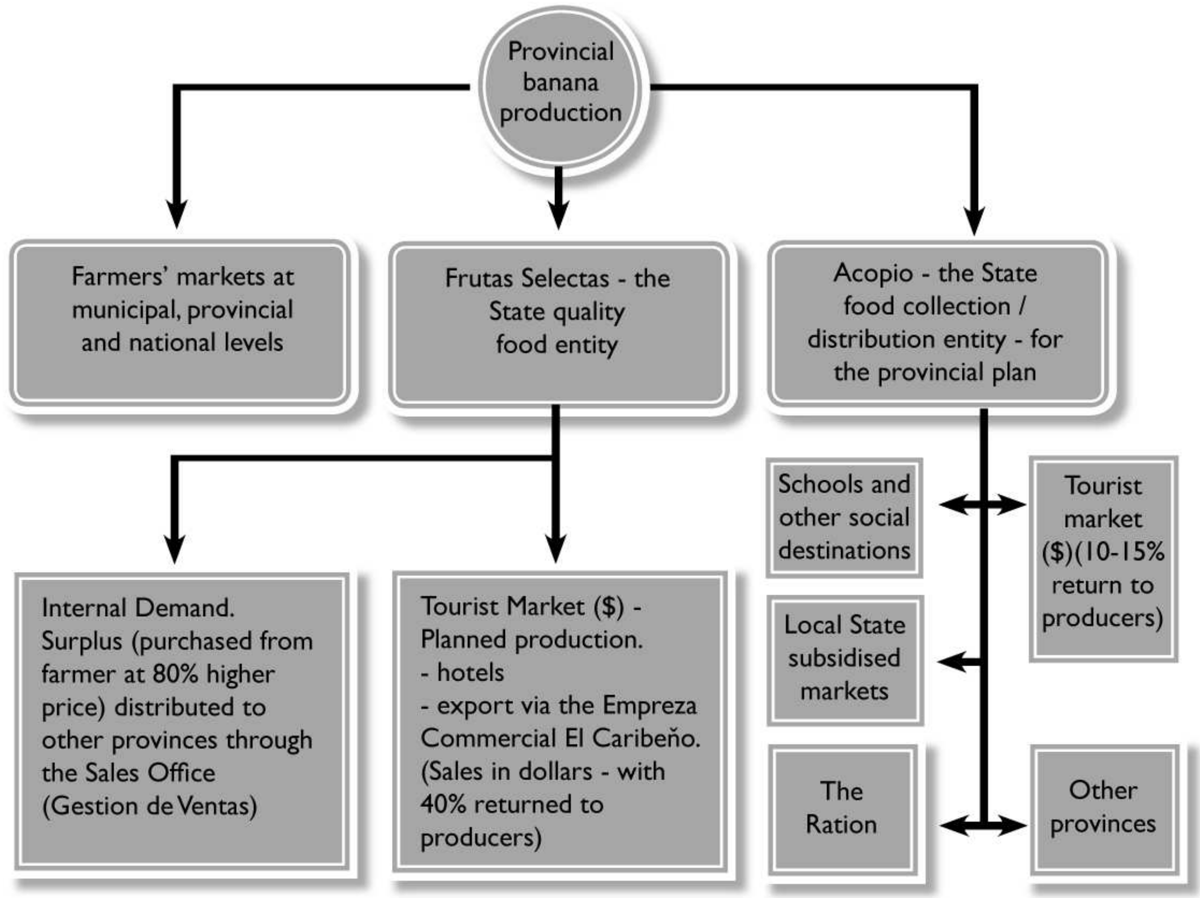
Bananas were largely marketed through the Mixed Crops division of Acopio, as banana yields in Havana province were high and adequate to supply the tourist market there. The National Union of Acopio in Havana calculated the national balance of banana based on monthly provincial and municipal estimates from field surveys and yield analyses. To supply the ration book, any variety of banana was used. Bananas in the farmers' market sold for $0.3-0.35/kg, which was considered a high price but one which consumers were willing to pay when the fruit was ripe and could be eaten immediately. Lower quality fruits went for 1.5c each ($0.15-0.2/kg), and those which had been artificially matured for 2c each.

Tourist markets were supplied with both Cavendish and the modern FHIA varieties, though Cavendish was more popular with both tourists – due to the longer shelf life, and the producers – due to its stronger fragrance masking the ripening chemicals used. The State tourist food supply entity, Frutas Selectas, also marketed bananas through its own network, competing with Acopio, not on price (which was the same) but on quality. There was a limited demand by hotels for 'healthy' bananas (*platano sano*). There was a little seasonal exportation of banana, but this depended largely on the presence of a buyer. Potential buyers would have to deal with the State entity Empreza Caribeňo. If Havana Province was unable to supply an export demand, then other provinces would be called on for their surpluses, but only after they had fulfilled internal demand, which included supplying the farmers' markets. These bananas were sold to the buyer at a slightly higher price, so as to compensate for transport costs. Due to concerns over the quality of the FHIA banana being produced, Ministry staff felt it currently more useful to focus on supplying the internal tourist market than exporting.

Source: MA/12

MINAG respondents generally felt they had weathered the most difficult period and could now understand the value of diversification into a wider range of food suppliers. It was suggested that Acopio could even decentralise further, if the CPAs and CCSs would sell directly to all the *Placitas de Nuevo Tipo*. One municipality in Havana Province, for example, had 23 such *Placitas*, and 8 sales points, which were in the hands of Acopio but which could be given over to the producers. Sales taxes had been one constraint on selling at these markets, and the State had halved this tax (from 15% to 7.5%). Yet in the city of Havana, there was a complex network of sales points: one municipal Acopio office was supplying to 30 different points in the city, and it was felt that the distribution logistics still needed supervision and could not be decentralised (MA/12).

Figure 9.5 Market destinations of banana production at provincial level



9.3.6 Coping strategies amongst the population

Current food sources for the population

In 2000, the population had access to food through the following sources:

i) Subsidised:

- State sales places and stores accessed with the ration book (*La Placita*, *La Bodega*),
- social feeding through institutional cafeterias in work places, schools, hospitals.

ii) Unsubsidised:

- private farmers' markets (restrained open market competition),
- State agricultural sales places with capped prices (*Placitas precio tope* or *Placitas de nuevo tipo*) (prices here should be 20% lower than in the farmers' markets, depending on season),
- black market,
- State dollar outlets e.g. supermarkets, restaurants,
- private peso restaurants, street food.

Prices fluctuated, as did the availability of products, the supply of which was largely seasonal. Daily newspapers paid much attention to the current state of food supply in the agricultural markets (Recio & Jiménez, 1999). Meanwhile the quantity of food available through the ration system was decreasing in line with the State strategy to wean off the population

Household coping strategies

Households coped with this situation in different ways to ensure food sufficiency. This section presents three contrasting strategies adopted by three different households. The first is a rural family within an isolated CCS co-operative, the second a provincial urban family, and the third an extended family unit in the capital of Havana. These examples are shown in boxes 9.6, 9.7 and 9.8 respectively.

Box 9.6 Food security from the view of José, a rural campesino farmer in an eastern province (F/C/1)

José comes from a farming family: he, his father and brother worked on a State Production Enterprise up to 1993 and then on family land as part of a CCS. José himself was trained to technical level as a veterinarian, and has since undergone two training courses on farm management: at the national ANAP training school and locally with the Mixed Crops Enterprise.

On starting a family of his own, he applied for and was given 24 ha for himself, to expand his dairy operations through a State programme to increase school milk supplies. Though he describes it as good quality land, it was covered in marabu, a hardy, woody, thorny shrub which he had to clear by hand and with the help of an old tractor (constructed of spare tractor pieces) he shares with his extended family. He also had to install electricity, paying the State electricity company two pigs to lay approximately 3km of new cable. He would like more land, but the municipal MINAG has refused his request so far. He sees other people obtaining more land, through bribery, but he refuses to do this as he is saving his capital to invest in stocking the land. José had been fortunate in having the capital to purchase 11 cows for his enterprise.

José is a member of a CCS co-operative, linked to the local State Livestock Enterprise. The co-operative would like to apply for 'strengthening' by the State, but at present it does not meet the basic eligibility requirements – it lacks a tractor and basic tools. As a result, members cannot purchase subsidised inputs through the State system but have to pay black market prices which are 2-3 times higher. Still, although José has had plenty of experience with high-input agriculture in the late 1980s, he feels that the main constraint on productivity is the lack of tools and machinery to undertake the basic land tasks (rather than chemical inputs). His extended farming family help each other out through exchanging seed, labour, produce and so on.

José has to sell some of his produce: cheese, milk and meat, to the State. This includes all the beef he produces; home consumption of beef is illegal. Not being 'strengthened' limits the market opportunities of the CCS, especially as he lives, approximately 7km from the nearest town, and a 3 hour bumpy bus ride from the provincial capital. The taxes he would have to pay at the farmers' markets are prohibitive. His main income comes from selling his cheese (approximately 90%) on the black market, to women who then bus it up to Havana.

He receives a typical subsidised State ration. This comprises of the following basic items, per month:
1lb dark sugar (0.4c/lb), 6lb white sugar (0.75c/lb), 5lb rice (6c/lb), 6oz beans, 6oz pulses, 2lb tinned ham.

He can also buy roots, tubers, fruits and other products from the State ration store at higher, but still subsidised, prices. At this store, 1lb of rice costs 17.5c (ie. 3 times the price of the ration). José receives a special diet for his baby daughter including, sometimes, beef and milk. So along with the ration, José produces his own food, largely pork, milk, cheese, wheat, and horticultural crops. He also exchanges with family members. He has access to other peso markets including the agricultural sales points and the farmers' market, although prices there are less affordable for him, and more variable. Sugar, oil, more rice and fat, all have to be bought in the dollar shop or on the black market.

For a young, ambitious and hardworking farmer like José, the poor access to land and markets are limiting his potential productivity.

Box 9.7 The food security strategy for a provincial urban family in a central province (KI/1)

The Conejo family own a 4-roomed, one storey house on the outskirts of their town. Their youngest son remains at home, bringing in $7.5/month from his job in a local processing factory. Sra Conejo describes in detail their food ration per month, as follows:

Per person:

5lb rice (1c/lb), 0.5 litre oil, 2-3lb salt, 6lb white sugar (0.8c/lb), 1lb brown sugar (0.4c/lb), 1 bread roll/day (0.15c/unit), 1/4 lb beans or pulses, 1lb fruit banana (2.5c/lb), 6oz soya meat, 1-2lb roots & tubers, 1 tin fish to share 3 people (7-10c/tin), 3-4 eggs (0.75c/unit), 1/2 bar soap, 1 toothpaste to share 3 people, 12oz coffee, 4oz tea, 3litres cooking fuel, 2 gallons petrol.

Other items, such as fruit and meat, may be included but their quantity and availability varied each month. The old people and children are entitled to extra rations including 1litre milk/day and cereals.

Sra Conejo recalls when the ration provided for all their needs, including pork that was sold at 5c/lb. Nowadays they can purchase pork from the State market at $0.75/lb, or from the agricultural market at $1/lb, and fat at $0.75/lb. For vegetables they go to the State *organoponico*, and for extra oil, soap and detergent to the dollar shop. The black market, and street hawkers always have something to offer, such as pork (at $0.75/lb) and cheese. These sources are cheaper than the farmers' market because no tax is paid. They also have a more reliable supply. Sra Conejo has heard that people in Havana receive more through their ration including fish, and one whole bar of soap per month.

The family keep 2 pigs and 5 chickens in the 2m^2 backyard of their house. Sr Conejo gets up early in the cool morning to prepare coconut sweets using sugar he saves from the ration and from other sources, and coconuts which he can obtain almost free. He produces about 70 sweets a day, and, selling unofficially via a middleman, he receives 2.5c/unit, which brings in $1.75/day less his minimal production costs. The Conejo family are fortunate: one son lives abroad and sends home small amounts of money in dollars. With these they can purchase some luxury items such as soft lavatory paper, and are planning an extension to their house. They consider themselves resourceful and, with low financial overheads, they can live a relatively comfortable life.

Box 9.8 Financial and food coping strategies of an extended family in the centre of Havana (KI/6)

Sra Sanchez, in Havana, is the matriarch of an extended family of 7, living in a three bedroomed apartment in a prosperous central suburb of Havana. Her son, his wife and their two teenage children sleep in one bedroom, while Sra Sanchez, her daughter and other granddaughter in another. The third bedroom is left empty. Her son owns a flat in the neighbouring suburb that he chooses to rent out. With all three grandchildren studying, and Sra Sanchez and her daughter-in-law minding the house, the only wage-earners are her son and daughter, who both hold full time jobs - although they are able to take substantial time off.

Prior to the Revolution, Sra Sanchez had been a nightclub singer and entrepreneur, and the change in government had brought an end to the glamorous life upon which she and her husband had thrived. In the 1960s, and with two young children, they decided to move to Spain. Her husband went ahead – but shortly afterwards State emigration laws changed and Sra Sanchez and her children were unable to follow. Lacking practical skills, she had survived, and especially through the 1990s, by informal wheeling and dealing. For this family, the major income generator was their property. Their colonial apartment was grand and spacious, and they had converted two rooms into a separate apartment that they rented out to foreign visitors. Together with the rent from the son's house, they had a substantial dollar income which they used to purchase imported material goods, and to upgrade and enlarge their house further.

Through their dollar income, the family are able to supplement their ration with sufficient amounts of meat, special-occasion luxuries, and other additions, largely through the black market or from local State stores. There is always a queue at these stores, but Sra Sanchez or her daughter-in-law have the time to wait. Agricultural sales points (*La Placitas*) at both ends of their block sell a (limited) range of produce directly from farms in the Province, and a farmers' market is 15 minutes walk away. These markets are, however, rarely visited by this family. They choose to eat few fresh vegetables other than lettuce and tomato, but fry most of their food and consume quantities of processed, sweet foods and drinks. They feel food insecure, constantly discussing food and their insufficient access to it. Given their adequate financial resources, there also appears to be insufficient knowledge of healthy dietary habits. The felt insecurity is not only about food; the family also have a wall-to-ceiling cupboard bursting full of medicines and pills which they accumulate from their foreign guests.

In contrast to these, in 1999 the author encountered a more desperate coping strategy while travelling on field work in Havana Province. Two women from the province of Camaguey had hitchhiked for 2 days to reach Havana, where relatives who were working on farms would provide them with two sack-fulls of roots and tubers to take home to their families. This was one, perhaps extreme, instance that indicated the possibly more desperate state of food security in more marginal areas, with people being willing to travel so far, and using so much of their time, for such low value, starchy foodstuffs.

Co-operative farm coping strategies

CPAs in Havana Province

As mentioned in Chapter 6, some CPA co-operatives had (were encouraged to) renounced their right to State rations as they became more self-sufficient and to show that they were not a burden on the State. In this sense local food security had increased – of both local availability and access to food, and by eliminating transport the food would be fresher and of higher nutritional quality, at least at harvest times. Self-provisioning took up a relatively small percentage of land area, only 8.3% on one co-operative.

In global, material terms, these farmers were relatively poor. Individuals on all the co-operatives had incomes of less than one dollar a day, including profits. Yet living costs were low: housing, albeit basic and often cramped was provided; schooling was free; basic foodstuffs were supplied at a very low price; and medical care was free (although medicines were in short supply). Occasionally work clothes and boots were provided. Although protein consumption was low due to the limited livestock and little meat available through the ration system, each farmer member had his/her own family home garden where some kept goats. The main expenditures would likely be on foodstuffs not obtainable through the co-operative or ration system, such as cooking oil and clothing, use of public transport, and children's needs. Items that needed to be purchased in dollars, such as cooking oil, were often inaccessible, owing to difficulties in making arrangements with the State to produce and sell crops that would generate a dollar income. Notwithstanding this basic State support system, there was little contingency for emergencies or “seed” money to support innovation or development. There was little evidence of on-farm processing or value adding in on CPAs in Havana province.[255]

UBPC and CCS farmers in Havana, Cienfuegos and Holguin

In the private CCS sector, much land was being given over to self-provisioning, and this brought with it the promotion of ‘perennial production strategies’ such as, for example, planting of early and late varieties of mango and cassava to extend seasonal availability (MA/29). CCS farmers in the field survey attempted to be individually self-sufficient, producing up to 90% of their food needs. However, it was only the older farmers actually achieved this; the younger, less experienced, had to purchase more food.

On the UBPCs, food produced was sold to member families at cost price - this was largely grains, roots and tubers, and horticultural items. Some UBPCs provided more, depending on their production. One UBPC in Gibara-Holguin supplied milk on a daily basis, 4 eggs per week, meat and other foodstuffs to its members. Generally, UBPC workers had access to peso shops via their associated Enterprise. These shops carried a wider range of products, of higher quality, comparable to those found in dollar shops, but at a subsidised price (F/U/1). Some individual members of UBPCs were also producing their own foods, working a *Navé* - a small plot of land devoted to rice production. This land was owned by the co-operative, and the farmers had to pay a rent in the form of part of their rice harvest.

In Cienfuegos and Holguin provinces, the CCS co-operatives produced 90% of their food on-farm, and the UBPCs between 65 to 90%. All also accessed the State ration, and the CCS co-operatives in both regions accessed the dollar outlets. In Cienfuegos, all the co-operatives also

[255] Compare this to CCS farmers in Pinar del Rio (see Chapter 6), whose only marketable crop was tobacco and who self provisioned a wide variety of other foodstuffs ranging from staples to condiments which were all considered too expensive to purchase. There was a reasonable level of home-processing, such as of tomato into puree and sauce (Rios Labrada et al., 2000[a])

obtained food from the peso shops, and about half visited the farmers' markets. In terms of proportion of supply, CCSs in Holguin found that the ration supplied 8% of their food needs, and the dollar outlets 2%. For UBPCs in the same area, the ration supplied 15-25% of food needs, and 10% came from workers' self-provisioning plots.

The majority of farmers felt that there was currently less food available compared to the late 1980s, but more than in the worst years of the crisis around 1993. Discussing changes in food sources compared to the 1980s, UBPC farmer F/U/2 (Holguin) described how, in the past, the UBPCs used to supply only the workers' cafeteria, sending all the rest of the produce off-farm, whereas individual workers were now able to purchase produce at very low prices: for example, this year they recently paid $0.065/kg for beans on-farm, while on the farmers' market beans were being sold for $0.44-0.66/kg. CCS farmers were less likely to note a change in food availability; they traditionally had a locally-sourced diet.

Overall feelings of insecurity

Despite all the changes, including substantial positive improvements, there remained in society a widespread feeling of food insecurity. On farms, even those producing abundant food, this insecurity focused around types of food, and specifically the lack of meat and other primary proteins. For example, whilst living and working on a CPA co-operative in the province of Las Villas, the author observed co-operative workers, and especially women, consume one tray-load after the other of starchy carbohydrates (rice with beans, cassava and fried sweetpotato). Workers were overeating, yet they did not feel satisfied. As a result, their productivity suffered. Off-farm insecurity could be partly attributed to the still-precarious sources of food or finances to access it. Dependency on a daily State ration, with a fluctuating composition, meant that households were unable to stock up with food reserves (a problem compounded by the lack of cool storage facilities in many households) and did not feel in secure control of their food future.

9.4 FOOD ADEQUACY

9.4.1 Policy on food adequacy in relation to agriculture

Adherence to the socialist principle of meeting human rights to adequate food in Cuba, meant a more explicit recognition of the link between agricultural production and adequate diet. This was evident, for example, in the general objective of agriculture in the National Nutritional Action Plan: "*To increase agricultural production, aiming to completely satisfy the nutritional needs of the population, based on increasing efficiency of use of human, material and financial resources, whilst at the same time conserving the environment*" (Republica de Cuba, 1994, p.60). The Plan set out specific objectives for national agricultural production in relation to ensuring food adequacy in terms of nutritional composition, diversity and freshness:

- development of the farmers' markets and self-provisioning plots to provide fresh foodstuffs,
- increase the supply of fresh and processed grains, roots, vegetables and fruits to provide dietary fibre and a varied diet,
- increase the supply of animal protein-rich foods: eggs, meat and milk,
- increase the supply of vegetables oils,
- increase sales of poultry chicks for home-fattening,
- increase planting of fruit and timber trees on farms.

Specific strategies were included within the aim to improve health and nutrition levels. These included: raising awareness in schools and in the adult of the risks of an inappropriate diet; reducing the quantities of refined salt and sugar used in agroprocessing; promoting the consumption of fresh vegetables, roots, grains and fruits in both social and individual feeding; creating centres for micronutrient nutritional vigilance in all provinces; and increasing availability of foods rich in vitamins A and C. The System of Food and Nutritional Surveillance (SISVAN) paid further attention to the nutritional adequacy of social food provision such as rations. Consideration was also given to raising food standards to international ISO standards and to setting up a network of certifying laboratories for foodstuffs and water

All this looked good on paper and in discussions. Based on primary evidence from the field, and aside from urban agriculture, the drive to increase production yields overshadowed concern with health issues within the agricultural sector. Little attention was paid to micro-level health issues and their relation with agriculture and, as elsewhere in the world, the issue of human health was dealt with by the Ministry of Public Health with little concern by the agricultural and food ministries.

9.4.2 Institutional responsibilities and post-crisis changes

The Institute for Nutrition and Food Hygiene (INHA) in Havana, under the Ministry of Public Health, was a key contributor on food security issues and was responsible for organising the Food and Nutrition Surveillance System (SISVAN). Over the last few years it had become independent, doubling in size[256]. Responsibilities associated with managing SISVAN included surveillance of mother and child nutrition (through the primary health care network), social feeding, and chemical and biological food contaminants. The institute was also responsible for identifying and dealing with, not only the undernourished but also the obese (Amador & Peña, 1991). A further responsibility was for making nutritional guidelines for the National Nutritional Action Plan - following WHO guidelines - and then developing dietary recommendations based on these. At 2000, these recommendations were not complete.

The constraints of the Special Period impacted research on food and nutrition just as it had for agriculture. INHA's research was public-funded and therefore constrained to what could be undertaken in national currency. The lack of resources affected both research topics and publications. López Espinosa & Díaz del Campo (1996) describe how the principal food journal, the Revista Cubana de Alimentacion y Nutricion, continued to publish throughout the early 1990s, but less frequently and with far fewer articles than before (an average of 16.5 articles per issue as opposed to 23).

9.4.3 Health fluctuations and emergencies in the 1990s

The nutritional status of the population up to 1989 has been discussed in Chapter 2. As with food availability, there had been plans to improve food adequacy within the National Food Plan of the 1980s. Again, such plans were interrupted by the start of the crisis.

Continuing into the mid and late 1990s, and according to an FAO report, the number of undernourished people in Cuba increased by 11%, between 1990-1992 and 1997-1999. This was partly the result of cutbacks in State provision: schools had previously provided children up to the age of thirteen with milk, but this age limit dropped to 6, and notably children under the age of 5 maintained similarly high nutritional indicators as in previous years. Other health indices showed a similar continued decline: the incidence of low birth weights rose from 7.3% to 8.8% between 1992 and 1996. The ongoing sanctions were also culpable: annual deaths caused by the sanctions was 7,500 adults (over 65) during the most critical period, and this figure was the lowest estimate (Garforth, 1999; Sinclair & Thompson, 2001).

Overall, although nutrition generally declined throughout the 1990s, the decline was greater during the first part of the decade, after which the rate of undernourishment fell. Although food supply still did not quite meet demand, supplies were more stable, owing to increased refrigeration and improved distribution. To put it in perspective, the health of vulnerable groups still remained one of the best in Latin America (Sinclair & Thompson, 2001).

[256] With 169 employees, of which 56 were researchers and the majority female.

Changes in dietary habits and the return of 'western' disease

The basic Cuban campesino diet is rice, beans, roots and tubers, meat and some salad. There are some regional variations: less processed food and more traditional roots, milk, meat and rum is consumed to the east of the island; more fried roots and tubers in the centre; and more rice and soups ('slave food') to the west (Nunez Gonzalez & Gonzalez Noriega, 1995). Prior to the 1990s, almost the only vegetables consumed were onion, cucumber, pepper and tomato (García Roché & Ilnitsky, 1986).

As a response to the crisis, people were encouraged to consume vegetable-based foods instead of animal protein, and breast feeding was promoted and rose from 63% in 1990 to 97% by 1996 (Garforth, 1999). Since 1994, food scientists started to substitute the loss of dairy with soy products, particularly flavoured yoghurts for children. Over 40 dairy factories were converted to process soya. Apart from yoghurts, they also produce soy based cheese, ice cream and chorizo (Montanaro, 2000). From 1991, Cuba started to import vegetable oils, transforming the basic source of dietary fat from animal to vegetable. Although heart disease fell from 160 per 100,000 in the 1980s, to 88/100,000 in 2000 (and was at a low in the early 1990s due to the decline in consumption of pork fat) yet it has remained the main cause of death, because of the continued high consumption of low-grade, saturated fats (MH/R/2). Sugar consumption increased dramatically as a proportion of the daily diet, owing to the lack of alternatives, As recently as 1999-2001, sugar and its products composed 21% of total dietary energy supply (FAO, 2004).

At the end of the 1990s, availability of some foodstuffs had increased dramatically, particularly certain vegetables which were introduced and made popular by the Chinese community before being taken up by Cuban urban gardeners. For others, availability remained very low, particularly fish, as a result of overfishing and demand from the tourist market. Cubans mostly have to rely on canned and freshwater fish. With the promotion of urban agriculture, some sectors of the population were eating more healthily. "*The dietary habits of the population have changed a lot. Vegetables used to be called weeds, but now they are accepted in the diet. Vegetables used to be the most expensive and unobtainable part of the diet, but now they are available – urban agriculture supplies half of the city's vegetable needs*." (MST/2). The drive for urban home garden production potentially provided a good supply of essential vitamins, minerals and carbohydrates to urban households as well as medicines and spices (Altieri et al., 1999).

On the other hand, unprocessed products, such as brown rice and wholemeal bread, found little mainstream acceptance among consumers even though it could be purchased cheaply in one of a small chain of peso 'health' shops. Untreated bread in particular was felt to perish more rapidly in the tropical climate if not packaged properly. Similarly, vegetable consumption remained low, and although this was partly put down to the high costs of the farmers' markets, households would choose instead to purchase processed, imported foodstuffs with any spare dollars (see Box 9.7 for an example).

Unsurprisingly, the number of obese and overweight people has mirrored the dietary trends over the last 10 years: in Havana City 30% of the population were overweight or obese in the 1980s; this dropped to 16% in 1993, but rose again to 36.5% by 1999 and was continuing to increase as food availability increased (MH/R/3). A national study on obesity was more recently reinstated by INHA, and the results of this would be used to educate the population on nutritional guidelines, via radio, television and other media. In this sense, the 3-4 year crisis was long enough to reduce some western diseases, but not long enough to change habits. At the end of the 1990s, the most common causes of death amongst the population were the same as those in the 1980s (in order of frequency): heart attacks, cancer, cerebro-vascular, accidents, pneumonia, suicide, and diabetes. Levels of osteoporosis had doubled, which may be due to the decrease in milk consumption (although much milk was available on the black market).

There was a clear need for more awareness-raising on nutrition. Yet as Sanchez commented in 1994 "*There is still a lot of convincing to be done to encourage Cubans to change their dietary* *habits. Education and active participation are the key to solve this problem*." (Windisch, 1994). Combined with this, participation and active involvement in public health programmes remained low, with most Cubans adopting a passive approach in their use of use the public health service (Garcia Caraballo, 1996).[257] In terms of positive dietary health moves, the Committee for the Prevention of Disease through Dietary Modifications, at the National Cancer Institute in Havana, ran education programmes on the link between diet and disease, and promoted vegetarian diets, organic foods and exercise (Montanaro, 2000). One nutritionist (MH/R/1) suggested that the population had been spoiled by the State's attempt to meet their unhealthy food preferences. Although appearing passive receivers, "*the people's way of resisting is to refuse to eat what may be offered to them, and so the State has learned not to offer what may be rejected*." In this way, the State had opted for an indulgent rather than a benevolent form of paternalism, at least where food was concerned.

Several challenges stood out to improving dietary quality. By necessity, the State ration focused on bulk items - starchy carbohydrates. The quality of products was low, what with few farm gate quality standards and the better farm produce being siphoned off to the more profitable tourist and other destinations. Individuals could only receive their ration from their local food distribution point at which they were registered and thus were limited if they had to travel. Further, there was a clear and increasing differentiation between the quality of food available to the Cuban population and to tourists. This included the amount of chemicals applied and the use of genetic engineering. As tourism was becoming increasingly important to the Cuban economy, the service industry was becoming more professional and in particular targeting the more up-market, wealthy tourists. The restaurants and official private eating establishments (*paladares*) reflected this with relatively high prices. Peso food outlets remain poor quality. Such differentiation strengthened the view amongst the population of the luxury lifestyle in the outside world.

Trends in food safety concerns

In terms of food safety, INHA was responsible for monitoring food product contamination, such as levels of mercury in fish, nitrates, lead in vegetables produced near roads and aflotoxins in cereals. Prior to the crisis, INHA had been examining the issue of residue levels in food crops (mainly nitrites in horticultural crops) destined for export to Eastern Europe.[258] However, this research was dropped after exports stopped, and the need to feed the people took priority over eliminating contaminants (MH/R/2). Because of a lack of resources and especially reagents, research in the 1990s had tended to focus on only the most vulnerable crops and on biological rather than chemical contamination.[259] The privatisation and decentralisation of agricultural production also made it harder to monitor and control food safety and has contributed, according to respondents, to a higher incidence of nitrate toxins.[260]

Studies of agricultural produce between 1990 and 1995 demonstrated a generally low level of pesticide residues. There were major exceptions to this, and particularly of EBDC[261] fungicides and other pesticide residues in tomato, onion and potato,[262] which exceeded maximum permissible levels (Dieksmeirs, 1995; Vega Bolanos et al., 1997). Overall the number of individuals reported as

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[257] There was currently work underway to develop methodologies for resolving community food problems at Popular Council level (MH/R/2).

[258] García Roché & Ilnitsky (1986) had found a high incidence of nitrates in certain food crops in Cuba, and García (1987) that nitrate levels of vegetables in Cuba were not inferior to those reported in European countries.

[259] In terms of biological contamination, incidence of food-related disease outbreaks fell rapidly in 1992, due to the changes in sources and forms of food consumption. It then rose from 1993 onwards because of the increased consumption of locally-caught fish and of street foods, especially sweets and meats. Street foods were particularly prone to be disease carriers, because of the state of disrepair of refrigeration units and the poor food habits of food preparers and vendors (Grillo Rodríguez et al., 1996).

[260] INHA had laboratories in their provincial centres, each with a sanitary inspector who visited the agricultural markets and warehouses. One impact of this monitoring was that, in 1999 the sale of pork was suspended owing to high nitrate levels found in supplies.

[261] Ethylenebisdithiocarbamates.

[262] All these crops received priority in terms of agrochemical input distribution.

suffering intoxication by pesticides increased up to 1992 and from thereafter decreased up to 1995, although this figure was likely to be an underestimate as overall incidence of intoxication was under-registered. Mortality rates during this time were low, at just under 2 per 100,000. Nevertheless, research demonstrating the toxic effects of pesticides[263] led to the Ministry of Public Health regulating and prohibiting the use of organochlorines (in 1990 and 1995) Field interviews showed little health awareness or concern within MINAG over the use of agrochemicals, apart from a MINAG initiative in Holguin Province to evaluate, in conjunction with health professionals, their indiscriminate use.

Only a very few studies emerged in the 1990s linking agriculture to human nutrition, and those which did saw the link from a different perspective. Rodríguez-Ojea et al. (1998), for example linked mountainous rural populations with iodine deficiency. Although this was seasonal and due to fluctuating access to imported foodstuffs, a correlation was found between iodine deficiency and levels of soil erosion. The authors suggested that the promotion of food self-sufficiency had induced this less varied (less import-dependent) diet. This study led to the creation of a multisectoral National Committee for the Control and Eradication of Iodine Deficiency Disorders in Cuba, and a nationwide monitoring system for the control of iodised salt production and distribution. This incident highlights two key themes, repeated elsewhere in this study. First, that the State's approach to nutritional deficiency was that of direct substitution rather than looking to the cause of the problem; in this case soil deficiencies.[264] The second was that promotion of food self sufficiency needed to be accompanied by measures to ensure that local natural resources were capable of supplying sufficient nutrient requirements.

In relation to this, national programmes from the Ministries of Food Industry and of Health, were established to counteract the major macronutrient deficiencies – of iron, vitamin A, and calcium. This included fortifying children's food, and importing flour supplemented with iron (since 1998). Food supplements were acknowledged as short term measures, but longer term solutions achieved through direct food sources would mean changing the balance of crops being produced and food habits, and, according to health professionals interviewed, both of these would require awareness raising. A small amount of nutrition-related research was being undertaken between INHA and INIFAT to evaluate the impact of an increase in vegetable consumption on a target community. However, there had been no obvious work on the impact of change in agricultural approach during the 1990s on dietary health. INHA staff had little awareness of ecological agriculture and its relation to food quality. Staff expressed interest in researching the appropriateness of the nutritional content of ecological products to human health, but lacked the resources to undertake such research.

9.5 DISCUSSION ON TRANSFORMATION IN THE CUBAN FOOD SYSTEM

9.5.1 Overview

The Cuban State has placed a high priority on nationwide food security and has implemented three strategies for meeting this objective: a food nutritional monitoring system; an increase in domestic production, through whatever means possible, and continuing to guarantee access to food for all. Opening up agricultural markets and giving producers more control over their resource base has stimulated production, which has increased steadily since the early 1990s, contributing to greater food availability. While the State continues to ensure a certain equitable access to this food, consumers are being weaned off the food ration system and towards an, albeit narrow, range of less

[263] At 1990, and given the noted increasing consumption of vegetables and that 90% of nitrates were ingested through vegetables, tubers, legumes and rice in Cuba, a proposal had been made to establish maximum limits of nitrate residues in these products (García Roché & Grillo Rodríguez, 1991) .

[264] Soil iodine levels may be increased by the addition of seaweed fertilisers. Alternatively, iodine-rich crops may be grown or supplied, such as garlic, lima beans, spinach or squash. At the same time, lack of zinc in the diet may act as a suppressant, as can consumption of crops such as maize and cassava.

subsidised food sources. Yet there is still a substantial deficit in supply, continued dependency on imported foodstuffs and disparities in access to food are widening. At the same time food distribution has been decentralised and is moving toward a more localised pattern with the emerging realisation by the State that the 'one size fits all' approach of industrialised agriculture is not viable. This has had implications on the balance of crop types grown at the local level, but it is difficult to quantify the influence of changes in approaches to production within this.

Nevertheless, there was a lingering feeling of food insecurity by the population, coupled with a continued preference for the traditional diet heavy in carbohydrates, sugars and fats. As a result, western diseases are still prevalent and obesity is on the increase; many people do not take advantage of the increase in the availability and accessibility of healthy food products, such as fresh fruit and vegetables. Inadequate nutritional levels in food are dealt with by supplementing foodstuffs rather than by addressing more fundamental issues, such as soil health or public awareness, although there are signs that this is changing.

The necessity of maintaining national food sufficiency in the crisis years, meant that Cuba’s agricultural strategy remained focused on achieving high yields through continued industrialised approach where possible. Yet at the same alternative strategies were developed and integrated within this framework.

Overall, and notwithstanding the continued sanctions, Cuba now holds more sovereignty over its food security than before, in terms of the control and decision-making power it wields at national level in relation to global food markets. It has demonstrated that it is not so much the type of agricultural production system which influences nationwide food security, but the political will to produce and obtain food and ensure its equitable distribution. At the same time, Cuba’s system of food security is, at least in part, based on a more ecological approach to production, demonstrating the technical feasibility of such an approach within a nation’s food security strategy.

Increase in national purchasing power could possibly undermine this achievement, if it were to lead to more food imports, which undermine domestic production. Balancing economic priorities – importing cheap food, with social priorities – supporting domestic production, would be tested. Overall Cuba’s experience shows that with the political will, nationwide food security can be maintained, even during a period of extreme crisis This suggests shortcomings in political will and/or priority setting by other less industrialised countries – and their advisors - where food insecurity continues to blight the lives of substantial proportions of the population.

From these general conclusions, more specific insights can be derived into the fourth main research question of this thesis: concerning the wider implications for the food system of a change towards ecological styles of production. Equally, some specific aspects of the Cuban food system have a broader relevance in the context of international food security.

9.5.2 Key changes in the food system affecting food security

Meeting national food security

In terms of sufficiency of supply, national food availability had certainly increased since the beginning of the decade, due to the State having identified alternative sources of imports, continuing food aid, and to a gradually increasing national production. A higher proportion of basic staples were now met by domestic production than before, and more fresh fruits and vegetables are available. Yet, there had been a decline in the availability of animal proteins. Maintaining stability in the internal food supply over time was problematic due to inadequate storage facilities to buffer against seasonal fluctuations and harvest failures. On the other hand, increased self sufficiency meant that the island was more protected from international market fluctuations, and this protection was similarly felt at provincial and farm/family levels.

The ration system, which had endured throughout the decade, had ensured a basic adequacy of distribution to the population. Yet this was being phased out in place of less subsidised food sources. Inequalities were increasing, exacerbated as the burgeoning tourist sector received the highest quality produce, although social feeding programmes and additional rations for children and the elderly continued to provide a "nutritional safety net". Owing to continued shortages of foreign exchange, Cuba was unable to import as required, yet this constraint provided a stimulus for further food self sufficiency. Cuba restricted imports to those foods that it was less able to produce domestically, and at the same time prioritised importing crucial foodstuffs over other spending requirements.

Meeting household food security

At the household level, there was a perception of insufficient availability of food, largely because of a lack of both free choice and access to culturally valued foodstuffs, such as meat products. This notwithstanding the increased choice and access to fresh fruits and vegetables, where urban supply was not accompanied by consumer education to stimulate demand. These feelings of food insecurity still existed, evident in patterns of overeating, even when there was an adequate supply. Some of was related to access, with certain basic products being obtained only with dollars that were handled by only 50% of the population. In rural areas, CCS producers had managed better than those from UBPCs, having more autonomy, possibly better market opportunities, and more possibilities to funnel surplus production into the black market.

In terms of dietary balance, the traditional Cuban diet was poorly balanced, with a high proportion of fats and carbohydrates, whilst the commonly available diet was deficient in proteins. However many of the cheapest and most available foodstuffs – grains and legumes, fruits and vegetables, could make up an adequate quasi-vegetarian diet, with the appropriate knowledge, awareness and cultural willingness.

On a daily basis the ration provided a basic supply, although its content varied and was unpredictable. This unpredictability of content extended to the local state sales points, though less so to the farmers' markets. Seasonality of domestically produced fruits and vegetables influenced supply stability and price. Equally dollar incomes were sporadic; farming co-operatives may earn dollars if and when they were contracted for an export crop; families may receive sporadic dollar remittances from relatives abroad; and families may exchange any spare pesos into dollars. Intra-household supply was more balanced given the individual ration and the social feeding. In times of crises, Cuba had a system in place which prevented householders from being marginalised from food: first, through the equitable food collection and distribution system which facilitated transportation of both imported goods to rural areas and domestic produce to urban centres; and second through urban production which provided city dwellers with direct food source.

9.5.3 More ecological approaches in relation to food security

Changes in farming strategies

Cuba was producing an equal quantity or more food in the 1980s under an industrialised monocultural regime, but was less food secure, partly because this system was inherently ecologically precarious, and also because it was plugged into the COMECON food economy. More recently it has increased food security and sovereignty, through an approach which has included low input and organic elements. Overall it is evident that food security is more dependent on the organisation of the food system than on the agricultural approach employed. This notwithstanding, Cuba's adoption of ecological approaches has not jeopardised food security (as some might argue it would) and but, on the contrary, has generated several benefits relating to economics, health, the productive resource base and the environment.

Changes in regionality and complexity

Several factors - the lack of fuel for transport, storage facilities, resources for nation-wide technology dissemination, and imported foodstuffs, all contributed to the emergence of a strategy of regional production. These external influences increased awareness of the other benefits of decentralisation, such as more local control and improved efficiency.[265] Chapter 7 showed how more attention was paid to the suitability of land for specific crops, and with meeting local demand. In this sense, agriculture appeared to be taking on some of the characteristics of an ecological approach, but for reasons of resource scarcity. For example, beans were more widely planted in order to meet domestic demand, rather than as an organic attempt to increase soil fertility.

The State food planning system had, up to the 1990s, been easy to manage because of the large volumes of food being imported in predictable quantities. In the 1990s, Cuba had to devise a different planning and distribution system. Food distribution became more complex, with more legitimate private initiatives which had to compete with parallel State activities. The farmers' markets, urban agriculture, and smaller scale farms all helped decentralise food supply networks and create certain direct producer-consumer linkages. These were encouraged by the State in order to minimise profiteering by middle-men (as opposed to increasing consumer awareness of food issues). Small-scale food processing also increased.

Nevertheless, although national policy and less favourable terms of trade led to a significant decline in export production, agricultural commodities were still Cuba's main source of foreign exchange and were important nationally. At the grassroots level the small injection of dollars from e.g. tobacco production into household economies was an important incentive. Therefore, a degree of interaction with international markets was both crucial and useful.

Changes in breeds and varieties

There were conflicting factors influencing the use of indigenous varieties and crops. On the one hand, the plant breeding and seed sector were more aware of the use of varieties better suited to local physical and socio-economic conditions. Yet at the same time, and despite farmer preferences for the former, exotic varieties and hybrids were still widely promoted, partly within the continued industrialised system and partly through international development schemes. Perceptions about and choices over traditional and improved varieties was contested, at both farm and support level. Cultural food preferences also favoured some exotic foods, particularly potato and wheat products, which were more popular than traditional carbohydrate sources, such as malanga (cocoyam) and cassava. These traditional crops, were being dropped or lost, as was knowledge about their preparation methods.

Domestic beef production and consumption amongst the general population fell to almost negligible levels, owing to the poor fodder supplies and inappropriate breeds left over from the industrialised era. Again, this was out of necessity rather than choice in terms of more sustainable restocking of agricultural lands, but it led to diversification into other primary meat sources such as pig and chicken which could more rapidly integrate into smaller scale production systems.

Changes in food quality and health

The crisis of the early 1990s had highly paradoxical health implications. It increased the health status of many sections of the Cuban population as shortages of food, particularly of fats, enforced a healthier diet on the majority. It also encouraged food preservation. Yet it also precipitated increased mortality and morbidity amongst the elderly, sick and weak. By the end of the decade there was marked resurgence in the incidence of obesity and the diseases of affluence, especially diabetes and heart conditions. It was evident that state policies to ensure access to an adequate food supply (in terms of quantity) need supplementing by a programme of nutritional education. While the Cuban population were not subject to the influences of food advertising, long established customs and traditions, largely inherited from the Spanish, pervaded their food preferences. There was also an increasing demand for fast food, not because of advertising but because of its

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[265] Volpato (2004) terms this a 'relocalisation' in terms of both production and consumption and of re-establishing links between local culture and the environment. She also notes that it is not only about a greater reliance on home-grown food but also on wild food gathering and use.

association with a western lifestyle, which many Cubans aspired to. This was to some extent provided by State-run fast-food chains supplying chicken and soya-burgers.

Concepts of freshness, quality and health were important factors in the development of urban agriculture and have contributed to making healthy food more widely available, but were less influential vectors of change in rural production. The growth of urban agriculture was supported by much technical and conceptual know-how from abroad, from countries where the dietary habits are different and where vegetables are given higher priority. If the Cubans had developed urban agriculture without external support it might have focused more around the production of animal protein (such as back yard pig production). It was as yet too early to know the effect that increased supplies of fresh fruit and vegetables have had on the health of those who do choose to consume them. Equally, the absence of any separate distribution channels for produce from more ecological systems made it impossible to test whether the growth of these has had any beneficial health impacts on consumers, although one notable health benefit identified by farmers was the decline in intoxication from daily chemical handling.

9.5.4 An alternative model for food security for the developing world?

"*Sustainable agriculture means that there is enough food to eat.*" (Farmer F/P/9)

The Cuban food system showed exceptional resilience to the crisis of the 1990s, compared to other countries in crisis. This was largely due to the State prioritising equitable access to food over private gain, as far as possible on a nationwide scale. It was also due to the relatively rapid ability of the State to learn and change, particularly in reconciling a more market-led approach with a socialist political ideology (though less so in terms of its overall agricultural strategy).

Long-term State investment in rural infrastructure – electricity, housing – and of social benefits such as the ration, which reached every corner of the country, weaken the applicability of a macroeconomic analysis of the cost benefits of marginal cultivation. The systematic reduction of inequalities and the non-market logic under which State farms had operated reduced the relevance of price signals in individual decision-making. Farmers did not appear to be only driven by cost-benefits, and mostly felt that their conditions were comparable with, or better than, those in non-agrarian employment, albeit with some intra-sectoral jealousy between types of farming co-operative. Out-migration to rural areas occurred, initially with State support but later as a recognition of the opportunities that existed in the countryside.

While Cuba succeeded in maintaining a basic level of food security for its population throughout the crisis years, it has yet to achieve security in national production. Fluctuations caused by natural hazards such as cyclones and droughts and inadequate post harvest measures (particularly storage) remain major barriers to this goal. Self-provisioning (and sales of surpluses to the local community) have contributed significantly to increased food security at the household and community level. The spread of this activity, and level of state support for it, is unique to Cuba, especially in urban areas, makes a significant contribution to a *feeling* of security, and of being buffered from external conditions. Yet the feelings of insecurity still exist, both on rural co-operatives and urban households. Lack of access to self-provisioning and irregular incomes appeared to be frequent external contributory factors to this, but, from field observation, psychological discontent appeared to play a large role. The results suggest a problem with international development. Western authorities which influence the direction of development in less developed countries, tend to see problems from their own current values and situation rather than reflecting on their own earlier previous development trajectories. For example, in most industrialised countries, food security no longer occupies a central role in agricultural planning, and therefore it is disregarded when planning development in other countries, or rather it is considered an issue to be taken care of by ‘market forces’ (e.g. DFID, 2004).

Cuba’s political regime has sometimes been judged for its centrally-planned nature and, even with the move to decentralised and subsidiarised management (including financial), the food system may appear to exemplify this tendency. Yet, and as commented on in Chapter 3, the free market food system of other countries is also highly centralised, with a handful of private companies controlling national or commodity markets, often acting through hidden subsidiaries that provide both horizontal and vertical linkages through the food chain. Paradoxically, these ideologically different systems show quite similar features, which indicates one of three things: 1) that these features are unavoidable, 2) that these apparently different ideologies are in fact stemming from the same paradigm, or 3) that one or the other is not manifesting its true nature. The difference is that while the global, neoliberal trading system continues to become more centralised and controlled by fewer corporations, the Cuban system is moving toward a more diverse and decentralised system. If both continue in their current directions, the Cuban food system may even move into unchartered territory in terms of displaying an ecological food system. Industrialised agriculture has arguably been a failure in socialist regimes (Buys, 1993), and perhaps external forces are pushing Cuba to develop a farming and food system more in line with its ideological tendencies. There are also parallels and potential synergies between Cuba’s socialist approach and popular moves to relocalise economies in order to sustain them in the face of the effects of accelerating globalisation and centralisation.

10 THE STATUS AND DEVELOPMENT OF ORGANIC AGRICULTURE IN CUBA

10.1 INTRODUCTION: DRAWING-IN ON ORGANIC AGRICULTURE

This chapter sets out to review the nature and extent of organic agriculture in Cuba; that is, the production and institutional systems which are intentionally and explicitly ecological and which align themselves with the organic movement. In doing so, this chapter addresses fundamental issues concerning the extent of ecological agriculture in Cuba, issues involving its potential and the institutional challenges it encountered. Using the term 'organic' helps to draw out these challenges, to reflect on the extent of an institutional organic sector and its influence on agricultural development, and also to understand Cuban perceptions on the nature of sustainable agriculture. In any case, the term organic is recognised and used in Cuba. The original Cuban Association for Organic Agriculture (ACAO), since 1999 the Organic Group of ACTAF,[266] is the country's official organic body. Organic movements generally are characterised by their ecological, philosophical and social values. To what extent did these values concur and/or conflict with those of the establishment? Did Cuba take advantage of the growing world demand for certified organic produce to generate much needed foreign exchange? Tracing the threads of the Cuban organic movement within the tapestry of the agricultural sector provides a richer picture of the internal dynamics at play during this period of enforced change.

This chapter is divided into five sections. First, the status of certified organic production is reviewed, together with the challenges encountered in its development, and particularly those relating to market know-how and the ability to meet certification standards. Second, and as a supporting case study, the potential for certified organic banana is evaluated. Third, the institutional support mechanisms for organic agriculture are pieced together, to provide a picture of the modest backbone of support that has emerged during the Special Period. The fourth section analyses the results of a quantitative survey undertaken during the field work, on Cuban research perspectives on the development of organic agriculture in the country. Finally, an analysis of the development of the Cuban organic movement identifies further dynamics of the State-led versus grassroots institutional approaches. Pulling all these issues together, some general conclusions may be drawn regarding the institutionalisation of organic agriculture in Cuba.

10.2 THE STATUS OF CERTIFIED ORGANIC PRODUCTION IN CUBA

10.2.1 Overall status at the end of the 1990s

As of 2000, Cuba had no permanent, commercial-scale organic farms, although throughout the decade foreign buyers were intermittently certifying the production of specific crops (largely sugar and fruits) in scattered locations, for export through agreements with MINAG and the Ministry of Foreign Trade (MA/33; KI/13; Pohlan et al., 2000). This export-driven production was unintegrated from the rest of the farm upon which it was based, and would collapse if and when the buyer pulled out. There was no certified organic production for domestic markets. Even if the purchasing power

[266] Cuban Association of Agricultural and Forestry Technicians

existed, the State food collection and distribution system did not make provision for product differentiation; and in urban farmers' markets, there was no indication of differentiation between, for example, produce from *organoponicos* and that from the less strictly controlled *parceleros*. However, there were a few pilot projects supplying '*productos sanos*' or healthy produce to national tourist markets. Experiences with sugar and citrus are discussed here; those with banana are treated in the subsequent section.

10.2.2 Experiences with organic sugar

Challenges of institutional role differentiation

There had been some experience, mainly in the province of Villa Clara, of organic sugar production. The University of Las Villas was involved in researching and piloting organic sugar production, to feed into future plans of the Ministry of Sugar for at least one organic sugar mill in each province (Varela-Pérez, 2000). There was found to be no intrinsic problem in the production of organic sugar. The main problems that occurred in piloting organic sugar production were in its processing and marketing. The equipment of the pilot plant was old and rusty and contaminated trial produce with iron. When a high quality grade of sugar was eventually produced, the State's marketing organisation failed to secure a buyer. The CAI (Agro-Industrial Complex) workers, under the Ministry of Sugar, had been encouraged to invest the extra effort to produce good quality organic sugar to international standards, encouraged by the incentive of a dollar return which would be invested in improved working conditions. Many foreign buyers were interested, and seeing this, the Ministry of Foreign Trade – which had held little stake in its production but was in charge of the sale - upped the asking price. Eventually all the buyers pulled out, and the sugar was left in the storehouse. It was the workers at the sugar plant who had lost out.

Experiences of complying with foreign standards

Another sugarcane CAI, with a number of production units including UBPCs, CPAs and CCSs, converted to organic sugar production, and documented its experiences for the benefit of other, future organic export initiatives (CAI Carlos Balino, 2000). During the five-year conversion process, the land was divided into three parts: organic, in-conversion, and industrial, and a management register was kept for each. From the experience, specific recommendations were made on ex-ante feasibility. These were that feasibility studies should consider not only technical considerations but also the availability of materials and financial resources, and the overall market potential. Further, assurances should be obtained of co-operation from all players involved in the project, including higher-level tiers of government, and these assurances include environmental commitment to meeting buyers' certification standards along the whole chain. In adapting to organic production, the CAI divided its production area in order to meet traceability standards, and noted that traditional planting, cultivation and harvesting plans, as well as the financial accounting system, were not compatible with the organic approach. Several process considerations around dealing with foreign inspectors and buyers were identified. These included the need to be ready for spot-checks at any time, as "*the inspector is a policeman and can speak to whoever he wants, and that is why it is necessary to accompany him everywhere, in case of people who are not related to the project*.", and that being truthful and transparent was the best approach, but "*without appearing foolish*." They cautioned that many potential buyers would make process recommendations which would require a lot of extra investment, but with no guarantee of sale. Finally, the project recommended installing a specialised organic marketing officer within the CAI, and that Cuba Sugar, another State trade entity, had proved proficient in handling international trade relationships.

10.2.3 Experiences with organic citrus

Structural advantages and institutional changes in the Citrus Corporation

Citrus was the commodity sector where most experience had accrued on organic production, partly because of the longstanding commercial expertise of the Cuban Citrus Corporation[267], and partly because, as citrus was only a minor staple of the Cuban diet, there were lower domestic self-sufficiency goals to fulfil than for major staples such as banana. The Citrus Corporation itself had a longer vertical structure than other State enterprises, topped by a greater degree of institutional autonomy. All the required administrative and commercial functions were contained within the Corporation rather than located externally. This has made it easier to build internal consensus and to co-operate to achieve agreed goals without the challenge of ministerial bureaucracy. This, and the Corporation's historically-accrued financial and managerial resources, gave it a relative advantage in developing an organic sector.

In 2000, the Corporation had formed an internal, multidisciplinary, organic group to undertake research and development on the whole production chain from field to market. The formation of this group had not, according to members, required changes in research orientation, because they had for a long time been working on organic issues – such as biopesticides - in a disciplinary fashion. The Special Period had acted as a catalyst to pull it all together, and coupled with foreign commercial demand, some of the team had more recently undergone specific training on organic agriculture. The project liased with various national institutes on specific system components; with the Institute for Pastures and Forages on under-sowing legumes, with the Institute of Mechanisation on appropriate equipment such as compost spreaders (which the project was helping to evaluate), with the Institute of Ecology and Systematics on local biodiversity characterisation, and with the Soils Institute for a supply of compost.

Experiential learning with organic citrus production

The approach to organic citrus production was, according to the Corporation's organic group member MA/R/15, aimed at developing a large scale and intensive system with high production goals. Several citrus cropping areas in Havana, Cienfuegos and Ciego de Avila started with the conversion process in 2000. Much of this land was certified as 'in conversion' by European certifying bodies (Vallin et al., 2000). They included a UBPC with 530 ha of grapefruit and orange production, and another with 200 ha. These UBPCs were selected on the basis of their extent of diversification, their proximity to industrial centres and their previous level of use of agrochemicals. The citrus itself was cultivated in a monoculture, although a whole-farm approach was adopted with, for example, on-farm livestock being utilised for their manure. This was an important factor as manure was becoming more difficult to obtain by the Corporation; the *organoponicos* had priority access, and the livestock farms were diversifying and using manure within their own farm system. Thus the group were working toward creating semi-closed, self-reliant systems. Compost was made from the residues of the citrus processing mixed with livestock wastes, and biofertilisers and zeolytic organic fertilisers also added. According to Vallin et al. (*ibid*) and KI/13, application of these techniques served not only to reduce the use of agrochemicals, but also had an appreciable affect on yields and fruit quality, on economic returns, and on the conservation of natural resources. Yet notwithstanding these positive results, the costs did not internalise the start-up costs, including the time and effort required to learn and develop the new techniques and technologies (MA/R/13).

Training for the citrus farmers was organised on the 'new' technological issues such as vermiculture, compost, legumes, *Rhizobium*, and *Azobacter*. The extension approach was described as interactive, through "*a discussion of what is being transferred*" (MA/R/15). According to the

[267] Because of its long history as a major export crop, citrus production and commercialisation was handled by a specialised commodity corporation rather than through MINAG's production enterprises.

team, farmers were receptive to an organic approach, owing to its similarities with traditional family farming, and were noting improvements in plant health. However, they still preferred the ease of agrochemical inputs and were concerned about profitability given the high initial start-up costs. Production costs were very high in this first year of conversion, because of the investments required to improve production; previously these citrus plantations had received very little care. The research team anticipated that labour demand would ease off after conversion. Yield figures were, at November 2000, not known, but it was anticipated that the high quality and care would mean fewer post harvest losses. Nevertheless, production was unlikely to be profitable in the conversion period, and the Citrus Corporation was bearing the losses. Certification was one area that was lacking, and though someone was responsible for this, training had not been received and they were looking to MINAG to organise a national certification system. The team appeared very committed to this project, and yet admitted that it was a real challenge. They were learning that organic production was not synonymous with low- or no-input but that it required building complexity, even in terms of input materials and sources.

As of 2000, commercial organic citrus production was underway in two sites: one in Guantanemo which was supported by German babyfood interests and working with organic-by-default CCS and individual farmers, and the other in Cienfuegos supported by Swiss research interests which had been working with the Citrus Corporation on comparative trials since 1997. The intention was to incorporate other fruits into the organic citrus project, and with this in mind, experimentation with 200 ha of coconut was already underway.

10.2.4 Organic development of other crops

Other organic crops currently being developed were coffee, honey, urban horticulture, medicinal plants, coconut, pineapple, cocoa and mango (MA/33; MA/36). Several institutes were interested in becoming involved in organic or 'healthy produce' projects, because of the potential dollar revenue. For example, the agricultural department of the University of Holguin was planning a project to supply organic-type crops for tourists in the nearby resort of Guardelavaca, certified by the provincial Meteorological Centre in co-operation with the Ministry of Tourism. Similarly, Sanidad Vegetal was supporting the organic production of fruit and horticultural crops on two organic farms in Matanzas Province, to supply the tourist industry of Varadero. Part of the dollar revenue was intended to support INISAV's network of CREEs.

10.2.5 Concluding remarks

There have been just a few tentative steps toward market-oriented organic production, and these pulled or pushed by foreign interest groups. The learning experiences are clear. The case of organic sugar exporting shows that, as and when this activity receives stronger policy support, a more joined-up approach between Ministries will be required, and a refining of approaches to international trading relationships.[268] Increased revenue, and particularly access to dollars, proved a major incentive for producers to invest the extra time and effort into producing (including processing) organically. The learning experiences with organic citrus production exemplified how the so-called 'organic-by-default' production of Cuban agriculture was vastly different from the organic production required to meet organic standards. It also showed that certified organic production in Cuba was being approached, at least partly, with an industrialised mindset in terms of scale of operation and approaches to farmer involvement. The experiences with both sugar and citrus indicated the importance of developing national organic standards and know-how.

[268] Cuba's cautiousness about doing business is reflected in the report of a UK agricultural mission to Cuba, in 1998, which explained "*Only when Cuba trusts that a company is not just there for profit, but is prepared to build a business relationship and commit time to the country, is the company likely to develop business*." (MAFF, 1998).

10.3 THE POTENTIAL FOR ORGANIC BANANA PRODUCTION

10.3.1 Extent of contemporary organic banana production

As with sugar and citrus, by the end of the decade there had been some occasional and scattered certification and piloting of organic banana production. In the province of Ciego de Avila, where there was little problem with black sigatoka disease, organic FHIA varieties were being produced on a large-scale State farm for export (KI/13). Further east still, in Guantanemo Province, the provincial Mixed Crops Association was experimenting with organic Cavendish. Here, soils and climate were similarly conducive for a low incidence of black sigatoka (although a previous organic banana initiative here had been wiped out by hurricane damage). Some organic FHIA 18 was also being grown in Havana Province, but had been unsuccessful in attracting a buyer due to the general foreign preference for Cavendish.

10.3.2 Farmers' perceptions and practices on organic banana production

Chapter 7 had examined farmers' perceptions and perceptions on organic banana production. In terms of specific husbandry practices for banana production, a number of organic soil management strategies were or had been practised by farmers across the three provinces studied, including crop rotations and incorporation of residues (by 96%), use of oxen (83%), intercropping[269] (77%), minimum tillage (72%), application of manure, compost and green manures (61%), application of worm compost (50%), and application of ash (<50%). Similarly, organic pest and disease control strategies included selection of resistant varieties[270] (82%), using rains to disrupt pest life cycles (78%), application of Bt (62%), crop rotations[271] (68%), biological insect control[272] (62%), and (<50%) also de-leafing and maintaining clean rows, ensuring good soil preparation, separating susceptible varieties, and cleaning the corm to kill pest larvae. Other husbandry techniques included planting at the waning of the moon in order for the plant to be stronger and have more bunches, mulching banana leaves, and use of banana as a soil-cleansing crop or as a long-term green manure. In terms of water saving, planting was coincided with the rains (by 96%), drought-resistant varieties were used (84%), soil organic matter was built up for water retention (56%), and other techniques included mulching and precision irrigation.

A model CPA co-operative in Holguin Province had intentionally adopted a non-certified organic husbandry approach for its high-yielding banana production, driven by State support for specialisation. This is described in Box 10.1, and compared with the approach of a UBPC farmer in the same province who was using a more benign organic approach, and who was driven more by the current resource-scarce context and higher market prices he was encountering for his quality produce. These examples demonstrate the feasibility of organic husbandry techniques in the current context, and indicate that high levels of knowledge, training or financial resources were not necessarily required. Especially the second example demonstrates that co-operative members, in this case a head of *finca*, could have a reasonable amount of individual freedom over production decisions. The main influencing factors for this farmer were a lack - of irrigation equipment, the freedom – of producing outside the State plan, the market pull - for quality produce related to his profit-share in the *finca*, and his own attitude toward 'good' cultivation.

[269] With bean, papaya, pineapple, cassava, maize, cucumber, flowers, chili pepper, avocado, fruit, onion, coffee, okra, sweetpotato, garlic.
[270] For example, resistant varieties of 'burro' rather than 'macho', and the use of disease-free micro-plants (though these required more water).
[271] For example, rotating short stands with annuals such as beans and tobacco.
[272] Specifically *Beauvaria bassiana.*

Box 10.1 Non-certified organic banana production in Holguin Province, comparing high-tech and low-tech approaches

Non-certified, high-tech organic banana production (F/P/14)

The CPA co-operative Congreso Campesino en Armas in Holguin Province had been profitable since its foundation in 1979 and won the Vanguardia Nacional (National Vanguards Award) in 1999. Its good performance was put down to a combination of good soils and good management (its president was a social science graduate). Because of this, it received extra support from the State which it had invested in specialisation into sustainable banana production, and it was currently used by MINAG as a showpiece for this.

Banana production was intentionally organic, and the crucial factors for this were identified as sufficient water and quality micro-plants. FHIA 18 was the main variety used, but this was planted with five other FHIA varieties in mixed rows, with a more drought-resistant ‘burro’ variety at the head of each row. All the FHIA varieties appeared resistant to sigatoka, and no pesticides were required. Microjet irrigation was applied in precision form, and micro-plants were purchased at 52c/unit. All traction was undertaken by oxen as tractors could not manoeuvre well down the rows. Stands were expected to remain for 6 to 7 years. FHIA 18 gave the highest yields, at 46.9t/ha. The co-operative also grew the more sigatoka-vulnerable burro and macho varieties, planting these in the drier areas of the farm. All banana was sold to Acopio.

Non-certified, low-tech organic banana production (F/U/8)

Nearby, a livestock and mixed crops UBPC had 87 ha put to banana production, which it was farming in a more benign, organic manner. The head of one banana *finca* (16ha) described how he used traditional burro and macho varieties, partly because of his lack of modern irrigation facilities but also because these had, in his view, better flavour and quality and attracted a higher market price. He also chose to use root suckers from his own stock rather than purchased micro-plants, as he felt that the former were more vigorous. Yields averaged 10t/ha. Instead of chemical inputs, he applied a small amount of manure (0.1 t/ha, from the UBPC’s own livestock herd) at planting time. After that he would leave crop residues in the field (he experimented with intercrops of papaya and pineapple), mulch around the base of the trees, and generally practice minimum tillage. Oxen were used for all activities except initial soil preparation, and this farmer explained that even if petrol supplies increased he would continue with oxen as they were better for the soil, required little extra time, were more precise and attained a higher quality. Pests were not a problem, aside from the occasional outbreak of black sigatoka at periods of heavy rainfall, but this was neither considered a problem; the crop could still be cultivated and there was no more than a 10% crop loss. The main mitigation strategy of this farmer was to follow his father’s advice that “*the most important factors are attention and cleanliness*”, and therefore he ensured that the rows were kept clean by removing diseased leaves. The banana crop was used for self-provisioning and also sold on the farmers’ market at $50/t. Owing to its higher quality, this price was, according to the farmer, three times the State purchase price for banana, and also higher than that received by other farmers at the market. (Production costs were estimated at 1c/unit, and sale price 3.5c/unit).) This farmer would use more organic techniques if he had more knowledge and training, and if such techniques were more available.

In terms of farmers’ perceptions, a minority (although the majority in Holguin province) would adopt this approach if they had a choice.[273] They felt that it was possible for Cuba to grow organically and achieve good yields if certain conditions were satisfied and particularly access to potassium sources. Other constraints were identified as the scale of operations required, and the ease of using chemical inputs. Some farmers had done away with the need for chemicals, such as one who was instead using*“20t/ha of chicken manure, and I have no pests – my bananas are resistant.”*[274] (F/C/19)

[273] According to field sources, rates of synthetic fertiliser application on banana production had dropped from 60,000t in 1989 to 7,000t in 1999 (MA/40). Yet FAO statistics show that in 1999, application rates were 14,309t potassium chloride and 6,520t urea (FAO, 2003). Seventy five percent of farmers interviewed were using at least a small quantity of chemical fertiliser, and 43% were using pesticides and 36% herbicides.

[274] This farmer was using Vietnamita and burro varieties.

10.3.3 Institutional perceptions and promotion of organic banana production

Research and extension on organic banana production

Amongst research on the agronomy of banana production, a large proportion was applicable to organic production, and included some interesting new findings for Cuba. This research included the development of more resistant varieties, particularly to black sigatoka; biological controls for the banana weevil borer; inoculation with bacteria and fungi; IPM; and the use of Bt against nematodes. Research was showing that intercropping peanut, French bean, maize and sweetpotato in FHIA banana stands increased soil biomass and beneficial soil nutrients (Milián et al., 2000). Biological nematocides could be used to protect microplants and, with the addition of sugarcane waste and compost, helped increase plant growth (Castellanos Lopez et al., 2000). Locally-produced soil improvers which performed well with banana production, included the ash-and-manure based product Fertocen[275] (Simó González et al., 2000), *Teramnus labialis* legume cover (MA/R/32), and wastes from rum production (Garcia Perez et al., 2000). The research sector identified their sources of information on organic banana production as coming from university libraries, the military, and the internet.

In terms of institutional perceptions, the research and extension sector had a more positive view than farmers about the performance and potential of FHIA as organic varieties. Researchers felt that FHIA varieties were more resistant to black sigatoka, and some also that they were more tolerant to low water availability.[276] Extension advice generally promoted a complete change to FHIA varieties, although some researchers recognised that these varieties required more external inputs, and that the taller FHIA21 was vulnerable to wind damage. One researcher explained "*Although other countries may not prefer FHIA, in Cuba our main concern is for high yield, not for taste, so FHIA are appropriate here*." (MA/41). Mulching, compost and the use of biofertilisers were also recommended by extension services.[277]

Some researchers felt that organic methods could obtain similar yields to industrialised ones, and one researcher quoted a recent study which had estimated yields of 80t/ha under low- and zero-input conditions (MA/R/30). One specialist was intending to produce organic bananas, explaining "*The FHIA bananas are already being produced almost organically, but there is no certification yet in the country*." (MA/27/B). Similarly, extensionists also thought it was possible to produce organic bananas, although this would require a huge amount of organic fertiliser. Supporting this, an analysis by FAO (2003) of Cuban banana production had identified the reasons for yield increases in the face of lack of fertilisers and irrigation as being: new management structures, improved clones, better quality seed obtained by tissue culture, use of organic materials, and improved prices for the producer. Fewer respondents held strong reservations, that Cuba was not yet ready for organic banana production. Reasons for this concern were the lack of bio-controls and especially for *Fusarium* (MA/R/29).

The marketing of organic bananas

Stakeholders in the institutional support sector felt they could feasibly supply the internal tourist market with organic or 'healthy' bananas, where there was already an identified demand (MA/9). MINAG's ten-year banana plan included organic banana exports to earn foreign revenue, irrespective of whether national demand had been completely met (MA/40). Yet it was thought to take another 3 to 4 years before this would go ahead, in order to fulfil domestic needs a little more.

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[275] Developed nationally by INIVIT.

[276] This perception was supported by FHIA in Honduras, which felt that hybrids FHIA-18 and FHIA-01 held great potential as organic bananas because of their resistance to black Sigatoka (Krigsvold, 1999).

[277] Pohlan et al. (2000) recommended increasing the efficiency of organic banana production in Cuba through decreasing planting densities, and increasing the application of organic materials, rotations and intercropping.

Some thought that there was more foreign demand for Cavendish varieties as these were of higher quality and had a longer shelf life (KI/9). A study done by MINAG (1999) on consumer preference amongst nationally differentiated groups of tourists found that, although none could specifically distinguish between FHIA and Cavendish, Europeans generally preferred the watery, less sweet varieties. More market research would be required to assess demand for FHIA varieties. Foreign interest groups had also undertaken studies on using Fair Trade labels, but had encountered challenges in the degree of participation that farmers were able to make compared to the level required by the standards.[278]

10.3.4 Concluding remarks

This analysis shows that the production of organic banana is certainly technically feasible, and can include cutting edge agronomic techniques as well as traditional ones. These practices are already being practised by a large minority of farmers albeit without the intention to achieve organic certification. The institutional sector was, however, promoting banana varieties which, although they could be grown organically, would require high external inputs (in terms of micro-plants and irrigation). There was a strong internal tourist market for the produce and an intention to develop the export trade over the coming years; the current 10-year plan for banana production included organic bananas for export, although according one MINAG interviewee,"*This is a bit risky at present, given the obstacles.*" (MA/40)

10.4 THE INSTITUTIONAL SUPPORT SYSTEM FOR ORGANIC AGRICULTURE

10.4.1 Introduction

Whilst Chapter 8 reviewed the coping strategies of the whole agricultural support sector, this section spotlights those areas with a specific organic focus, which would provide support for the organic production described in section 10.2. These areas cover policy, research and extension, and include the external and internal influences on these groups and the resulting policies and processes which have encouraged or discouraged organic production.

10.4.2 Organic policy

"From Castro on down, the official line is that organic agriculture is here to stay." (Simon, 1997).
"Organic agriculture has been adopted as the official government strategy for all new agriculture in Cuba, after its highly successful introduction just seven years ago." (The Pesticides Trust, 1998).
"Cuba is perhaps the best example of large-scale government support to organic agriculture… It is an integral part of agricultural policy." (Scialabba, 2000).
"…Cuba was forced to convert to organic agriculture in the early 90s on a nationwide scale, with some very exciting results." (Montanaro, 2000).

While many foreign reporters have commented on Cuba's pro-organic policy, in reality there was, up to 2000, no legislation on organic agriculture. Perhaps the most recent high-level endorsement was in a speech given by Castro at the 1996 World Food Summit where he stated that "*Enhancing food security demands extending sustainable agricultural techniques so that the various economic units operate as agro-ecological farms.*" In 2000, MINAG made an internal announcement of its intention to produce organically for export. According to several sources (including MA/35; MA/36), "*An order has come from the top to give the Ministry of Agriculture the green light to pursue organic production for export.*" Notwithstanding some delay in making this public, by late 2000 there was more explicit talk, including in the provinces, of MINAG's new attempt to institutionalise organic agriculture. In this year, the Organic Agriculture Group (GAO) of the Cuban

[278] Since then, fair trade orange juice from Cuba has come on sale in Europe.

Association of Agricultural and Forestry Technicians (ACTAF) was officially responsible for the development of organic agriculture in Cuba.

10.4.3 Organic research, extension and information

Organic systems research

Research on specific agronomic techniques and technologies appropriate for use in organic farming systems was explored in Chapters 6 and 9. Aside from the foreign-led research on certified organic conversion projects, there was relatively little research on socio-economic, systems-wide aspects of organic production, such as issues of conversion, comparative cost-benefit analyses, markets, or human health impact studies. As well as the lack of policy support, the focus of agricultural research was on technical issues, research tended toward disciplinarity, and there were few resources for publishing.

Notable exceptions of organic systems research were the Agro-ecological Lighthouse Project and Participatory Plant Breeding Project[279] as described in Chapter 6. Another exception is the longstanding work on organic production systems by the Pastures and Forages Research Institute (IIPF) and especially on crop-livestock interactions. Research emanating from this institute shows organic systems in a positive light, such as the increases in biodiversity, energy efficiency, and overall improvements in farm productivity of organic systems (Funes-Monzote & Monzote, 2001). Food production may increase five-fold through such systems (MA/R/24), and Cuba could achieve self-sufficiency in milk production on the same land area through improved pastures. Labour force was shown to increase in the first year of a small-farm conversion, and from then on to decrease, while returns of yield/income to labour increased (Suárez et al., 2000). In this conversion, fossil fuel use was eliminated by the third year.

Organic extension, training and conversion support

The pathways for the extension of appropriate organic production techniques were the same as for industrialised, while specific organic development projects were treated as discrete initiatives. Regarding information provision, sources of organic information identified by farmers were largely research institutes: INCA, ICA, ANAP, IIHLD, and Sanidad Vegetal. Few farmers, or researchers, identified ACAO or ACTAF as a source of information, and MINAG staff also pointed to the research institutes as being sources. Notwithstanding the small but ambitious agro-ecology training courses run by CEAS, there were no market-oriented courses running in Cuba. Farmers felt a lack of training on and information on organic production. Curiously MINAG officials thought that more training was required for producers, whereas others felt that MINAG officials themselves needed training.

Although there were no incentives or support for converting to organic production, the potential use of subsidies was raised and discussed at institutional level. Subsidies could be organised through the State agricultural enterprises; a model was the Citrus Corporation which was underwriting costs and losses of organic citrus production (although this was one of the most wealthy support entities).

The high international profile accorded to Cuba's organic agriculture gave rise to many interactive learning opportunities. These included study tours, training and capacity development in urban agriculture by NGOs from the USA, Australia and the UK; the development of experimental organic farms with Swiss and Austrian collaborators; and collaborating development of organic

[279] Although there was no specific organic plant breeding, the PPB Project in Cuba was using organic principles in its focus on locally adapted, resistant varieties. Ríos Labrada et al. (2000) argue that Cuba has good conditions for developing informal organic seed systems.

production and processing with Canada (Holm & Pither, 1999). All these initiatives were effective in that they were bringing in foreign revenue, knowledge and prestige.

10.4.4 Development of organic certification and markets

The development of organic certification in Cuba was a slow process over the decade. The Department of Quality Control of the Ministry of Agriculture was responsible for developing organic standards. For several years ACAO had been advising the department on the need for local certifiers and the development of certification. MINAG itself preferred to use foreign certifiers. Some departmental staff attended the first inspectors' training course, run by ACAO back in 1994 (CUCEPRO, 1994). Meanwhile, organic interest groups from several countries were providing support for the development of certification systems. Much of this however was to train Cubans as certifiers working to foreign organic standards, rather than assisting Cuba in developing its own standards. In 1996, a multi-Ministry commission was formed to develop certification but was later disbanded without completing the task, owing to a lack of financial backing (MA/36). In 1998, the development of organic standards was revived, in collaboration with a number of institutes and ministries. They successfully sought foreign assistance for this work.

By the end of the decade, a draft document on organic standards had been prepared by the Department (Republica de Cuba, 1999). Once agreed, this would then need to be submitted to IFOAM for approval. The general standards, based on those from other countries including Argentina, Brazil, the UK and Italy, as well as on EU and FAO standards, consisted of recommendations and prohibitions and covered all crops, and work in progress was focussing on specific crops and regions. The definitions of organic production, and sustainable production, given in these Standards is shown in Box 10.2.

Box 10.2 Definitions of organic and sustainable production from the Draft Organic Standards of Cuba

"Organic production: is a system in which the use of practices or substances which attack the environment, plants, animals and society are restricted or prohibited; avoiding soil degradation, regenerating fertility and natural biological balance; in accordance with the established law in each country or region.
Sustainable production: is a system which achieves the preservation of natural resources and the organisation of technology change in a way which ensures the satisfaction of man's needs with the consequent decrease of his unfavourable action on the environment. It allows for the regulated use of synthetic, chemical substances in an integrated production approach."

Source: Republica de Cuba, 1999

So at 2000, the country was still dependent on foreign certifiers. MINAG was aiming to have their own IFOAM accredited certifiers, and to this end staff were being trained in Italy. They also intended to form an inspection service drawing on expertise from within MINAG's own research institutes.[280] Such development was costly and attempts to attract foreign funding for this capacity building had not yet been successful.

In parallel with this, MINAG was considering how to reach the domestic tourist market through an own-brand, softer labelling system, which would not require international accreditation. This brand would still prohibit the use of agrochemicals, and attract a premium price. Initially focused on horticultural and fruit crops, the system would channel these through the normal supply routes (e.g., Frutas Selectas, Citricus Caribe, etc.) but ensuring product separation. Another possibility being considered at the end of the decade was for agrochemical-free production of selected crops for the

[280] Initially, the State assumed that it would set the standards, inspect them and also own the production. The organic movement for some time pressed the State that potential foreign buyers would not accept a central Government role in this (MES/2). Thus the State had to give these roles away to other organisations. There is some internal vying for control of standards between specific research institutes and university groups (MES/2).

Cuban people, at least in small volumes. These products would not require standards, would be distributed through normal channels, and would command minimal price premiums.[281]

Nearly all ecological production practices that were introduced in the 1990s were motivated by the need to meet domestic food requirements from a vastly reduced flow of inputs. There was an implicit view that it would be counter-revolutionary to export organic products when there was a national food deficit (MA/34; MA/38). Yet for much of the period the agricultural sector had been simply too busy struggling to feed the population to think of, for example, using the export revenue of higher value organic crops, to purchase cheaper foodstuffs (MA/R/1, MA/23). Another reason for not having developed organic exports was the insufficient organisational capacity and know-how to meet export quality standards (KI/2), and surrounding this the insufficient funds to build such capacity (MA/34). Some sources voiced that in addition, higher level personnel had been unconvinced of the benefits of organic agriculture (MES/R/6).

As already mentioned, a recent focus of the MINAG strategy for organic development was on the internal tourist market (MA/36), and possibly linked with the development of agro-tourism (Alvarez & Funes, 1998). Yet, there was still substantial international business interest in tapping into Cuba’s (potentially) organic production as well as fair trade products.

10.4.5 Perceptions on organic agriculture and its future

Sectoral differences in knowledge levels

While the Cuban organic movement as a whole was highly knowledgeable about the principles and potential of organic agriculture, there were varying viewpoints within this. On the one hand, organic agriculture was synonymous with no-input, resource-poor conditions; at organic conferences in Cuba, the contexts of poor cropping conditions and low soil fertility were applied (e.g., Ventura et al. (2000). On the other hand, organic agriculture could be concerned with abundance and enrichment; studies documented the emergence and existence of 'spontaneous' organic agriculture, whereby producers had built up complex, integrated and profitable organic agro-ecosystems without external support (e.g., Guillot Silva et al., 2000). It was also seen as a standards-based, poor substitute for agro-ecology, such as by one interviewee who explained “*Organic agriculture is based on bioinputs and is expensive because of certification, whereas agroecology may include the use of agrochemicals if absolutely necessary*.” (KI/4). Similarly, another felt that the population would be unable to pay the higher prices commanded by organic foodstuffs.

Varying and low knowledge levels were also found amongst State entities and research groups. For example, an organic literature review from the Research Institute for Food Processing in the late 1990s (IIIA, 2000) omitted discussion on several key organic issues, such as food quality, and concluded that it was difficult to determine whether a product satisfied the organic grade. Similarly, management at the Soils Institute believed many Cuban products to automatically qualify as organic within Europe, due to the lack of chemical fertilisers and pesticides being used (MAFF, 1998).

Orellana et al. (1999) carried out a telling survey in which they posed three questions to a group of 72 people, comprising largely of scientists but also farmers and academic interest groups. The first question asked whether organic agriculture was based solely on the use of organic inputs. Sixty percent of respondents affirmed this, explaining that if the inputs were not organic then it was a fraud. The large minority who disagreed felt that it could include the use of chemicals when justified, for economic or ethical reasons. The two concepts which fed the definitions of organic agriculture were soil fertility and biological productivity. The second question asked whether organic agriculture could feed the needs of a growing population. Fifty-four percent of respondents agreed with this, although the percentage of scientists among this group was smaller. The third

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[281] In the province of Cienfuegos, *organoponicos* were already producing quantities of vegetables under a production scheme called “functionally organic”. Taboulchanas (2001) estimates that to satisfy international organic standards, producers in this scheme would have to change certain practices such as that of using certain inputs, as well as to register their production.

question, on whether urban agriculture was grounded in an ecological basis, was affirmed by 78% of respondents. These views provided an indication of Cuban perceptions on the definition of organic agriculture as well as on its potential which was seen in a less positive light by researchers than by farmers. Based on these results, the authors then devised a formula to quantify organic agriculture, comprised of the variables of seed varieties, bio-inputs, traditional management practices, and quantity of products, processes and services. From this they concluded that organic agriculture was *"a management system in harmony and dynamism with the agroecosystem, which guarantees an integrated protection of foodstuffs with high biological quality."*

Perceptions on the future potential of organic agriculture have already been reviewed in previous chapters. The majority of farmers felt that their co-operatives could perform equally well under organic approaches, if more knowledge and organic inputs were easily available. With the growing awareness of targeting domestic tourist markets, university agricultural departments were interested in developing more research projects on organic agriculture (MES/2). State agricultural enterprises were less interested. One marketing manager (KI/8) did not feel organic production to be useful at present, because produce already commanded a good market price, and yield losses on conversion would make organic production unprofitable in the short term. He felt that the longer-term trend would be towards organic, but was advising foreign buyers to move slowly with this.

Attitude change was a crucial factor acknowledged and stressed by the Cuban organic movement (e.g., Funes, 2002; Funes Monzote, 1998). Ríos Labrada et al. (2000), recommend that the significant technological shift toward ecological agriculture, which had already occurred over a relatively short timescale, needed to be accompanied by a campaign of environmental and health education. They point out that Cuba is well placed to undertake this, through the presence of qualified personnel with experience in community development work, through the strong mass communication channels already in place, and through recent, positive experimental results. They conclude (p.16): *"it is more difficult to raise conscience than technology, and this is the challenge for the future."*

10.4.6 Concluding remarks

At the beginning of the 1990s, there were hopes both within and outside Cuba that organic agriculture might provide the answer to the problem of food production in Cuba. For instance, in 1994, Rosset & Benjamin wrote that *"large-scale conversion to organic farming can take between three to five years to achieve previous levels of productivity. Cuban scientists and planners hope to accelerate this process by using sophisticated biotechnology techniques, such as the mass production of naturally occurring local organisms to create biopesticides and biofertilisers."* From within Cuba, Funes (2002) reviewed several many factors favouring the development of organic agriculture in Cuba:

- strong demand for agricultural products
- high number of qualified personnel working in the sector
- population experienced in community work
- administrative and social structures which support food self sufficiency
- official mass media willing to sponsor publicity campaigns for the people's benefit
- research results compatible with the organic model
- recent urban-rural migration
- organisations dedicated to the creation of an agro-ecological culture.

In addition, the absence of private agribusiness interests meant few advocates of an industrialised system.

Nevertheless, the centralised planning system meant that the State held the key to promoting organic agriculture, and this support was not visible for most of the decade. This included the lack of promotion of organic conversions, or of legislation favouring organic approaches. State interest in organic agriculture from 2000 was limited to its foreign income-generating potential. This perception of organic agriculture as a marketing vehicle which was characterised by a prohibition of chemical input use and which had little contribution to make to domestic agriculture, was shared by many in the institutional sector. Other perceptions, such as those captured by Orellana et al. (1999), likened it to urban ecological production, to production which could sometimes justify the use of agrochemicals, and which, for many farmers, could meet food needs.

10.5 INFORMED INSTITUTIONAL PERSPECTIVES ON THE FUTURE OF ORGANIC DEVELOPMENT: RESULTS OF A QUANTITATIVE SURVEY

10.5.1 Background and methods of survey

As well as capturing secondary evidence on the development of organic agriculture, and qualitative perspectives from actors in the agricultural sector through field interviews, this section reports on the results of a quantitative postal survey on the challenges and opportunities facing organic agriculture. Originally intended as an information collection exercise to be carried out during the author's participation in an organic conference in Cuba, cancellation of the conference lead to a postal survey targeting the conference registrants (more details on the circumstances and methods are provided in Chapter 4).

The selected cohort were in a unique position to provide informed insights, comprising mainly researchers, lecturers, ministry staff and producers most of whom would have presented papers or posters at the conference and therefore assumed to have a relatively high degree of knowledge of/and or interest in, organic farming. A postal questionnaire was sent out to 137 such individuals. The questionnaires consisted of six questions designed to obtain information on the following issues:

- reasons for interest in organic agriculture,
- the relation between the organic movement and the Special Period in Cuba,
- the main knowledge and support institutes,
- whether the Cuban experience of the special period has strengthened or weakened belief in the potential of organic agriculture,
- factors required to support the further development of organic agriculture, and
- challenges to the further development of organic agriculture.

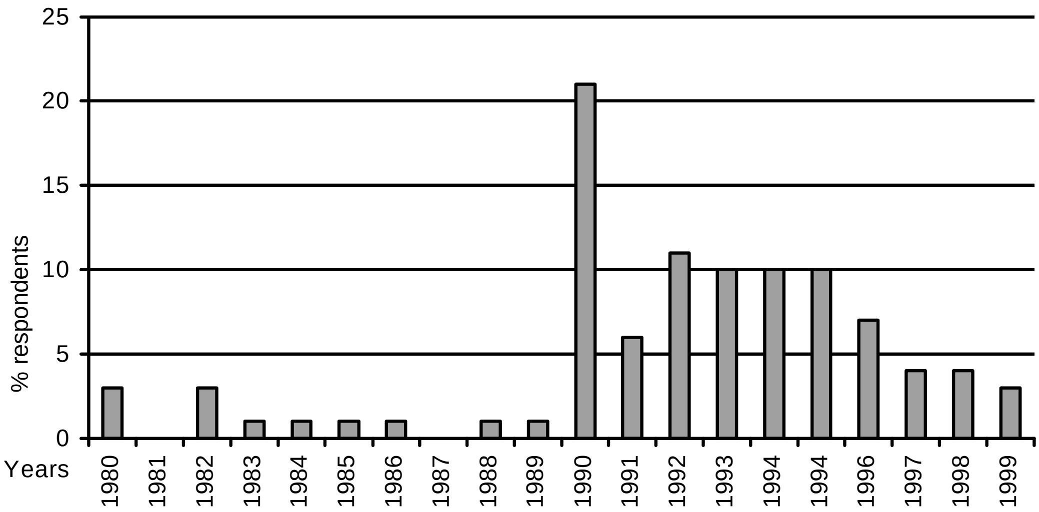
The response rate to the survey was 53%. Thirteen of the 15 provinces in Cuba were represented in the survey with the majority of respondents, 55%, based in Villa Clara and Havana. Overall, 42% of responses came from the western provinces, 33% from central ones, and 26% from the eastern provinces. Females made up 18% of total number of questionnaire recipients, and 15% of total respondents. Overall, therefore, the respondents were considered representative of the target group. In addition to replying to the survey questions, several respondents enclosed detailed letters providing more in-depth responses, and explicitly stated that they saw this subject as being of great importance to the country.

10.5.2 Results and discussion

The trigger of active interest in organic agriculture

The growth of active interest in organic agriculture coincided with the onset of the Special Period in Cuba. This is shown in Figure 10.1. Thus the crisis appears to have stimulated openness to learning a different approach. Far fewer respondents came to have an interest in organics during the second half of the decade. It is not evident whether this reflects a more recent decline in the true rate of interest in organic approaches or the greater ability and confidence of more experienced professionals to participate in a professional capacity in such a conference.

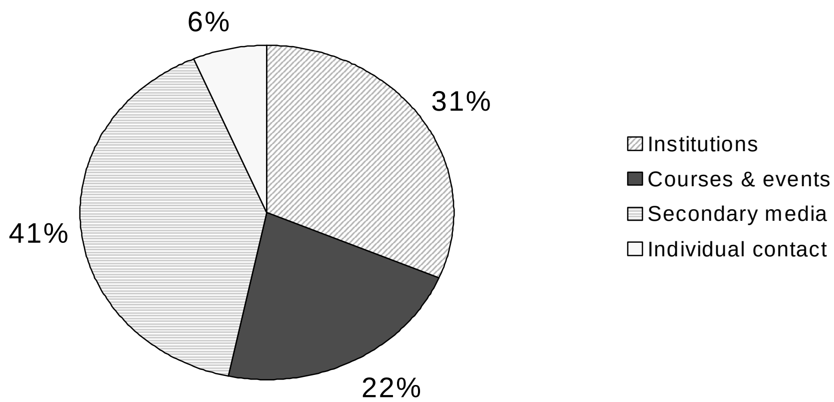
Figure 10.1 Date of first active interest in organic agriculture



Information sources on organic agriculture

The Cuban Association for Organic Agriculture (ACAO) was directly named as an information source by 15% of respondents, but if the organic journal that it published was included, this figure increased to 29% of respondents. This is shown in Figure 10.2.

Figure 10.2 Initial information sources on organic agriculture (% respondents)



In addition, more respondents identified courses, workshops and events that ACAO had been instrumental in organising (such as the courses at CEAS/ISCAH) This suggests that ACAO operated through a facilitative, supporting role, although responses may also be influenced by the currently unclear role of ACAO as it was being transformed into another structure, ACTAF.

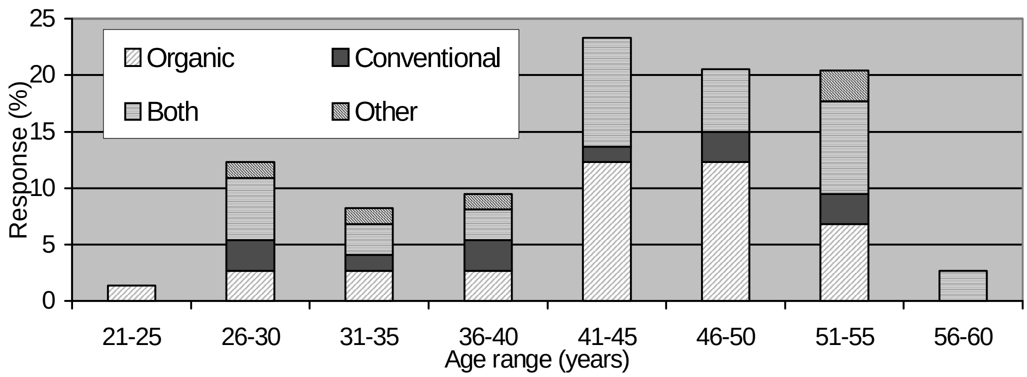
Similarly, CEAS/ISCAH was directly named by 11% of respondents, but was responsible for the postgraduate training courses, which were identified by a further 8%, bringing its total up to 19%. Thirty three percent of respondents identified information sources coming from outside the country, and this was particularly marked in the early part of the Special Period, suggesting that it played a key role in the commencement of the development of organic agriculture in Cuba.

The future of agriculture in Cuba

The majority of respondents, 41%, took a pragmatic, integrated perspective on the future direction of agricultural production in Cuba, although a large minority, 38%, held out for organic agriculture.

Only 14% saw future agriculture as being predominantly conventional. Several respondents noted that the State played a decisive role in maintaining more industrialised agriculture through policies that supported intensive production of specific crops. There was also a perception that State production was more likely to be conventional than that of private, small farmers.

Figure 10.3 The future of agriculture in Cuba by age of respondent



Respondents from research centres were more likely to see the future as organic than those from universities or Ministries who saw the future as industrialised. There could be several reasons for this, including the awareness in administration of institutional and logistical challenge, whereas the research sector may be focused on and more aware of technical potential. Older respondents were more likely to see the future of agriculture in Cuba as organic or a combination, whereas younger respondents were more likely to view it as conventional, as shown in Figure 10.3. This is an almost counterintuitive result but might relate to the younger professionals in ministerial positions and older ones as farmers or researchers. Female respondents were more likely to see the future as organic than the male respondents.

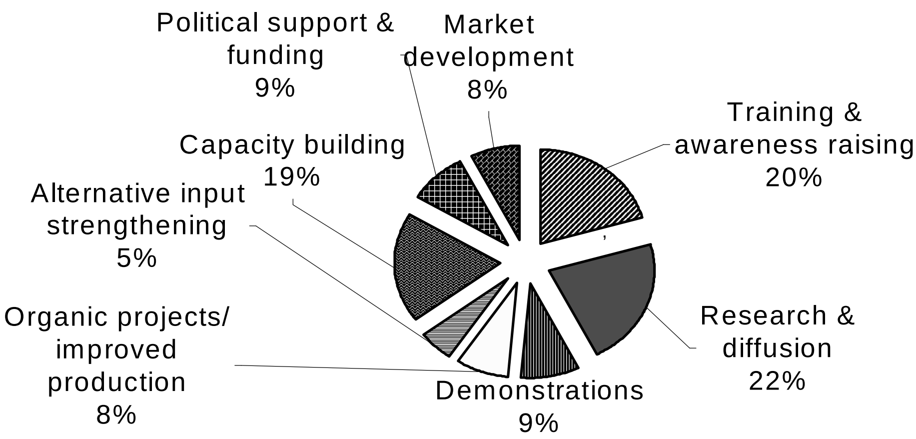
Current support for organic agriculture in Cuba

The crisis and the effects this had on the availability of agrochemical inputs was seen as the major driving force for organic agriculture in Cuba, as indicated by 49% of respondents. This reinforced the argument that organic agriculture was taken up in Cuba because of enforced external circumstances, rather than because of any conscious change of attitude. Respondents emphasised that the country had developed a strong capacity for knowledge, research, training and dissemination and that this contributed significantly to the ability to respond to the crisis and implement a more appropriate agricultural system. They were inclined to view technology and technology generation, and the production and implementation of scientific results, as more influential than the capacities of producers. This may indicate the low level of confidence in farmers' capabilities. Relatively little mention was made of market forces in support of organic agriculture, reflecting the basic politico-economic approach of Cuba in prioritising national self-sufficiency over exportation.

Actions for driving forward organic agriculture in Cuba

Some clear and strong messages on this issue emerged from the responses. Overall, respondents wished to see high-level action to stimulate the growth of the sector. This should involve financing specific development projects and demonstration areas, appropriate research, training of higher level management, strengthening the infrastructure for alternative input production, and establishing the infrastructure required for national certification. Other higher-level initiatives should include disseminating knowledge and information in the agricultural sector amongst producers and citizen consumers, and permitting the establishment of differentiated markets so as to provide incentives for producers. These responses are shown in Figure 10.4.

Figure 10.4 Actions necessary to push forward organic agriculture in Cuba (% response)



Respondents were aware that different approaches would be required in order to develop organic farming in different sectors of farming. State sector production was seen as needing a lot of training and even some restructuring, whereas the non-State was seen as requiring more support and autonomy. The responses received were focused more on production issues rather than on markets, consumer demand, conversions, inspection and accreditation. This indicated that the perception of organic agriculture amongst this group was closer to ecological production than to market-oriented organic production. Unsurprisingly, responses to the questions relating to the strengths and actions for organic agriculture did show some disciplinary bias. For example, soils specialists focused on the need to improve soil bio-inputs, recycle organic materials and strengthen the infrastructure for input distribution.

10.5.3 Recommendations for the future development of organic agriculture

Based on these survey results, a number of key recommendations emerged that would considerably strengthen the organic agricultural sector. These revolve around the following issues:

- Increased training and awareness-raising on organic agriculture, specifically for management including Ministries, and for inclusion in academic courses, and also for consumers.
- Increased country-wide dissemination of knowledge and information on organic agricultural techniques and principles.
- Appropriate research, and practical demonstration of results.
- Focus organic projects and organic production zones, involving the whole agricultural sector in a participatory manner.
- Increased organic input production, availability and dissemination.
- Institutional strengthening of:
  - the producer base
  - the extension service
  - organic certification and regulations
  - organic promotion groups.
- Direct political support and legislation.
- Development of organic markets with price differentiation as a producer incentive.

The date when the largest group of respondents had first become interested in organic agriculture was around 1990, and the most frequently named institute and source of information on organic agriculture was ACAO. The largest group of respondents saw the future of Cuban agriculture as being a combination of organic and conventional approaches, either within or between farms. Older respondents and females were more likely to see the future as organic. The main driving forces for organic agriculture in Cuba were seen as the unavailability of chemical inputs and the contribution of research and training. The most important actions required to push organic agriculture forward, were research and diffusion, training and awareness raising, and capacity building.

The survey provided insights into the areas that needed strengthening and supporting. This survey was particularly relevant in that it sought to identify differing opinions about the actions required to further develop organic agriculture. It revealed that actors directly involved in organic agriculture held an informed wealth of knowledge that would make a huge contribution to any debate on agricultural strategy in the country. Given this, the main conclusion was the need for dialogue between MINAG and key actors in the agricultural sector to devise appropriate strategies which would have a real impact on production and on capacity of the organic movement to support this.

10.6 THE DEVELOPMENT AND INSTITUTIONALISATION OF THE CUBAN ORGANIC MOVEMENT

10.6.1 The Cuban Association for Organic Agriculture (ACAO)

The Cuban organic movement had been highly influential in fostering the development of organic agriculture and related support in Cuba. As in Europe, organic thinking existed in Cuba for as long as industrialised agriculture has first been practised. Funes (2002) quotes the Spanish-Cuban Count Francisco de Frías y Jacob who said, in 1862, "*Intercropping and crop rotation in Cuba will reverse the rampant land degradation caused by ignorance and greed*". Much later, in the 1970s and 1980s, farmer-experimenters and pioneering researchers, made some individual efforts to develop alternatives to industrialised agriculture. Yet it was only at the beginning of the 1990s that these efforts came to the fore and attracted institutional support, out of necessity.

The formal establishment of a national organic agricultural group occurred in 1992, when individuals from the research and teaching sector met up at the Agrarian University of Havana (UNAH). This led to the organisation of the First National Conference on Organic Agriculture, in May 1993. This was attended by over 150 delegates (almost one third from abroad) and the led to the establishment of the Cuban Association of Organic Agriculture (ACAO) which was subsequently registered with the Ministry of Law (MA/R/14). ACAO comprised of a President, an Executive Committee of 11 who met monthly, and a Steering Group of 36 met quarterly. The principle objectives of ACAO are shown in Box 10.3.

Box 10.3 Principal objectives of ACAO

- To develop national consciousness of the need for an agricultural system in harmony with both humans and nature, while producing sufficient, affordable and healthy food in an economically viable manner.
- To develop local agro-ecological projects, and promote the education and training of the people involved in this new paradigm of rural development.
- To stimulate agro-ecological research and teaching, and the recovery of the principles on which traditional production systems have been based.
- To coordinate technical assistance to farmers and promote the establishment of organic and natural agricultural production systems.
- To encourage the exchange of experiences with foreign organisations (with special emphasis on the Latin Aerican tropics and subtropics) and with specialists in sustainable agriculture and rural development.
- To promote and publicise the importance of marketing organic products.

Notable among the objectives was the emphasis on the development and promotion of ecological production techniques, and that the issue of marketing organic products took a low priority. Equally noteworthy was that the movement emerged, not from a farmer base, but from a more academic group, as Rios Labrada et al. (2002), explain "*The first idea was to apply the organic concepts in education and research as an important way of influencing the productive sector.*"[282] ACAO operationalised these principles through the following activities (several of which were encountered during field work and which have been commented on in previous chapters):

- Awareness-raising and information diffusion through organising workshops, field days, conferences and other events involving farmer participation, and the establishment of mobile agro-ecological libraries.
- Trimestral publication of Agricultura Organica, since 1995.
- Initiation of an 'Agroecological Lighthouse' project,[283] which applied agro-ecological concepts on a small range of farms throughout the country. This was supported by the UNDP.
- Multi-sectoral collaboration with the Ministries of Agriculture, Education, Sugar, Higher Education and Science and Technology as well as with ANAP and the Cuban Council of Churches.
- Organisation of two further national organic conferences, in 1995 and 1997.
- Assisting in setting up Masters and PhD programmes (including correspondence courses) in agroecology, at the Sustainable Agriculture Studies Centre (CEAS) of the Agricultural University of Havana (resulting in 500 students being trained by 2002).
- Organising the training of Cuban professionals by foreign certification bodies.
- Developing strong linkages with the international agro-ecological and organic movements, participation in international events and hosting tours by foreign interest groups.
- Establishing provincial support groups.
- Initiating the development of an organic certification system in collaboration with MINAG, ISCAH and others.
- Promotion of farmer-to-farmer agro-ecological extension methods.

Throughout the mid 1990s, ACAO was highly effective in its reach and achievements, especially given that it had neither an office nor core financial support from the Ministry (MA/R/14). For example, it was able to provide support and maintain contact with almost 80% of delegates who attended that first organic conference. Previous chapters have shown how ACAO was behind most if not all, of the activities and information sources relating to agro-ecology, and its members included those scientists who had been developing ecological alternatives back in the 1980s. For example, ACAO was also responsible for introducing into the country the farmer-to-farmer extension method that was subsequently taken up and promoted by ANAP. As one member commented "*It is difficult to evaluate our work because we started many projects and ideas of other groups. The producers themselves probably never hear of ACAO because they only contact individuals who have received the training from us*."[284]

Toward the end of the decade, membership (non-paying) had grown to 800. By 1999 ACAO had produced eleven issues of its magazine, with a print run of 1,000 copies, each issue for which it had raised $5,000 to cover production costs. One-quarter of the magazines were distributed abroad, and the remainder among its Cuban membership. Its mode of operation was described by one core member (MA/R/14) "*The aim was always to be spontaneous, never to force ideas or members, so it did not have formal groups at any level where people are obliged to meet*." In 1996, ACAO received the prestigious Saard Malinkrodt Award for its work on organic agriculture.

[282] Compare this to organic movements in industrialised countries which have, by and large, developed as grass-roots farmer organisations.
[283] The 3 CPAs of the field study in Chapter 6 were part of this project.
[284] During field work, the author repeatedly came across this phenomena; that stakeholders involved in agro-ecological projects which ACAO had helped to set up would frequently not identify the movement when asked to name organic support or information sources.

10.6.2 The 'strengthening' of the Cuban organic movement by the State

Increasingly, ACAO's role and *modus operandi* was attracting attention within the Cuban establishment (see below) and the validity of its registration as a legal organisation was being challenged. In 1998, moves were initiated to affiliate it with a State-created group: the Cuban Association of Agricultural and Forestry Technicians (ACTAF). ACTAF had, over the previous years, been a relatively dormant organisation, and ACAO initially welcomed this affiliation. ACAO was finding that its increasing commitments and activities required more infrastructural and human resources that it had at its command (ACAO, 1998), as it believed that it would retain its autonomy. Therefore, one of ACAO's planned tasks for 1998 was "*To continue to contribute to revitalising ACTAF as an organ to which ACAO can belong in the future*." (*ibid*).

However, it became increasingly clear that this strengthening process was not leading to the desired outcome of ACAO. In April 1999, its name was changed to the Organic Farming Group within ACTAF, and key individuals were put under the command of Ministry-selected staff. By November of that year, ACAO's projects and activities had all been assimilated by ACTAF. Some members of ACAO resigned, and those that remained had to accept the new structure. According to one disgruntled ex-member of ACAO "*ACTAF are not neutral – they are aiming at advanced producers so do not include all those farmers represented by ACAO. They also have different objectives, and organics is not mentioned in their mission statement*." The international organic movement was also concerned about this institutional merger, and in recognition of ACAO's achievements, and to highlight its plight, nominated ACAO for the international Right Livelihood Award,[285] which was awarded in December 1999. The State allowed the prize to be claimed provided that the credit would go, not to ACAO, but to ACTAF, the Ministry of Agriculture, and "*the thousands of Cuban men and women who are developing and implementing organic practices day by day, as another way of resisting the tightening of the economic blockade that our country has suffered for more than 40 years*" (quote from Funes, 2002, p. 15). This became the official party line for ACTAF staff, as one later explained (MA/35), "*The Grupo Organico [ex-ACAO] won the prize for all organic agriculture in Cuba, not just the Group. ACAO was only a small group of 30 people in all the country. Now it is open to everyone*."[286]

In the following year, the fourth national organic conference, planned by ACAO for over two years, was postponed two months before it was due to take place. The Organic Agriculture Group within ACTAF tried to reverse this decision, arguing that it would diminish Cuba's credibility, disrupt the travel plans of the 250 registered international delegates, and undermine its chance of being chosen to host IFOAM's World Congress on Organic Agriculture. In an internal document, the Group concluded that the organising committee felt deeply affected by this postponement, "*considering that previously we held three events successfully in far more difficult conditions and under the Ministry of Higher Education, whereas now that we are officially within ACTAF and the Ministry of Agriculture and with all the organisation completed, we are not able to go ahead*."

The conference was rescheduled by ACTAF for the following year, although a number of anticipated foreign delegates declined to attend in protest at the change in institutional management of the organic movement. While the conference was still a success (the author was one participant), in the absence of some key organic players (both domestic and international) there were some noticeable differences, including a focus on scientific results over social issues and networking, and accompanying training courses being run exclusively for international participants. A number of interrelating factors may have contributed towards this institutional change, and specifically to the State's attitude towards ACAO, as follows.

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[285] There was also the view that the US had manouevred for ACAO to win this award in another effort to attack Cuba, and that ACAO was unaware of this (KI/4).

[286] This description of ACAO contrasts with that reported by a foreign evaluator in the run-up for nomination and prior to the merger, "*Its* [ACAO's*] membership spans the whole agricultural sector, from farmers to farm managers to extension agents, researchers, professors and government officials. It also spans the political spectrum from pro-government conservatives to those favouring major reform, and is thus immune to charges of political partiality*." (KI/14)

- Pioneer individuals within the organic movement may have become too autonomous, possibly flamboyant, for the socialist regime, especially in terms of international travel, access to foreign exchange and knowledge. The movement became seen as a collection of individual personalities, rather than a faceless collective representing the Cuban people, and jealousy may also have been stirred.
- An increasing number of foreign visitors were coming to the island to look at organic agriculture and to provide funding for it, and the State may have felt it was losing control over the activities.
- ACAO's status had never been fully approved of by MINAG. This was in line with Cuba's general antipathy towards (autonomous) NGOs, which were suspect to being vehicles for US infiltration (MST/2; KI/14).
- A small number of key actors associated with the organic movement had used their international travel opportunities to seek residency in other countries over the decade.
- The relatively centralised planning of agriculture did not allow for farmer agency over their cultivation strategies or over formation of their own organic groups which would have provided a stronger grassroots basis, and therefore stability, for the organic movement. This view was voiced by Ministry representatives, and one key informant (KI/15) who explained, after the merger, *"I warned ACAO five years ago of the problems if they did not link up with producers in a big way. The problem is that the farmers did not start the organic movement. … Perhaps at that time it was too early, but I suggest that they start again from the producers up."*
- ACAO, for all its apparent attempts to maintain institutional allegiance, was perhaps too non-conformist or *avant garde* for the establishment. Organic production strategies were not the main thrust of State agricultural policy, and, as discussed in previous chapters, were frequently seen as promoting a low-yielding system. Certainly as the crisis eased toward the end of the 1990s, there was less urgency to experiment away from the norm. There were cases where proposed organic development projects which had secured substantial foreign funding were not supported by domestic institutions or provided with matching Cuban funds.
- Because of its work as behind-the-scenes facilitator, up to the mid 1990s ACAO was unable to provide quantitative evidence of its achievements or impact. For example, there was little systematic analysis of yields and economic returns under organic agriculture (particularly given the high proportion of scientists within ACAO). Equally, data on the number of people using ACAO's documentation centres was not recorded. Although this lack of impact analysis is not unusual amongst the research sector, such evidence would have provided a useful line of defence for organic agriculture as well as for the movement.

Overall, it appeared that ACAO had been successful in facilitating organic agriculture from behind the scenes. Yet (and similar to the experiences of a participatory development project in Pinar del Rio described in Chapter 8) such behind the scenes work contributed to its subsequent problems: there was less direct proof of its positive impact, while acclaim went to the groups and initiatives it had supported (these still survived), and this lack of clarity could even be (mis)interpreted as a means to complot. Further, and notwithstanding its efforts otherwise, it had been unable to pioneer and at the same time maintain good correspondence with the establishment, which may also have contributed to a lack of trust.

On the other hand, organic agriculture was not in conflict with socialist ideals. On the contrary, as long as the movement focused on national demand rather than pursue the international trend of exporting to a wealthy market, its concepts rested well within the prevailing political arena. José Martí, one of the nation's ideological figureheads, favoured agricultural techniques synonymous with organic approaches, stating, for example, that *"the day that a people start to depend for their survival on only one crop is the day that they will be committing suicide"* (cited by Roque, 1999). He also understood the importance of maintaining a diverse balance of minor crops, of importing only those which grew in different agro-ecological zones and he emphasised appropriate mechanisation, targeted soil fertility techniques, and forest conservation. (*ibid*)[287]

Nevertheless, a more widespread conversion to organic agriculture would have required more concerted political will, and more time. The organic movement did not have enough time to prove the value of such an approach before agrochemicals started to become more widely available again. Funes (2002), in tracing the development of organic farming in Cuba, recognises that *"the principal techniques receiving widespread application have only been of the "input substitution" or "horizontal conversion" varieties (reduced input use, soil recovery techniques, etc.). A narrow technical focus has not yet allowed us to take significant advantage of the mechanisms of synergy that would be made possible in a more completely agroecological conception of agricultural development."* Funes optimistically refers to the 1990s as the 'first phase' of a widespread conversion process.

10.6.3 The Cuban Association of Agricultural and Forestry Technicians (ACTAF)

The Cuban Association of Agricultural and Forestry Technicians was founded in 1987 as a network of agricultural specialists. It had not had a very high profile or set of responsibilities until its reactivation at the end of the 1990s. ACTAF's overall objective was "*Support for the development of a productive, efficient and sustainable agriculture, capable of guaranteeing national food security and agro-industrial needs whilst taking into account the safeguarding of the environment and man."* Within this framework it had a number of more specific goals: assisting with "*the maximised exploitation of harvests and by-products*", contributing to farm workers' development and technical training, stimulating and supporting research and extension project activities both for sustainable agriculture and agro-industry, fostering international co-operation including professional exchanges, and diffusing results and overseeing meetings (ACTAF, 1999). Within ACTAF were a clutch of institutional theme-based groups, one of which was the Organic Agriculture Group. The others were on seeds (with the Seed Enterprise), weeds (with the Sugarcane Research Institute), plant health (with Sanidad Vegetal), agricultural engineering (with several relevant institutes), and forestry (with the Financeros Forestales).

Criticism of ACTAF over its appropriateness to house the philosophy of the organic movement was somewhat justified; as an umbrella organisation its approach was mainstream, to target "*all levels and forms of production*". They focused on both large and small producers as in their view "*a small unit cannot feed everyone*" (MA/35). Although not working with State farms, their focus was on UBPCs, a group which they felt needed more support. Organic farming was notably absent from its specific objectives, and its production approach was explained as *"…ACTAF may work through a wide field of actions, mainly directed at balancing a rational, sufficient and efficient use of chemical methods with organic and biological alternatives...*" (ACTAF, 1999, p. 12-13). ACTAF staff saw their role as extensionists for the promotion of a raft of technologies. Specifically regarding organic agriculture, this would mean the promotion of diversification (without losing specialisation), and integration (apart from the currently existing plantations). ACTAF recognised that farmers needed encouragement to undertake organic agriculture, and felt that certification was a further challenge to its growth. Although they acknowledged that the level of organic production in Cuba was far lower than was perceived internationally, they pointed out that Cuban production was largely free of chemicals, with only potato and tobacco in receipt of such.

In 1999, ACTAF initiated a network of affiliations, and held its first congress in October of that year. By 2000 it had 10,600 members, and was aiming for 50,000 i.e. 20% of the national total of

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[287] Similarly, Ché Guevara once noted *"While the law of value is expressed in a relatively pure form in the world market, in our domestic economy its operation will be greatly influenced by the impact of the socialist sector and by the amount of socially necessary labour required locally to produce a given article. Moreover, it is quite possible that we might be much more interested in an investment to develop some type of product that is not the most profitable, but would nonetheless be more desirable from a strategic point of view, or simply, more beneficial to the population."* (cited in Tablada, 1987, p.143).

agricultural researchers, producers and associated institutes. They had also organised groups in five provinces, whose functions were to host technical meetings and collaborate on donor-funded projects. Of its thematic groups, the Organic Agriculture Group was arguably the most developed, although the Group's 600 members were dwarfed by ACTAF's overall membership. By the end of 2000, almost all of ACTAF's specific projects, whether in progress or being approved, were organic and had been initiated through ACAO and its contacts. Box 10.4 shows these projects (funder and start date in brackets)

Box 10.4 Specific projects of ACTAF at 2000

- Transformation of the Cuban organic movement (Food First, US)
- Development collaboration on organic agriculture in Cuba (Oxfam America, US)
- Institutional strengthening (HIVOS, NL)
- Home gardens (PERI)[a]
- Urban agriculture (CEREI) [a]
- Organic agricultural production (Oxfam America, US)
- Agro-ecology and SANE (IDRC, Canada)
- Assistance on organic agriculture (Oxfam, Canada)
- Institutional strengthening (SPF, France)

[a] Country unknown

Source: ACTAF staff (MA/35)

Supporters argued that ACTAF's task was to have a specific organisation to deal with externally-funded projects in a cohesive fashion and to learn from these experiences. In this way, ACTAF could use its position to organise a consortium of Cuban organisations for foreign-funded projects (KI/4). ACTAF provided a quasi-autonomous government agency, with NGO status that could be used as a channel for collaboration with foreign organisations wishing to work with Cuban farmers or to invest through development aid without being too closely associated with the State. ACTAF staff explained further, "*Being an NGO, we are both a counterpart of the State and representing the extensionist's voice. We can undertake activities that the State cannot, such as training and extension*." (MA/35). Such was the level of foreign interest (and especially in organic agriculture) that in early 2000, ACTAF was having to "invent" new projects to satisfy their demand. As one staff member explained (MA/35) "*There are many foreign groups who don't want to fund the State directly. And they can't go through ANAP because lots of producers don't belong to ANAP, for example those in urban agriculture*." Critics argued that ACTAF had been reactivated in order for the State to assert control over the burgeoning number of more independent initiatives, especially those involving foreign collaboration (and funding), such as those which ACAO was involved in.[288] The relationship between ACTAF and MINAG was somewhat ambiguous. Staff explained that ACTAF was not directly related to MINAG, but that owing to financial restrictions it was nonetheless housed in MINAG's headquarters in Havana and MINAG was also paying the wages of its five staff. ACTAF had to raise funds from other sources (projects, membership, publications and events) to cover its other overheads. This included funds raised by and for the Organic Agriculture Group, such as those received from the Right Livelihood Award.

In terms of developing their Organic Agriculture Group, ACTAF saw it as weak and in need of strengthening. To do this, ACTAF was attempting to increase affiliates by sending out a national invitation, and in 2000 the Group itself was planning to run elections for new executives. ACTAF's only publication was 'Agricultura Organica' which came from the Organic Group. It was formalising the publication by registering sales and attempting to make it self-financing through subscription rather than attempt to attract the same financial support that ACAO had achieved.

[288] ACTAF staff themselves were reluctant to provide a reason for its reactivation (MA/35).

10.6.4 Concluding remarks

From the above, several factors indicated the disadvantages of the Cuban organic movement being housed within, and answerable to, ACTAF. Philosophy and objectives were different and sometimes conflicting. Ultimately ACTAF was an organisation concerned with promoting 'sustainability' rather than organic agriculture. Funds dedicated to the development of organic agriculture in Cuba were going to support a much larger organisation with a wider remit. ACTAF staff, brought in from other disciplines, were having to develop strategy and projects, and interact with international interest groups but without the depth of understanding as longstanding actors in the organic movement. This meant that they were less convincing, and also unable to take full advantage of the potential opportunities presented to them. The international organic movement operated on friendships and contacts built up over time, and this had to some extent been lost. Overall, even though ACTAF's annexation of ACAO may have been well intentioned and intended to generate benefits by increasing capacity in managing foreign projects, it did not have the expertise or trust to work effectively with the international organic movement.

This study of the fluctuating development of the Cuban grassroots organic movement also demonstrates the conflicting dynamics generated by the interplay between grassroots groups and government. Ultimately this conflict may boil down to the difference between the things that the State is good at, and those things that individual entrepreneurship is good at. This is a dilemma which in Cuba may take more time to achieve a balance. Under the present circumstances it is difficult to envisage how the Cuban organic movement will be able to maintain its' cutting edge nature. One very likely outcome may be the emergence of a new splinter group, possibly under a different guise, in which the more informed, progressive and pioneering individuals will rediscover the space to operate.[289]

The paradox may be that Cuba is trading on its (only partially founded) reputation as an organic pioneer (perceived as using organic approaches as a tool to meet domestic food security needs), as a means for developing a standard export (and tourist) led organic model – whilst reverting back to reliance on agrochemical use (and possible even biotechnology) as a means for meeting domestic food security needs.

10.7 CONCLUSIONS

In many respects Cuba had the perfect conditions to develop organic production. It was arguably an appropriate form of agriculture in Cuba where high knowledge levels rather than inputs were available, where the State placed emphasis on the importance of human health, and where there was a critical need for export revenue. Yet similar challenges were present as in other countries, and a few more unique challenges also.

The crisis spawned the organic movement and offered it a unique opportunity to lead the way during Cuba's period of vulnerability. Circumstances were right, the State was open for alternative approaches, and those who had been thinking organically could use their beliefs to contribute to food security goals. Some farmers developed organic systems, as for example, banana producers who chose it as a means to specialise or cope under the conditions. This experience convinced farmers that organic production was technically feasible. The institutional sector was not so convinced, and organic individuals within that were feeling that their voices could be better heard and that they did have a real contribution to make to agricultural development even at the end of the 1990s.

The organic movement, also struggling in the resource-poor conditions of the decade, was unable to make a sufficiently timely and convincing statement in rural Cuba, as it, and the urban agriculture movement, had done in the cities. This was exacerbated by the somewhat entrenched mindset in the

[289] On the author's most recent visit to Cuba in 2004, there were signs of formation of such a group.

agricultural sector that was not present in the new institutions of urban agriculture, but also by various institutional power and ideological factors between a pioneering NGO and government. Two types of organic agriculture were being developed into the new millennium: one State-pushed and oriented to export, and the other driven by international donors and oriented toward small farmer development.

11 DISCUSSION: POLICY IMPLICATIONS OF CUBA'S ACHIEVEMENTS IN SUSTAINING ITS AGRICULTURE AND FOOD SECURITY BASE

11.1 AVERTING ECOLOGICAL NEMESIS: CUBA AS A ROLE MODEL?

Throughout the 1990s, "fact-finding missions" and study tours of Cuban agriculture organised by organic interest groups from the United States and Europe reported on the resounding success of Cuba in achieving a transition from a potential food crisis to implementing an ecologically-based, low-fuel agricultural system that was succeeding in feeding its population. Such reports prompted the undertaking of this research. The Cuban experience may serve as a test-bed for insights into increasing the sustainability of farming practices, of organising a less fossil-fuel dependent food supply, and of ensuring individual and national food security.

This chapter pulls together the empirical evidence of the previous five chapters to discuss the implications of the Cuban experience in relation to the four core research questions. Section 11.2 discusses the current forms of agricultural production and institutional support mechanisms that developed as a response to the crisis. Section 11.3 looks at the successes in increasing national food security, and Section 11.4 draws together the types of policies and processes which may further support ecological agriculture in the country.

11.2 CUBAN AGRICULTURE AT THE END OF THE DECADE: A PATCHWORK OF APPROACHES

11.2.1 Introduction

This section reviews the nature of the production system in Cuba at the end of the 1990s, and the institutional factors that were working to support and shape this system. It looks at the extent of use of petroleum-based inputs and of ecological husbandry practices. Beyond this, a picture emerges of Cuba's own, divergent forms of agriculture and corresponding institutional support systems, still in a dynamic process of development at the end of the decade. Even though ecological production appeared not to be playing the mainstream role, evidence indicated its strong supportive role as well as its potential contribution for developing a more healthy production and food system which was, at the end of the decade, underexploited.

11.2.2 Changes in the use of external inputs

The reality of agrochemical application

Availability of agrochemical inputs rose somewhat toward the end of the decade. Pesticide imports had dropped from 20,000t in 1990 to a low of just under 5,000t in 1993, but since then have risen steadily to almost 10,000t by 1998 (CNSV, 2000). Fertiliser use had also dropped, by two-thirds, yet toward the end of the decade, fertiliser imports were rising, from 96,000t to 137,000t between

1999 and 2001 (compared to the 1989 figure of 536,000t) (FAO, 2004). Supply levels fluctuated throughout the decade, as did that of petrol (Mesa-Lago, 1998). Although input prices rose over the decade, they remained lower than in the 1980s.

The reality of agrochemical use was a more complex one. Although import levels did drop to a low of 25-33% in the early 1990s, farmers were buffered by reserves, so that the most difficult period in terms of availability was between 1995-97 when these reserves had run dry. Although the majority of farmers had experienced a decrease in agrochemical usage, changes in use at farm level were far from uniform. Some farmers, and especially campesinos, had never been large users of agrochemicals and could maintain similar levels as previously or even increase them as incomes rose sufficiently to be able to purchase more on the black market. Other farmers, who had previously not had access to agrochemicals, were more recently incorporated into modernisation programmes that made them available for the first time. Farmers exhibited three types of response in their approach to agrochemical usage: i) being frugal; ii) never having enough/always wanting more; or iii) unneeded.

A patchwork effect was seen across the country. Agrochemical input distribution and access was officially controlled by the State. Farmers required permission in order to purchase agrochemicals from official sources. Certain crops, important for the ration or for export, received priority, such as sugarcane, potato, banana, rice, seed crops and root and tuber crops. Each municipality had different priority crops, and certain provinces, such as Havana, were more highly prioritised than others. High-performing farmers, including those with good natural resources or irrigation equipment and increasingly the campesino farmers, received preferential treatment. In contrast, only 18% of the total area sown with non-prioritised crops was fertilised in 1998 (FAO, 2003). This created a patchwork effect of agrochemical application, in both dosage and area covered, at farm, municipal and provisional levels.

Owing to fluctuations in input availability, in practice even prioritised crops and areas could fall short. Nevertheless, 75% of the co-operative farms visited for this study were regularly using agrochemical fertilisers on at least some of their crops, and 65% were using pesticides, herbicides and fungicides, albeit often at low levels, as a precision application, or as a curative rather than preventative. There was a widespread desire to use more agrochemicals, especially fertilisers, when they became more available – expressed by 83% of farmers interviewed. As well as distributing and advising on agrochemical use, the agricultural support sector – that is, research, extension and policy support - was also planning to increase the availability and use of agrochemicals: long-term (ten-year) crop production plans included a mixture of high-input, integrated, and low/ecological-input production in fairly equal proportions. Based on the level of use of agrochemicals in certain areas, and intention to use them in most areas, none of the forty or so farms visited could be said to be proactively practising ecological agriculture over the whole unit.

More important than agrochemicals: fuel shortages and adequate germplasm

Prioritisation was also applied to fuel distribution: different regions, crops and farmers had different levels of priority. This affected both machinery and irrigation use. For farmers, the lack of fuel was far more of a limitation to production than of agrochemicals, and a common complaint was "*falta petroleo*!". Fuel supplies did not increase over the decade in line with production increases, but remained low, generally meeting only 20-60% of felt needs. Irrigation was rationed according to crop: sugar took 39%, roots, tubers and grains 21%, and rice 16%. Fuel costs were not themselves felt to be a problem, and 70% of farmers interviewed would use more farm machinery if they had better access to petrol. These fuel shortages meant that farmers learned to use their fuel far more sparingly and effectively.

Farmers rated access to adequate seed varieties and seed quality as being as important as, if not more, than access to agrochemical inputs. Whilst farmers had reasonable knowledge about seed management, they held very little autonomy over seed selection and production, and on-farm seed saving was limited by lack of adequate storage. Meanwhile the State seed sector remained centralised, yet even toward the end of the decade its ability to adequately reproduce, store and distribute seeds was very weak, resulting in the use of inappropriate varieties and low levels of diversity. The rest of the country was dependent on seed production in Havana or abroad for 50% of its seed sources, and there was a lack of resources to develop new hybrids domestically. A black market was growing for seeds, with intermediaries travelling throughout the country.

Farmers' alternative coping strategies: the extent and use of ecological techniques and knowledge

Specific State-backed coping strategies were identifiable on farm: rationalisation, increased responsibility, improving workers' incentives, increasing self-provisioning, intensification, on-farm diversification and complexity building, and targeting market niches and specialities. Other strategies had emerged without State backing: of working in harmony with nature, or, for more marginalised, traditional farmers, of simply continuing with business as usual. Within this, farmers were forced to look to on-farm resources and the natural resource base in order to maintain or increase production. Many such alternative strategies were unintentionally consistent with ecological production; they were something that farmers had to do by default. These strategies could be broken down into those relating to soil fertility, pest and disease control, water usage, traction, and crop choice.

Soils were in very poor condition: 60% had been eroded and 25% severely eroded through intensive husbandry practices. To improve soil fertility, almost all farmers interviewed for this study were, on some part of their farm, rotating crops, incorporating crop residues and using oxen. The majority were also intercropping, practising minimum tillage and applying manure (at rates of between 0.1 and 22 t/ha). A large minority were using compost, legume crops and worm humus, some of which was produced on-farm. Manure came from State livestock farms, sugarcane waste from the CAIs, and green manures and biofertilisers from research institutes. In some cases, free manure had become a less plentiful resource as the livestock farms themselves diversified and started to produce crops, or to charge for this product. By 1998, 600,000t of worm humus and compost were being used (Treto et al., 2002).

Almost all farmers interviewed had used a range of pest and disease control methods, including selecting resistant crop varieties where possible, using natural weather patterns to disrupt pest lifestyles, applying Bt[290], and rotating crops. A large number were also applying other biological pest controls, and a mixture of simple techniques for good management. These included manual pest and egg removal, mulching, removing infected leaves and maintaining clean rows, good soil preparation, separation of susceptible varieties, irrigation, and use of clean seeds. Although the extent and degree of use of these methods was unclear, the total area treated with biological control agents increased from 300,000 ha in 1988 to 900,000 ha by 1998. These organic inputs were also used in a patchwork effect; most commonly in urban agriculture, and by UBPC co-operatives which could less easily afford to access agrochemicals on the black market. Other regions and producers showed minimal usage, and although overall quantities, frequencies and extent of use of ecological inputs was difficult to quantify, secondary data indicated that these were actually quite low.

Over half of the farmers interviewed were irrigating at least part of their farms, mostly powered by petrol-driven turbines or gravity. Some campesino farmers had been able to invest their new wealth in electric turbines. All farmers were planting in accordance with the rains: with awareness of planting time, rainfall variation and soil type, and all had adapted their irrigation schedules to make them more efficient. Almost all were using drought-resistant crop varieties where available.

For traction, all farmers were using oxen on some part of the farm and had modified equipment for this purpose.[291] The use of oxen had notably encouraged more care and attention of soil management. Labour savings were made by leaving crop residues in field, practising minimum tillage and sharing machinery. At the same time, fencing and wild areas were being removed to

[290] *Bacillus thuringiensis* is a bacterium that parasitizes the caterpillars of some harmful moths and butterflies. Spraying or dusting plants with spores of this bacterium is accepted as an environmentally safe way to control such pests.

[291] Such as the 'multi-plough' which had been developed so as not to invert the topsoil.

facilitate tractor manoeuvring. A widespread concern was that the deterioration of old farm machinery, and lack of petrol, had adversely affected agricultural productivity.

Crop choices were changing, with a move to less input-demanding crops and varieties and to bulkier root and tuber crops to fulfil the tonnage-based State production plans. The increase of crop theft also influenced decisions on crop choice, as did the rise of urban horticulture. Land use decisions were limited by irrigation possibilities, and more fallow land was being brought into production.

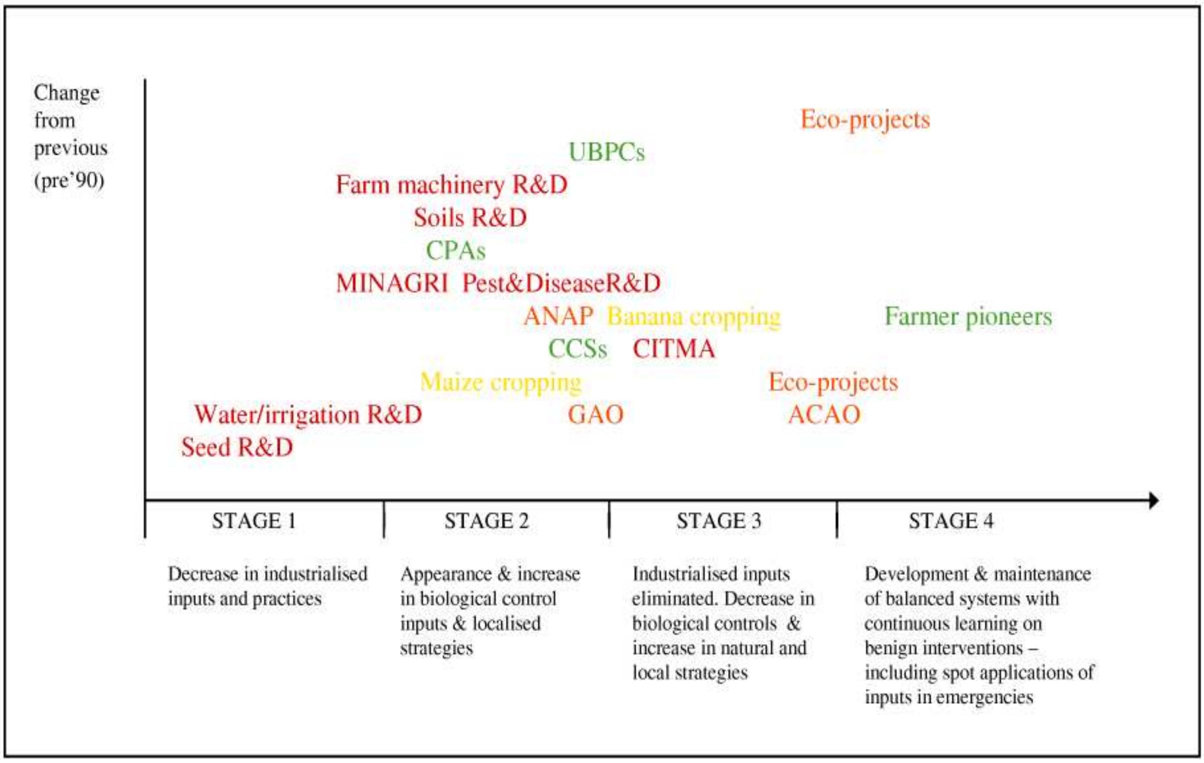
Along with input availability and influence of the support sector, a third factor influencing coping strategies was the level of on-farm knowledge. The CPA and CCS co-operatives studied contained a substantial number of farmer-members trained in different specialities, as well as those with other professional backgrounds. Amongst members was also a high level of traditional knowledge that had survived the industrialised period. This knowledge was very under-exploited on the CPA co-operatives where older farmers felt their knowledge to be outdated, a feeling that was exacerbated by the introduction of biological inputs. With a higher turnover of migrant and uneducated workers, the UBPC co-operatives held less traditional and local knowledge, but there were attempts to address this through training. Knowledge of, and awareness about, sustainable and ecological agriculture was still relatively low at the end of the decade, and especially on its background philosophy as opposed to a simple toolkit of ecological technologies. Overall, the farmers most satisfied with their current situation shared the following characteristics: they owned electric irrigation pumps, applied organic matter, owned or had easy access to a tractor, and applied only small quantities of agrochemicals.

11.2.3 The agricultural sector in transition

Funes (2002), in tracking the development of ecological farming in Cuba, identifies that "*the principal techniques receiving widespread application have only been of the 'input substitution' or 'horizontal conversion' varieties*." He refers to the period of the 1990s as the 'first phase', the basis for further widespread consolidation of ecological agriculture. Analysis of field work indicated the difference in positions of individuals, groups and institutions in terms of farming approach; some were still operating along industrialised lines, some were substituting agrochemical inputs for biological inputs as suggested by Funes and others, the minority, had transformed further to give up a reliance on any type of input and instead focus on a balanced interaction with nature. There was a tendency for ministerial institutions to be more industrialised, compared to proactive, ecologically-oriented projects organised by pioneering farmers, researchers, extension groups or NGOs.

Yet not everyone started from the same position: some groups, such as the organic movement (ACAO/GAO) or pest and disease research groups, were already operating closely to ecological principles early in of the 1990s, whereas other groups, such as the old State farms which had transformed into UBPCs, had been more highly industrialised and had since made huge changes in the 1990s to take on ecological techniques. There were also differences in the transition made in the regimes for different crops; certain non-prioritised crops, such as maize, had remained low-input, whereas crops such as banana have modified from high chemical input to often a more ecologically-oriented production approach. This analysis indicates that although the agricultural sector as a whole may be in the early substitution phase, many individuals and groups had nevertheless undergone huge transformations toward a relatively more ecological approach from their starting points at the beginning of the decade. An estimation of the degree of transition of the different entities and cropping systems, and the degree of change from the pre-crisis positioning, is made in Figure 11.1. Within this transition were two points where a change in attitude might have occurred: one at the point where substitutes for agrochemicals were used, and the second where even substitute inputs were dropped to make way for more benign management approaches.

Figure 11.1 Ecological transition of different sectors, crops, institutions and actors in Cuba



11.2.4 Coping strategies of the institutional support system

Wider influences on change

The shortages of inputs, fuel and food did not only affect agricultural producers. Financial restrictions meant a general lack of resources that affected the whole support sector: of policy and administration, research and extension. This forced greater financial accountability and economic self-sufficiency across the board, as well as organisational decentralising and restructuring. This change was both helped and hindered by the socio-political framework: helped, for example, by a horizontal and vertical fluidity of personnel due to lack of hierarchy, by high levels of education and by collective approaches; hindered, for example, by a continued poor access to international research journals, restricted travel, and a history of focus on techno-agronomic issues with little experience of farmer-led or participatory development approaches. Foreign influences also played an important role: international private sector linkages provided funding for industrialised agricultural development, and NGO linkages for more ecological development projects.

By the end of the 1990s, the Cuban agricultural support sector was still undergoing a process of transformation. Informal and formal institutional coping strategies varied from continuing with business as usual and blaming externalities for failure, to embracing completely new methodological and technical approaches. Although new approaches were often influenced, or even driven, by foreign interests, some were initiated internally, out of the experiences of the material limitations of the early 1990s or based on earlier pioneering work from the 1980s. Overall, a set of individualised and often unstructured features were emerging to characterise the institutional support sector.

Ambiguous agricultural policy

The production and agricultural support systems in Cuba comprised a mixture of industrialised and ecological elements. Some elements were remnants of the pre-1989 system (such as the use of agrochemicals), some were deliberately chosen and introduced in the 1990s (such as bio-controls), some were still to be discarded (such as the top-down extension model), and some arrived through lack of choice (such as urban agriculture). From the rather desperate ‘try anything’ approach of the early 1990s, which included ways to recycle and re-use agro-industrial wastes and to test more radical concepts such as of permaculture, the late 1990s saw more sophisticated approaches which tended to focus around a broadly interpreted concept of integration.

Although the term ‘sustainable’ was used in policy, there was little explicit, practical definition. For example, an objective of the National Nutritional Action plan was to *“combine alternative agricultural practices with those of the industrialised model”*. The new Agricultural Extension System had *“an overall aim for high yields and low inputs.”*, yet other field sources claimed that *“This country’s policy is to obtain the highest yields whatever the costs.”*. Research strategies supported the reduction, but not elimination, of agrochemicals, although research models referred to as ‘low input’ or ‘integrated’ were frequently in complete absence of agrochemicals.

The vanguard ‘Transfer of Eco-Technology’ service

The first step away from industrialisation – that of substituting agrochemical inputs with ecological ones – had been taken through the creation of Cuba’s biological input service: a network of over 220 bio-pest control production centres (CREEs) and more recent bio-fertiliser production centres including provincial processing centres for organic matter and vermiculture. Because of their substitutive nature, success did not depend on any major attitude change, and the simplicity of products meant that the service could be run by semi-skilled technical staff and operated in rural areas on farms, training centres or as stand-alone units. Farmers were instructed on input usage in a prescriptive fashion. The most successful products were those which did not require a lot of skill to apply, and which could be stored at ambient temperature. In addition to these centres, several research institutes were commercialising bio-products such as mycorrhiza and *Rhizobium* compounds and Neem products.

Maintaining State planning, encouraging local management

The State was maintaining its centralised planning and control over food security issues. This meant that the sector could rapidly implement new policy and effectively react to threats and opportunities. For example, a nationwide outbreak of *Thrips palmi* – a small insect which damaged several staple crops of the *Cucurbitaceae* and *Solanaceae* families, was brought under control within three years. The centralised planning system provided some avenues for interaction and feedback; not only the regular stakeholder discussions over farm production plans, but also, in Havana Province at least, selected campesino farmers who acted as advisors to MINAG’s Council of Ministers, and technical bulletins from research centres which were drawn up in consultation with municipal farmer groups. At the same time, the State was encouraging more localised management of resources, of market decision-making, of some aspects of research, and of extension approaches. With an increase in autonomy, farmers were also more interested in attending meetings and events. There were still some anomalies. For example, whilst there had been significant decentralisation of some entities such as the Seed Enterprise, MINAG appeared to be gaining more control over others such as Acopio and the grassroots organic movement. UBPC co-operatives may have acquired more internal autonomy, but were still strongly linked to State Enterprises for inputs and services.

Recognition and up-scaling of small-farmer strategies

Throughout the crisis, the campesino sector had proven its resilience through recourse to traditional practices and sufficient autonomy to innovate. This was recognised by the formal sector, which started to include more informal food production systems into production statistics. Campesino farmers were more actively encouraged to participate in State production plans and were relied upon for production of specific staple crops such as rice, roots and tubers. Further, campesino strategies, such as rotations, intercropping, diversification, and small-scale processing, were applied on ex-State, UBPC farms. These farms were also downsized and given increased autonomy. This led to a move toward a more diversified pattern of land use. Researchers started to use campesino farmers to test and adapt new agricultural technologies, and successful innovations were recognised and promoted. Such change was not found everywhere; historical linkages continued to favour State or ex-State farms, and experimentation with the institutional support for the campesino sector between 1997 to 2000 had left them isolated during this period. Further, campesino production was not necessarily ecological: campesino farmers were relatively wealthy and could afford to access agrochemicals sold on the black market.

A pluralistic and outreaching national research and extension strategy

With the changing nature of farming structures, of resource use, and of differing food needs, so agricultural research and extension also had to change, in terms of both content and methodology. The overall move was from top-down prescription to pluralism. A new Agricultural Extension System was planned, building on a network of existing, yet unlinked, extension efforts. A future plan was to gradually phase in fee-based extension services. A National Commission for Extension Education was also formed, and management staff of most co-operatives had, by the end of the decade, received some form of management and/or agronomic training. Some older extension features were retained, such as the radio and television diffusion channels and the inclusive Science and Technology Forums held at municipal, provincial and national levels. Within this pluralistic strategy, top-down extension approaches still played a role where a technique required mass-diffusion (such as ox-handling), where ex-State farm workers were not ready to become completely autonomous, and for certain technologies which were used as simple substitutes for agrochemicals such as certain biological controls.

Researchers were charged with developing more local, appropriate and applied research, although the lack of knowledge of, or access to, more appropriate methodologies such as participatory techniques was a constraint to its implementation. One researcher with several years experience of pioneering more interactive extension development described the role of the 'new facilitator' of Cuba thus: "*The main input necessary is knowledge, and to integrate this with indigenous knowledge. Therefore the extensionist is a knowledge promoter. Graduates are not necessary because personality and local acceptability are more important characteristics. Young extensionists are particularly successful, because the farmers feel paternalistic and the relationship works*."

A unique component of the research and extension sector, as with many aspects of Cuban society, was the relatively high level of altruistic or collective attitude. One university research group in Cienfuegos, for example, had developed a new technique to increase livestock productivity; they would only diffuse this to farmers who first agreed to sell the excess produce to the capped-price markets rather than on the free market, so that the benefits of the research would be passed on to less wealthy society.

The belated development of certified organic agriculture

The focus of the 1990s had been on maximising production quantities. Because of this, there had been little room for concern about intrinsic food quality, or differentiation of produce according to production methods. Certified organic production for export had neither been developed, partly because of the focus on national self-provisioning but also because of a lack of know-how and experience, and of political conviction for such. Despite this, a few organic export projects were initiated during the 1990s by foreign buyers and certifiers; mainly for sugar, banana, citrus, mango, coconut, coffee, honey and pineapple.

In late 1999, an order came "*from the top*" for MINAG to develop organic production for export, and by 2000 MINAG was attempting to institutionalise organic agriculture. Organic export production was included in the long-term production plans for sugar and banana. While responsibility for developing organic agriculture lay with the Organic Agriculture Group (GAO) of the Cuban Association of Agricultural and Forestry Technicians (ACTAF), draft national organic standards were produced by MINAG's Department of Quality Control. These standards defined both organic and sustainable production methods, the former depicted as being environmentally friendly and bound by legislation, and the latter focussing on meeting societal needs and with the regulated use of agrochemicals. At the end of the decade, consideration was also being given to developing a scheme to supply internal tourist markets with (non-certified) 'healthy produce.' This might involve developing an own- brand label which would not require internationally-recognised certification. It could also spin-off into higher priced, quality products for the Cuban market.

Concurrent growth of the biotechnology industry

At the outset of the Special Period, the State made an investment of $100 million into biotechnology research, for both agriculture and medicine. Biotechnology was seen as a major potential generator of foreign revenue. The industry included the development of biological pesticides and fertilisers, but saw its biggest strength as being in genomics. Although there were no nationally-produced GM crops on the market in 2000, the medium-term plan was to develop such crops for domestic, non-tourist consumption. Food destined for the tourist sector would be kept GM free, and GM development was not applied to the tobacco industry because of fears of harming international sales. With Cuban scientists relatively cut off from international debate, the Cuban organic movement was at the forefront of introducing information on the potential risks of GM technology (e.g. Fernández et al., 1999).

11.2.5 The contribution of ecological agriculture to Cuba's farming and food transformation

The relationship between agricultural production approaches and the food system

Although there had been no commitment to adopting an integral ecological production system, many individual elements of an ecological toolkit were being employed, and not only in terms of husbandry techniques but also of localising production-consumption linkages and providing more diverse and fresh produce availability. Further, Cuba's focus on maximising production quantities did not always conflict with sustainability objectives; with over 80% of agricultural land under permanent crops and pastures, so the remainder was forced under rotations and biological input use in order to increase the number of short-cycle food crops.

The steady increase in food production, and other gains in the food system, could be attributed to these but also to a whole raft of other factors: of switching to hardier and staple crops, of increasing farm efficiency through improved tenure and management arrangements, of recognising the contribution of smallholder production, of offering improved incentives, of more responsive research and extension support, and so on. In addition, and as with the case of popular rice production (described in section 11.3), the increase in self-provisioning and localised supply channels made it more difficult to assess on a macro level the details of the relationship between production and consumption, suffice to say that by enabling micro-level management, production and food supply issues were being resolved.

The main message drawn from this was that achieving food security was not so much dependent on a specific set of husbandry practices as on the political will to obtain food and ensure that it reached the population in an equitable manner. Cuba might be able to feed its people whether through more industrial or more ecological farming techniques. Yet farming techniques were important in that they did impact upon sustainability concerns, and in their relationship with wider supply issues. In this sense, the sustainability or optimisation of domestic food supply could be counted as a more important concern for agricultural production than the maximisation of yields, in the context of food security.

Emerging knowledge on the benefits of ecological production approaches

Even though promotion of an ecological production system was not mainstream, interviews throughout the production and support sector, and results of research undertaken on its performance over the decade, highlighted the benefits of existing ecological production techniques as well as suggesting a huge and underexploited potential for their expansion.

Farmers' empirically-based knowledge

The farmers interviewed were clearly aware of the benefits of decreases in agrochemical use, on their own health as well as that of the soil, livestock and the natural environment, and in terms of managing pests and diseases. Immediately after the crisis, during the early to mid 1990s, farmers had noticed changes on their farms: most had seen a rise in pest and disease numbers. A few understood that the ecological balance would restore itself, and several farmers noted that it had taken five years, from 1993 to 1997, for the first visible improvements in wildlife and natural systems to occur. In the absence of chemical fertilisers to maintain a mantle of fertility, the extent of soil degradation in the east of the country due to earlier unsustainable practices, had become more apparent. Yet soil fertility was shown to increase where proactive ecological measures were taken. Farmers also exhibited a natural ability to innovate and develop their own ecological solutions, and examples of this included fine-tuning of planting and harvesting dates to avoid pest attack, and intercropping with drought-resistant species to ensure food supply during climate failures.

Farmers generally agreed that many, if not all, of their production lines could perform under ecological management systems, as long as there were no external disruptions such as heavy pest attack, and as long as there was ready access to organic inputs. In their view, ecological production was technically feasible. As an example, Box 11.1 summarises the opinions of farmers about the potential for ecological production of bananas.[292] Almost all farmers agreed that ecological techniques could deliver good yields. Again for the case of banana, low- and zero-input production approaches could still achieve yields of 80 t/ha.[293]

Box 11.1. Farmers' opinions on the technical feasibility of ecological banana production

Across the three provinces studied, farmers felt that it was technically feasible to produce bananas ecologically and achieve good yields. The main condition for this was identified as the availability of alternative potassium sources such as ash. Strategies employed included crop rotation and incorporation of crop residues, use of oxen, minimum tillage, application of manure, compost and green manures, selection of resistant varieties, use of rains to disrupt pest lifecycles, biological insect control, maintaining clean rows, ensuring good soil preparation, planting at the waning of the moon, mulching with banana leaves, and using clean planting materials. One farmer on a CCS co-operative in Havana province explained "*I don't use any chemicals because I don't need any. I use 20t/ha of chicken manure and I have no pests – my bananas are resistant.*" Another, working on a UBPC in Holguin, further explained that "*The most important factors are attention and cleanliness.*" Although this UBPC did suffer from a major banana disease, black sigatoka, maintaining an ecological balance and healthy soil meant that losses rarely rose above 10% and the crop could still be cultivated.

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[292] Chemical fertiliser application for banana had dropped from 60,000t in 1989 to 7,000t in 1999.

[293] This may be explained by a technical evaluation of banana production by the FAO (2003) which identified reasons for yield increases in the face of lack of fertilisers and irrigation as being the improved varieties, better quality genetic material, and the use of organic materials.

Institutional scientific knowledge

A range of research findings was emerging which showed the potential of ecological agriculture. Some examples are shown in Box 11.2. Noteworthy is that these research projects would unlikely have developed had not the research sector been forced to reorient.

Evidence of the cost benefits of ecological approaches also emerged. The use of green manures was found to save $31 to $75 per hectare, depending on the crops and species used. Higher crop yields and reduced outgoings for synthetic fertilisers both contributed to this saving, which did not include the longer-term economic benefits of improved soil properties (Garcia, 1998). Intercropping showed to reduce total energy use and provide a better rate of economic return than monocropping (Quintero, 1999). The combined use of ecological approaches and appropriate crop varieties was found to maintain yield levels whilst reducing energy expenditure, therefore increasing farmers' margins (Ríos et al., 2001). In terms of dairy systems, milk production cost 4.3c/litre from zero-external-input systems, compared to 5.5c – 6c/litre from systems using purchased feedstuffs (Monzote et al., 2002). In mountainous regions, the benefits of soil improvements - constructing drainage bunds and using green manures – were calculated as $161/ha for maize production, and $3,985 for tobacco (Instituto de Suelos, 1998). The cottage-industry style production of biological pest and disease controls was over one hundred times cheaper than importing agrochemicals to do the same job, and the money stayed within the country (Maura, 1994).

Box 11.2. Examples of research findings arising as a result of the need to experiment with alternative approaches

- The highest number of mycorrhizal strains were found on campesino farms, not State or ex-State.
- The combining of two different bio-fertilisers could increase yields more than the use of one alone.
- Bio-pesticides did not leave significantly harmful residues in crops.
- Biological controls were more effective than chemicals for controlling certain pests.
- Incorporation of fast growing shade crops in a rotation acted as a weed suppressant (Paredes, 1999).
- The use of appropriate maize varieties under ecological conditions produced yields of 4.5 t/ha - equal to the State's high-input maize production plans.
- The multiple benefits of intercropping, for diversification, total productivity, efficiency of land use, pest and weed control (Perez & Vázquez, 2002; Casanova et al., 2002; Quintero, 1999).
- A new plough design – the multi-plough – avoided topsoil inversion and compaction, saved 40-50% petrol consumption, could be used with oxen, and resulted in productivity increases.
- Plants inoculated with *Rhizobium* were more resistant to both pests and drought.
- Substituting manure (20t/ha) or *cachaza* (sugarcane residue) (40t/ha) for the recommended dosage of mineral fertiliser increased maize yields by one-third, with *cachaza* outperforming manure (Pozo et al., 2000).
- Mixing slurry with zeolytes reduced environmental pollution.
- During conversion of farms to ecological, energy and labour efficiency increased over time, and total labour input decreased as the farm became established (Monzote et al., 2002).
- Integrated farms had higher levels of biodiversity. (*ibid*)

Source: field study unless otherwise referenced

Equally importantly, extensionists and researchers had started to learn from farmers and their practices. This learning included realisation of the crucial importance of traditional practices as the backbone for a resilient agriculture, recognition of farmers' capacity to innovate,[294] understanding that changes in husbandry practice required changing the mentality of the farmer, and recognition of the importance of farmer autonomy to enable spontaneous adaptation. More specifically, these

[294] One social geographer observed through her own field research that "*Farmers are practising new strategies, neither stemming from the research institutes nor from traditional knowledge, but new innovations such as intercropping with plantain, or planting early varieties because of the demand from the farmers' markets*". Similarly, Guillot Silva et al. (2000) document the emergence and existence of 'spontaneous' ecological agriculture, where producers have built up complex, integrated and profitable agro-ecosystems without external support.

professionals learned, for example, to avoid dependency on a small range of crop varieties and to develop natural control products for livestock disease.[295]

There was general agreement amongst the support sector of the detrimental impacts of the previous industrialised approach, and that high yields could be achieved without the use of agrochemicals. Yet compared to the farmers' general agreement on the feasibility of mainstreaming ecological agriculture, professionals in the support sector were more in favour of an integrated approach, mainly due to concerns over some specific insect pest, soil fertility problem or other scenario which had not yet been resolved scientifically. This was not the case for those professionals who had received training in agro-ecology; these individuals were able to draw from a wider range of relevant strategies and principles, and in practice were more noticeably involved in innovative work.

These results indicate the successes that have been achieved by those who attempted to work within the resource-restricted environment they found themselves in, developing innovative techniques and deepening their understanding of ecologically-based approaches. Although not mainstream, they suggest that upscaling of ecological practices is technically feasible and holds significant benefits for further sustainable improvement of food production in Cuba.

11.3 TRANSFORMATION OF THE FOOD SYSTEM: FROM DEPENDENCY TO INCREASED SECURITY

11.3.1 Cuba's response to the food crisis

The strategies put into place by the Cuban government to cope with the crisis are taken for granted from within the country, but from an outsider's perspective they provide a unique global example of different socio-political approach to improve food security.

11.3.2 The building blocks: human and social capital, and cohesive political will

Cuba's investment since the Revolution in its social infrastructure and human resource base paid dividends in addressing the crisis. Cuba had a high percentage of scientists and researchers, some of whom had already been working on alternative agricultural strategies such as of biological pest controls, a high level of national education with literacy running at 97%, adequate housing and health care facilities, strong national communication and information channels, as well as good transportation networks. In addition, a national nutritional monitoring programme had been in place since 1977, as well as a ration system to ensure a safety net for the poorest and equitable access to foods in short supply.

Moreover, it had a strong government committed to overcoming the crisis and maintaining its socialist principles. The immediate response of the Government was to introduce a mitigation strategy termed 'the Special Period in Times of Peace'. The government was able to mobilise broad support and co-operation between different Ministries and institutions. Agricultural, food distribution, economics and health institutions were obvious examples, but even the Armed Forces were called upon to help out. This political will extended from national, through provincial to municipal levels, and communication and hierarchical staffing structures were such that policy could be implemented nationwide, in the fastest possible manner.

At the same time, the State was able to mobilise civil society to provide grassroots support for initiatives. A number of Cuban non-governmental organisations strengthened their intention toward achieving food security (Nieto & Delgado, 2002).

[295] Spin-offs included the use of plant substances in petroleum-based industries such as cosmetics.

11.3.3 Strengthening of food action plans

Since 1977, Cuba had already established a programme, the Food and Nutrition Surveillance System (SISVAN), for monitoring the population's nutritional status. Considered the most advanced of its kind in Latin America, it had become an example of success for other countries. Each provincial centre of SISVAN, run by the Institute for Nutrition and Food Hygiene (INHA), regularly convened a multidisciplinary team to evaluate production forecasts, plan for shortfalls, and watch over micro-nutrient intake. The team also monitored the adequacy of social feeding and rations, and promoted nutritional education. Within this, an early warning system - *Alerta Accion* - identified the timing of interventions. By the end of the 1990s, the intention was to ensure a reserve of basic food supplies in each province, to safeguard against short-term emergencies, and to reinstate a national study on obesity. Education programmes were being planned to encourage consumption of fresh vegetables, the supply of which had increased because of urban agriculture, but the demand for which was lagging.

Cuba was able to draw on this resource to avert many of the worst elements of the crisis and put into place initial mitigation strategies for food security. For example, breast-feeding increased from 63% of young mothers in 1990 to 97% by 1994 due to promotional campaigns, and people were encouraged to consume vegetable-based protein foods such as soya (Felipe, 1995). In 1994, the Cuban government formalised a National Nutritional Action Plan. It's strategic objectives were to increase and diversify national food production, import those foods required to complement national production, and enrol people as activists in this action plan through promoting self-provisioning and raising food cultural awareness. It identified four official channels for distributing agricultural produce: the ration system, social feeding (e.g. to hospitals), industry and processing, and tourism.

This Plan was put together by a multi-sectoral ministerial committee. Provision was made for a dual monitoring of its implementation: with each sector establishing its own vertical and independent monitoring mechanism, and the Ministry of Economics establishing an overall monitoring mechanism and co-ordinating its execution (Republica de Cuba, 1994). Annual progress reports were circulated to all involved bodies, the State Executive Committee, the UN and other donors.

11.3.4 Ensuring food access: controlled distribution and social safety nets

The ration system had never entirely covered food needs, and in the 1980s its role had become much diminished because of the abundance of alternative sources of food. Yet it proved a vital structure for ensuring basic food access during the most critical years of the 1990s. The State – through Acopio - maintained purchase contracts with farmers to guarantee a basic supply of produce for the ration. Prices paid were relatively low, but Acopio would purchase surplus produce at double the price if more was required. Approximately 50-80% of production was channelled through the ration (Oliveros Blet et al., 1998; Rodríguez, 1998). Each person held a ration book, *la libreta*, valid at their local MINCIN ration stores: la *bodega* and *la placita*, where they also had access to other, less subsidised, food products. According to field interviews, the State was aiming to slowly eliminate the ration. As recently as 1996, 40-60% of food needs were supplied through the ration, but by 1999 this figure had dropped to approximately 10% (Nova, 1999; field sources). Nevertheless, many families were still dependent on it.

Meanwhile the State was encouraging alternative food sources for the population; markets with capped prices so that they remained affordable to lower-income households. These markets included the diversification at agricultural sales-points *Las Placitas*, and through the retail network (*commercio minorista*).

In addition, the Social Security System, established in 1979 and which included a component for the most vulnerable, by the end of the 1990s had provided over 1.5 million people (14% of the population) with special food services. At the same time, efforts were made to increase sources of income and thereby increase the purchasing power of the population. These efforts included self-employment, hard currency remittances from abroad,[296] State labour schemes, and the tourist industry.

11.3.5 The drive for self sufficiency at national, regional and local levels

Ensuring access to food was one over-riding priority; the other side of the equation was that of ensuring increases in production in a way that could reach the people under the circumstances.

Increasing the self-provisioning of farm co-operatives, institutions and households

All co-operatives and State farms set aside some land for group self-provisioning, which included livestock 'modules'. Food from this was sold to co-operative members at cost price. Whole co-operatives were encouraged to become self-provisioning and renounce the State ration. CPA farmers often also had individual home garden plots. CCS co-operatives, already highly self-sufficient, expanded their strategy to provide sufficient food for farm workers. This provided an extra incentive for the retention of labour (Deere et al., 1994). By the end of the decade, CCS co-operatives were approximately 90% self-sufficient, whilst the rate for UBPCs was between 65-90%. Work institutions had to take similar responsibility for feeding their staff. Even the MINAG headquarters in Havana had a small parcel plot for self-provisioning. Household self-provisioning developed through the growth of urban agriculture, which produced fresh food in close proximity to the population, therefore reducing transport costs as well as postharvest physical and nutritional losses.

Increasing self-provisioning at provincial level

Each Provincial Agricultural Delegation was charged with meeting local food demand with local supply as far as possible. The Ministries of Commercialisation, of Public Health, and of Domestic Trade formulated provincial production plans based on quantity and nutritional needs. The Ministry of Internal Demand then calculated how much of each crop would go to each destination, and in each municipality a department calculated food availability on a monthly basis. Acopio was responsible for sourcing produce to fill any provincial deficits.

The co-ordinated acceptance of the prioritisation of food security was clearly seen at provincial and municipal levels, where meeting the population's food needs took priority over commercial activities. Farmers were encouraged to renounce their State ration if they had become securely self-provisioning, and had to send a proportion of their produce to local schools and hospitals. Certain prioritised crops continued to have nationally-organised distribution, such as potatoes. It was generally accepted that complete provincial self-sufficiency was neither possible nor necessary, largely owing to the agro-climatic variations over the country.

The role of ecological production techniques

Official policy emerging toward the end of the 1990s corroborated the field evidence concerning the modest but continuing application of alternative, ecologically-based agricultural technologies as a substitute for agrochemical inputs. Specific elements of this approach included the replacement of pesticides and fungicides with biological control products, natural bacteria, botanical repellents, the conservation and management of natural enemies, crop rotation and intercropping, use of resistant varieties, and combining all this through IPM programmes. Organic soil amendments being promoted included the use of manure, compost, worm compost, sugarcane wastes, green manures and bio-fertilisers. Over 220 small laboratories and production centres were constructed nationwide for the production of biological control agents, biological pesticides and bio-fertilisers.

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[296] At November 2004, dollar circulation was prohibited and a 10% tax was imposed on their exchange in the country.

There was a push toward diversification, and especially through the increased interaction of crop with livestock production. Teams of oxen substituted for tractors and the knowledge and skills of older farmers were sought for the handling of these livestock as well as for other issues.

Training courses on these issues were run at all levels – for farmers, technical staff and administrators - in all areas of the country, and long distance diploma and postgraduate courses on ecological agriculture were developed. The uptake and the success of all these alternatives varied, however, and by the end of the decade, thorough quantitative evaluations remained scarce.

Enabling land access and encouraging urban-rural migration

Land was distributed, in perpetuity, to both campesino farmers interested in producing export cash crops, as well as half-acre plots to retired people and other family farmers for self-provisioning and local market purposes. The farms in the east of the country in particular noted an increase in the number of individual farmers, motivated by the possibility of legally obtaining land and being able to feed themselves and the wider population. By 1998, land rights had been given to 45,800 people, and particularly to professionals returning to family land and CCS co-operatives.

This policy of increasing access to land was also a factor that encouraged the growth in urban agriculture. The development of this sector has gained a great deal of international coverage (see Murphy, 1999; Weaver 1997). People from all professions took up this opportunity and, supported by the State, developed an intensive network of cultivated urban plots run explicitly along ecological principles. The emphasis on organic was partly by default: the lack of agrochemicals, but also because of concern that using chemicals in the urban environment would be harmful to human health. Use of chemicals was, on some types of production unit, by prescription only. In 1998, Havana alone had more than 26,000 urban gardens, producing 540,000 tons of fresh fruits and vegetables (Moskow, 1999).

Because of the reduced rural labour force, the initial strategy in rural areas was to organise agricultural work groups to undertake production activities. This was superseded by the provision of permanent housing and improved rural conditions. Between 1994 and 1997, 60,000 people had returned to the land. MINAG's 1999 document 'The Dignity of Farming Life' showed continued support for this process. Improvement in the living conditions of mountainous communities was given high priority through the Plan Turquino, and lower-income rural communities were targeted to grow cash crops.

From 1997 onwards, farm gate prices were steadily increased and, by the end of the decade, farming had become one of the highest paid professions in the country. Contract workers' wages tripled compared to the 1980s. By the end of the 1990s, the State dropped its policy of actively encouraging urban-rural migration; it was not longer needed.

Diversifying markets and food sources

Early on in the 1990s, the State started to develop alternative market options for the benefit of both producers and citizens and to ease transport and storage problems caused by lack of fuel and refrigeration facilities. It withdrew its guarantee of purchasing produce in excess of the agreed plan. Facilities to collect, process and distribute food products were concentrated in urban centres, and municipal markets opened to sell agricultural produce at capped prices direct from the producers. This avoidance of intermediaries, such as Acopio, was termed *tiro directo* (Enríquez, 1994) and was the first move to localise the production-distribution system as well as encouraging co-operatives to think and act as business enterprises. With the number of farms decreasing in size and increasing in number, it had been recognised that Acopio would be less able to cope.

To counter the continued growth of the black market, and continued food shortages, farmers' markets were established in 1994, which ran on the free-market principle of price control by supply and demand.[297] They were hugely successful in stimulating production, increasing efficiency and increasing access to fresh, local produce. All farmers were able to participate in these markets once they had met their agreed production plan with Acopio. Farmers showed their natural entrepreneurial capacity by responding to them overnight. To encourage food supply into the capital, a lower sales tax was imposed in Havana city, and prices were generally 20% higher than in the provinces.

By the end of the decade, five prices levels were available to farmers for their produce, either via Acopio or direct sales: the lowest price for social consumption (rations, schools etc), then for State food processing, then the capped prices of the agricultural markets such as *Las Placitas*, then the free-market price at the farmers' markets, and finally the highest price went for food destined for the dollar food market (both exports and the internal tourist market). The pervading collective perspective reflected in marketing attitudes. There was little complaint voiced at selling in the capped price markets and this was frequently preferable as the State would assist with logistical issues such as transport. Farmers also occasionally had to divert their surplus produce to regional shortfalls in the ration supply, for a much lower revenue.

Changes were made in prepared food outlets. Private individuals were permitted to sell prepared food through restaurants and street stands. Urban production could be marketed through on-farm shops, which were required to sell for 20% less than prices in the farmers' markets. By 2000, food prices had risen by up to 50%, and the market could support this, notwithstanding continual debate on food issues by civil society.

Farm re-organisation

During the most critical years of the 1990s, it had not escaped the Government's notice that the most resilient farmers, in terms of sustaining their own livelihoods and producing food surpluses, were the more independent campesino farmers, either on CCS co-operatives or as individuals (Deere, 1996; 1997). Therefore, there was a dramatic reorganisation and redistribution of State land toward a relatively smaller scale, co-operative model. In September 1993, a new type of non-State farm, Basic Units of Co-operative Production (UBPC), was established, taking over the majority of the old State farms. In 1992, 75% of cultivable land had been under State farms. By 1999, over 3,000 UBPCs had been created, reducing State-owned land to 34%. During this period there was also a strengthening - through increased support - for other existing State farms and for CCS co-operative structures.

The other major reform took place on-farm. Within a co-operative, an individual or work group could be given responsibility over a specific plot, manageable at a human-scale. This system was called 'linking man to the land' (*vinculacion del hombre a la tierra*) and was common on UBPC and CPA co-operatives. If yield performance was over the average and production plans exceeded, the worker(s) would receive a percentage bonus from sales, and if performance was under-average, deductions could be made from the wage packet.[298]

11.3.6 Investment in research, extension and training

Research programmes were re-oriented to become more applied, and owing to fuel shortages they tended to address more local problems. Extension services were expanded, with each farm co-operative having a resident facilitator. Training in more efficient farm management, including ecological agriculture, was run at all levels, for farmers, technical staff and farm administrators, including through long-distance and postgraduate courses. Although training a whole sector was a

[297] Although the State maintained a degree of control through a 10% sales tax proportional to volume sold. Later on, the State started to analyse produce on a monthly basis, and if particular crop prices were rising too high they would flood the other, capped markets with the same crop at a much lower price, to bring down the price in the farmers' market.

[298] Rosset (1996) argues that in an ecological system, it is this reconnection of farm workers with the land, and the ensuing micro-management, which raises yields, and not simply the use of biological inputs.

slow process, and many farmers had not yet received any training, yet the staff involved in this development stressed that State financial support had been crucial to the country’s survival during the crisis. Also crucial had been the ANAP training school, which had maintained courses for the campesino sector.

11.3.7 Increased post-harvest efficiency

As soon as possible after the crisis, a ‘parallel market’ of nationally processed foodstuffs was reinstated. Emphasis was placed on increasing the number of small processing plants to conserve fresh produce, and, the corresponding organisation of an adequate labour force to meet harvesting demands. Although prices were relatively high, this stimulated the growth of both industrial and agricultural production, and enabled access to higher quality products. Several major imported food ingredients were locally-substituted.

Acopio was charged with covering seasonal shortfalls that had previously been filled by imported produce. This was encouraged through early- and late-season production. In addition, and owing to the increase in farm numbers, Acopio had to increase the complexity and efficiency of its transport network, and to transport from farms direct to sales points to avoid costly storage. Joint collection points were arranged so that lorries did not have to visit each farm, and storage losses were reduced by 10%. The increase in market channels and pressures on fuel usage led to a huge decentralisation of the food distribution system. Trains were found to be more efficient for the longer distance transportation of non-perishable produce, and road transport was improved through the standardisation of schedules and improving information flows between storehouses and suppliers.

Institutions themselves also became more efficient. Acopio, previously a highly centralised collection and distribution organisation, was merged, in 1993, with the Mixed Crop Enterprise to form a marketing, production and service provision entity, in order to increase efficiency and support the formation of the UBPCs. In 2001, the tourist food delivery organisation, Frutas Selectas, which had previously run at a loss under Acopio, was transferred to the Citrus Corporation that had a long history of successful export production.

11.3.8 Autonomy over food imports, exports and international partnerships

Both despite and because of the large decline in overseas earnings, the State prioritised the purchasing of necessary foodstuffs out of its depleted foreign budget. In 2000, $700 million was being spent on food imports (Sinclair & Thompson, 2001); mainly grains, milk powder and cooking oil. Humanitarian aid also played a vital role throughout the decade: in 1995, $17 million of food aid was received, and by the late 1990s total humanitarian aid (including medical) was valued at $1 billion (Garfield, 1999). Such aid was nevertheless problematic as certain foreign donors attempted to work only with non-governmental organisations, a strategy rather inappropriate for a one-party country where most organisations were *de facto* State-run.

Decisions over whether to source specific foodstuffs domestically or internationally were taken by the Ministry of Economics and sought to balance pragmatism with political considerations. For example, onions and garlic were imported because of their high costs of national production and storage. Rice supplies for the ration were also imported at subsidised rates from China, because national production was met largely by small, independent rice producers whose output was more difficult to guarantee, measure and manage. Yet although potato production was costly, huge effort was made for national production, under high-input conditions, because it was a favourite of the people.

Generally, exports were rarely allowed unless the country was nearing self-sufficiency in that particular produce. Bananas were a case in point, although field interviews suggested that a further limitation to export might be the poor organisation of the industry which did not have the know-how, or was unable, to meet international quality standards. The internal tourist market was also considered an “export” market, as it brought in a dollar revenue. Producers could not sell direct but through the State Agricultural Enterprise to which they were linked, receiving a small percentage of their return in dollars.

The State also determined the terms of international investment, which had to contribute to developing at least two of the following three conditions: new technologies, new markets or tourist avenues, and new financial capital and resources. No investment was permitted in education, public health, or the armed forces, and nor was permission granted for privatisation.

11.3.9 Resulting increases in levels of food production

Given that a rise in production only started to show in 1995-97, it is too early to make conclusive statements on the achievements of these strategies based on the field evidence obtained at the end of the decade. Food aid and subsidised imports were still necessary. Yet national production had been turned around and was steadily increasing.

Initially, production of rice, and roots and tubers was prioritised. Root and tuber production had dropped only slightly during the crisis and it was relatively easy to quickly boost production of these rustic, small-farmer crops: production doubled between 1994 in 1999 (ONE, 2001). Rice production was increased through the development of a Popular Rice Programme. This entailed municipal-level support through enabling preferential access to land and higher market prices. It also introduced appropriate technologies, including rain-fed methods, use of nitrogen-fixing plants, animal traction, and low-tech, local post-harvest processing. Through this approach, small-scale rice production grew to supply an estimated 50% of national demand, yet because of the localised production-consumption lines, actual production figures for this Popular Programme were difficult to measure (Socorro et al., 2002).

Production of horticultural vegetables, pulses, citrus fruits and milk started to show signs of an upturn slightly later, around 1995. Around this date, the State started to acknowledge the significant contribution of informal producers on home gardens and self-provisioning plots. There was a far slower growth in the production of livestock products, which had previously been dependent on imported feed that had proved more difficult to substitute. Overall, production of the major staple crops rose by 31% between 1993 and 1996, and by 42% between 1993 and 1999 (based on statistics from ONE, 2001). Yet compared to these percentages, feedback from farmers and rural dwellers during the field interviews told of experiences of far greater production increases than national statistics show, indicating that the early and most direct beneficiaries of the drive for self sufficiency were the farmers themselves.

Overall calorific availability rose from a variously estimated 1,670-2,310 kcal/day in 1994, to 2200-2,610 kcal/day by 1999-2001. Because of the more localised food system it had become more difficult to quantify production or consumption, and official figures for the latter years were likely to be underestimates (although they were likely to be overestimates for the former years). Environmental variables played a role in influencing these figures; 1996 was a year of record yields (SEDAGRI, 1998),[299] whilst 1998 witnessed drought and hurricanes that adversely affected yields (MINCIN, 2001).

11.3.10 Regaining sovereignty over the food system

So production and yields of basic staples was gradually increasing, the food system pattern was changing, and most importantly, food availability was being restored to acceptable levels. This was remarkable given that the total State subsidy to the agricultural sector had, by necessity, fallen dramatically, estimates of drops between 50-90% between 1993 and 1996 onward. Castro (1996) attributed Cuba's achievements in meeting food security needs to political prioritisation and centralised planning: "*We can proudly say that despite the difficult circumstances, we were able to ensure equal access opportunities for the entire population to the available food, health and education*."

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[299] This supported by farmer interviews which highlighted awareness of a natural 4-yearly cycle of yield fluctuation.

The move toward a less chemical-dependent, ecologically-based agriculture played a role in increasing production, but was one of several measures. Ecological production techniques were only partially adopted and co-existed with industrialised approaches. What this analysis shows is that other measures were required to ensure that increased food production translated into adequate access to food. One of the most important of these in terms of nationwide food security was the ability, when necessary, for the co-ordinated movement of foodstuffs around the country. Food supplies could be unstable for a number of reasons, yet the planned food collection and distribution system was able to collect rural surpluses and transport these to urban areas, and to ensure the transportation of imported staple foods to remote rural areas. Another notable feature of this transformation was that notwithstanding the centralised planning, the State gave up much direct control over management of food production and distribution and encouraged initiative and activity at the grassroots level. The State moved, at least partially, from a role of provider to facilitator, and the outcome was that the population was fed. Examples of this were the success of the Popular Rice Programme, and the increased support for campesino production. Quantification and control was accepted as less important than feeding the population, and if grassroots initiatives were properly supported, then local and regional needs would somehow be met. It can be argued that other aspects associated with ecological food systems – of local production-consumption links, smaller-scale production, stable land tenure, and farmer autonomy, had also increased. Production and food distribution were moving toward a relatively localised pattern with the emerging realisation that the 'one size fits all' scheme of industrialised approaches had not delivered.

The example of Cuba shows what can be achieved with political will and, importantly, enacting this will both horizontally and vertically. Cuba's achievements in food security and sovereignty had come about by using its available resources and making decisions about what foods to produce domestically, and what and when to import and export. This example is in contrast to the experience of many low- and middle-income countries which still struggle with problems of hunger. Other politico-economic systems may not be immediately sympathetic with the measures that Cuba had taken to ensure equity, such as the use of rations or of prioritising domestic markets, yet Cuba's experience has shown them to be viable and an arguably necessary means of assuring access to food for all, at least during periods of vulnerability.

At the end of the decade, Cuba held more sovereignty over its food system than at any time in its recent history, and this system showed exceptional resilience throughout the 1990s. This was mainly due to the State taking full responsibility for feeding its people in an equitable manner, but a second factor was the State's capacity for rapid learning and change. This included a recent move towards a more market-led approach, and measures to wean the population off the ration system while ensuring that this did not impact on the poorest. All the while, Cuba was *"perfecting the socialist system, while balancing the introduction of new market mechanisms with sustained planning via foresight and anticipation of needs."* (Nieto & Delgado, 2002 p. 56).

11.3.11 Quality as an emerging challenge to food security

Despite sustained increases in production and food availability, the time period was too short to see the end of the substantial deficit in supply or of the continued dependency on imported foodstuffs. The UBPC co-operatives confronted several teething problems in their development, and co-operatives in general lacked training in the new types of marketing channels on offer. The general lack of fossil fuel continued to hinder the development of the whole sector, from lack of storage facilities to transport for on-farm research.

Notwithstanding the level of equitable access to food, disparities were widening, not least because of the ability of some to access dollar remittances from abroad. Meanwhile, an increasing inequality emerged between the quality of food sold to tourists and to Cubans: more care was taken over the quantities of agrochemicals being used on tourist foodstuffs, based on awareness that the tourist enjoyed 'healthy products' (*productos sanos)*. Similarly, there were plans for genetically modified crops to be grown for the Cuban population but not for tourist sales.

Although nutritionists were aware of the link between agriculture and nutrition, those in the agricultural sector were less so, and the push to increase output had overridden quality and nutritional considerations. During the crisis, "*It was more important to feed the people than to eliminate contaminants.*". The scarcity of agrochemicals limited research on their toxicity, and the privatisation of State farms made it more difficult to monitor and control agrochemical usage. High pesticide residue levels continued to be found in certain prioritised crops (eg. Dieksmeirs, 1995; Vega Bolanos et al., 1997). Shortfalls in the nutritional adequacy of diets continue to be dealt with through supplements rather than by addressing more fundamental issues such as soil health or crop nutrient supply.

Interviews from the fieldwork revealed a common perception, especially amongst farm workers and urban householders, of continued food insecurity. Yet in reality most people had access to, and consumed sufficient, if not excessive, quantities of carbohydrates, sugars and fats. This insecurity was more understandable for those not living on farms, where sources and supplies of food could be precarious, and where the daily distribution of the ration meant that households were unable to build up food reserves. The number of undernourished people in Cuba continued to increase slightly up to the end of the decade, even though the growth rate was declining and was far lower than at the start of the decade. The lingering feeling of food insecurity by the population, coupled with the continued preference for a traditional diet heavy in carbohydrates, sugars and fats meant that western diseases were still prevalent and obesity was on the increase; this undermined the advances made in making healthy, fresh produce more widely available. Fluctuations in overweight and obesity levels mirrored dietary trends, rising to 36.5% as food availability continued to increase at the end of the decade. Between 1999-2001, sugar and its products comprised 21% of total dietary energy needs (FAO, 2004). Fresh vegetables and wholegrain foods, although more widely available, were not popular food items. Interviews suggested little knowledge of dietary nutrition coupled with a preference for traditional diets (despite the Government's more recent attempts to address this).

11.4 CUBAN PERSPECTIVES ON SCALING-UP ECOLOGICAL AGRICULTURE

11.4.1 Driving forces behind current levels of agricultural sustainability

The driving forces for the increase in ecological approaches in Cuba over the 1990s were the same that united and directed husbandry nationwide: the lack of agrochemicals and petrol, and the drive for self-sufficiency. The crisis of 1989, together with sanctions and political isolation, appeared to have instilled the need for national independency from externalities, including of inputs. At regional and local levels too, independency from external inputs played a motivating role, with bio-inputs produced in-country and cheaper, and on-farm substitutes being more ready, more economical and more secure.

On the other hand, there has never been an explicit or joined-up policy on ecological agriculture. Therefore, even though certain strong components of an ecological system were present, such as the CREEs, a social organic movement (ACAO/GAO), demonstration agro-ecological farms, ecological training courses, urban *organoponicos*, and so on, there was no policy gel to hold all this together nor to prioritise this over other strategies. In this sense, and notwithstanding the efforts of the Cuban organic movement, any semblance of a widespread ecological system was in place not through cohesive policy but through a shared lack of other options.

The Cuban experience highlights that a scarcity of agrochemicals and fuel does not necessarily lead to a widespread ecological production strategy. Further proactive mechanisms would need to be in place, and not least a concerted policy backing. Without this, the existing ecological components of the agricultural system may likely remain fragmented and be unable to develop the synergies that could unfold through a more coherent approach.

11.4.2 Interpretations of ecological agriculture and its future in Cuba

Although specific individuals had been working with ecological principles since the 1970s and '80s, ecological agriculture emerged in Cuba as part of a broader response to the food security crisis, symbolised by the formation of ACAO in 1993 (see Box 11.3). Because of this, the focus of ecological efforts in Cuba were not on commercialisation nor on the strict avoidance of agrochemicals, but rather on systems improvements such as through encouraging crop-livestock interactions and economising on energy, fuel and land efficiency. Through interviews for this study, the Cuban interpretation of ecological agriculture emerged as being both cutting-edge and pragmatic, demonstrating an understanding of ecological science, holism, and social and economic considerations. Particularly noticeable was the routine use of the concept of equilibrium[300].

This Cuban interpretation could be said to conform more closely with the Latin American agro-ecological school of thought rather than the European certified organic model.[301] In contrast, the term 'organic agriculture' held certain negative connotations, as it was varyingly perceived as being based on bio-inputs, expensive because of certification costs, and unaffordable to the population. Some felt that Cuba exceeded the expectations of organic farming in the west: *"In fact Cuba talks about ecological agriculture which is one step beyond organic agriculture – it has to show sufficient yields to solve the food crisis…*".

Box 11.3. The Cuban organic movement (ACAO) and its achievements up to 1999

The Cuban Association for Organic Agriculture – ACAO – was founded in 1993. Unlike grassroots organic movements in other countries it was not farmer-led, but created as a response to the crisis by ecologically-minded individuals involved in agricultural research and training. Through the decade, the movement grew to approximately 800 members nationwide, including farmers, and was instrumental in many pioneering initiatives. In 1996, it received the Sustainable Agriculture and Rural Development (SARD) Prize for its work and, in 1999, the prestigious Right Livelihood Award that it accepted on behalf of the nation. Its' achievements included:

- Awareness raising and information diffusion through workshops, field days and other events.
- Organising mobile organic libraries around the country.
- Thrice annual publication of a national magazine "*Agricultura Organica.*"
- Initiation of a research and demonstration project "Agro-ecological Lighthouses".
- Organisation of three national organic conferences.
- Assistance with setting up higher education programmes on agro-ecology.
- Organisation of training of Cuban professionals by foreign certification bodies.
- Development of strong international linkages including with the international organic movement.
- Establishment of provincial support groups for ecological agriculture.
- Initiation of the development of national organic standards.
- Promotion of farmer-to-farmer agro-ecological extension methodology.

During the fieldwork, attempts were made to gauge perceptions on the future of ecological farming in Cuba. The most common perception was that Cuba would return to using more agrochemicals and other intensive production methods, but would not return to the levels of the 1980s now that viable alternatives had been proven. Yet within this, and although as a whole the agricultural sector was currently positioned at the input-substitution stage of an ecological transition, many interview responses envisaged a transformation to reach a stage much further: one of achieving and maintaining an ecological balance, of high yields, combined with pragmatic and sparing agrochemical use but with a focus on local resource recycling. A large minority also felt that, given the positive increases in both yields and knowledge of alternatives, ecological production had every

[300] One researcher used this concept to predict the likely future path of agricultural practice in Cuba "*It is the effects of equilibrium which will prevent us from returning to the practices of the 1980s.*"

[301] The former is described by Altieri (1995): "*Agro-ecology provides the basic principles to study, design and manage alternative agricultural ecosystems. It takes into account both the ecological and environmental dimension, and the economic, social and cultural aspects of the crisis of modern agriculture.*" (cited in Monzote et al., 2002, p. 208).

possibility of being mainstreamed, and this was supported by farmers' acknowledgement of its technical feasibility.

The following section summarises the perspectives and opinions of farmers, and other agricultural practitioners such as researchers, extensionists and policy makers, on the support that would be required to increase and even mainstream ecological agriculture. The perspectives of farmers are of particular relevance, given that the majority of farmland was now in private hands and production decision-making was *de facto* more decentralised.

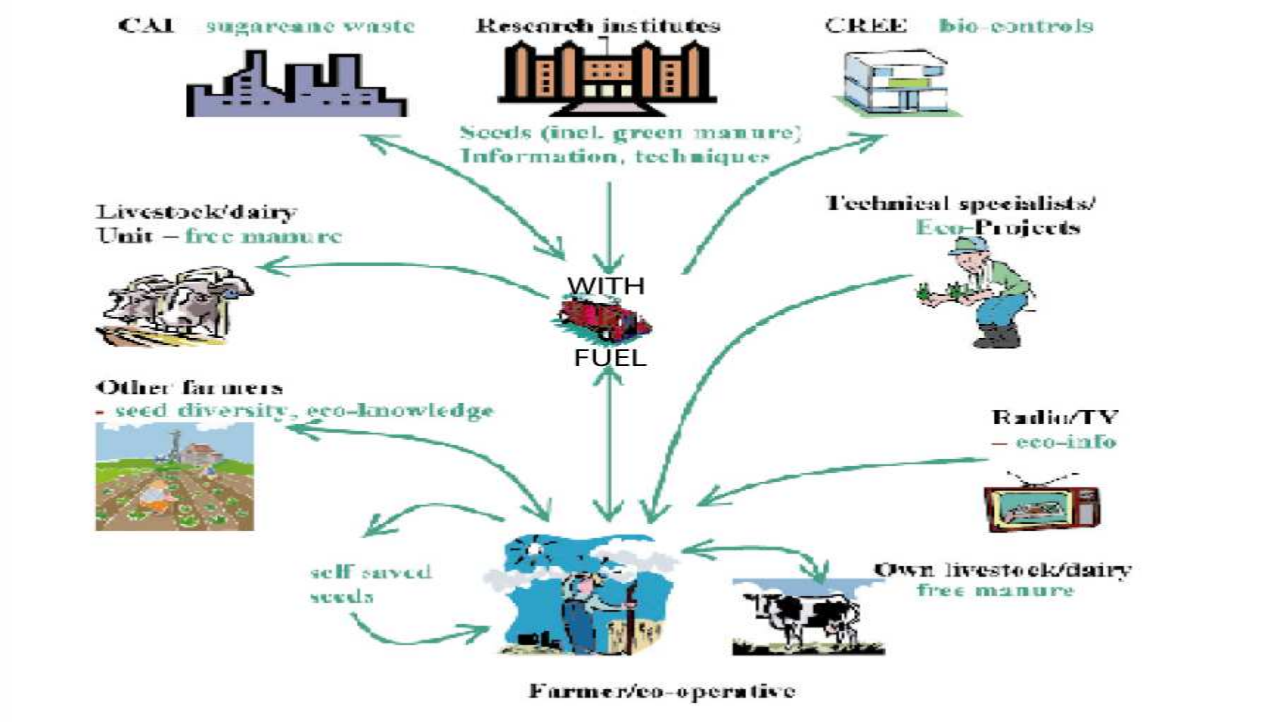
11.4.3 Opportunities for scaling-up ecological production in Cuba

Factors affecting a scaling-up

The previous sections recounted a number of positive responses from, and experiences of, farmers and support professionals who had adapted, or experimented with, ecological approaches. Funes (2002) identifies a number of factors that favour its development in Cuba. These included: the high number of qualified personnel, widespread experience in community approaches, supportive administrative and social structures, government-sponsored publicity campaigns in the interests of the people, favourable research findings, and the presence of organisations dedicated to the creation of an ecological culture.

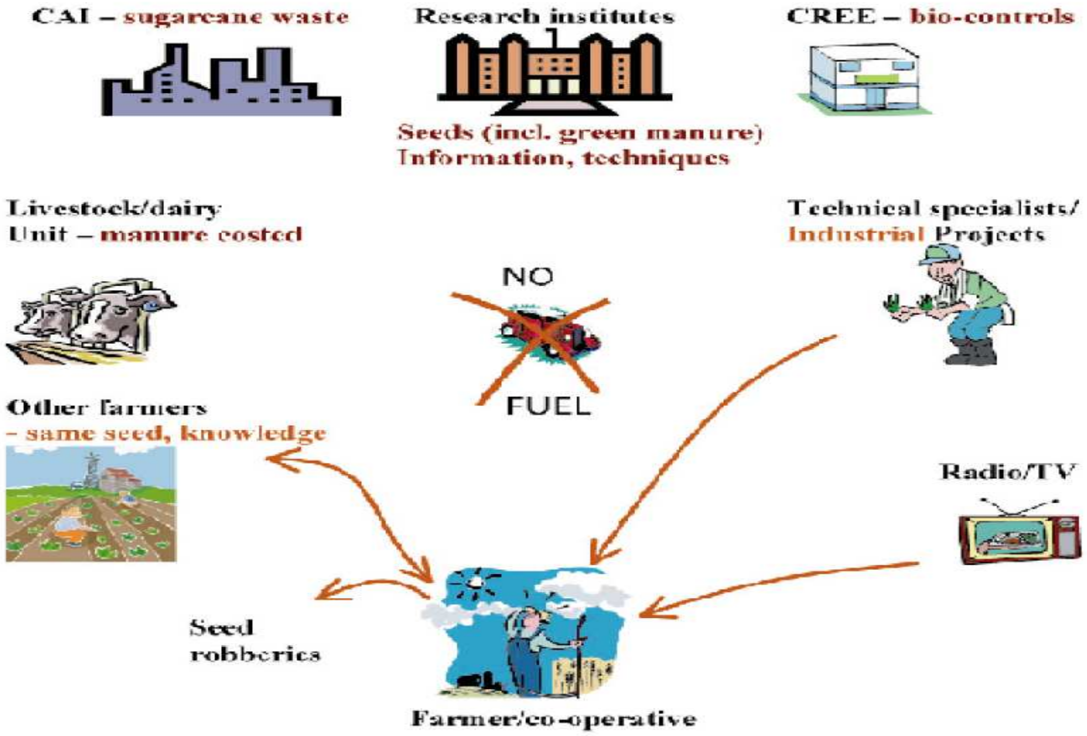
Based on the field interviews and farm visits, farm assets were conducive to more widespread ecological production, with neither land nor labour offering serious constraints (though there were regional differences in this respect). Any increase in labour demand was seen positively as it meant being able to employ more people, especially extended family members. Physical assets, such as machinery, were in poor condition and there was a lack of written technical information, yet farmers did not generally see these factors as major restrictions to any type of production, although this varied according to the type of farm. The improved economic status of farmers overrode all these considerations.

Figure 11.2. Compound diagram of the best-case scenario in terms of support for farmers desiring to follow an ecological approach, on CCS and UBPC co-operatives in Havana, Cienfuegos and Holguin Provinces



In order for ecological up-scaling to occur, farmers clearly identified their two major constraints as being a lack of organic inputs and of knowledge. Within this, farmers were subject to various factors that influenced the chances of them adopting an ecological production approach. If they were motivated toward ecological production, specific external conditions worked either for or against this[302]. These forces, as affecting the CCS and UBPC co-operatives in Havana, Cienfuegos and Holguin Provinces, are summarised in Figures 11.2 and 11.3.

Figure 11.3. Compound diagram of the worst-case scenario in terms of support for farmers desiring to follow an ecological approach, on CCS and UBPC co-operatives in Havana, Cienfuegos and Holguin Provinces



A more detailed analysis categorises the opportunities and related challenges of up-scaling into three types: those relating to knowledge, those relating to resource and technology access, and those relating to political and social factors. These are discussed in the following sections.

11.4.4 Developing ecological knowledge systems

Increasing ecological literacy

The extent of ecological innovation and experimentation was dependent on the presence and availability of relevant knowledge. Almost all farmers interviewed identified the lack of knowledge and training as one of the main limitations to the increased use of ecological approaches. The lowest levels of knowledge, amongst both farmers and the institutional support sector, were on alternative water conservation techniques, on product quality issues, and on the holistic and philosophical principles of ecology. Specific training needs cited by farmers included on dietary and health requirements of draught oxen, demonstration on appropriate soil fertility techniques, on seed exchange and seed quality control, and on the correct use of biological pest control products.

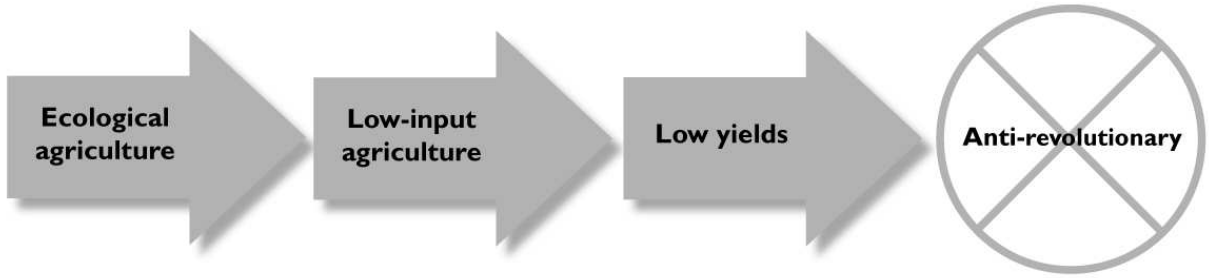
Ecological knowledge substituted heavily for inputs and technologies, and this strategy – of increasing knowledge on ecological management strategies - may assist farmers who were

[302] Decision making on CCS co-operatives was largely taken by each individual member, whereas on CPA and UBPC co-operatives there was a stronger management committee and collective production. Several CPA and UBPC farmers pointed out that farming ecologically was down to the political will of the co-operative.

encountering input supply problems. Addressing problems of water management from an ecological perspective, for example, might win over many farmers who viewed petrol shortages as the major constraint on productivity. Similarly, increased training on the use of organic inputs could dispel some of the concerns surrounding the efficacy of these pest control products, as well as concerns of disease-spread through the use of organic matter and compost coming from off-farm. Such concerns were currently limiting the use of these inputs.

Overall, increasing ecological literacy would also serve to demystify and avoid the common misperceptions surrounding ecological agriculture. Organic or ecological agriculture was directly equated with low-input agriculture, or a wealth-deficient situation. In fact it was also referred to as 'low-income' agriculture. Agrochemicals, meanwhile, were associated with more affluent times. The logical train of thought from this was to avoid a production system that yielded less, and especially given the Government policy to maximise yields. Figure 11.4 shows the extent to which this train of thought could be taken, based on a logic which was increasingly showing to be inaccurate and especially over the medium to long term.

Figure 11.4. The train of thought leading to hesitance over ecological agriculture



For farmers, equating ecological agriculture with a lack of agrochemicals, and therefore a deficiency, gave rise to several concerns. These included: fears about increases in pests and disease and decreases in yields; a drop in product quality (associated with product size); increased workloads given the lack of fuel; risk taking; techniques inappropriate for larger farms, and the irreparable extent of soil degradation. Because of farmers' arguably inaccurate definition of ecological agriculture, so its potential to enrich and regenerate the natural resource base was obscured.

Similarly in the research sector, ecological agriculture was associated with low yields, self-provisioning, and a general poverty situation. Low-input strategies frequently entailed not only zero chemicals but also zero irrigation or mechanisation and were directed at marginal lands.[303] Yet also, and since organic agriculture equated with prohibitions, there was the opinion that "*both organic agriculture and green revolution agriculture are akin to agribusiness*."

Yet during the three hundred-plus interviews undertaken, a huge diversity of opinions emerged about the actual performance of ecological husbandry practices, based on personal experience, on research results, or on secondary evidence and heresay. For example, some felt that intercropping resulted in lower yields and had a negative effect on harvest, whilst others were clear that it provided a more regular income and made more efficient use of the land and of farmers' time. Similarly, some felt State seed to be better quality, whilst others trusted farmers' self-saved seed for guaranteed quality and economy.

A number of variables might account for these seemingly contradictory responses. They may be due to differing: economic situations and needs (of farmers); value interpretations (for example, of what is meant by 'good yields' or 'quality'); levels of ecological literacy; personal experiences;

[303] Ecologically-oriented projects in Cuba tended to select lower-potential farmers, and this would obviously affect project performance over time. As one extension officer explained "*We will select the producers who have received less benefits and who have less potential, to show that if these farmers can achieve success than anyone can*."

worldviews, or combinations of all the above. Specifically within the support sector, there was an apparent underestimation of the real capacity and ability of farmers to successfully manage their own resources. Although more research would be required to identify factors influencing the non-uptake of ecological concepts, from the field studies it appears that individual education, experience and personality were important parts of the equation. A clear correlation emerged between those farmers and support personnel who had been exposed to training on ecological agriculture, and their awareness of alternative options and strategies, their ability to use these to innovate, and their lesser likelihood of envisaging dependency on chemical inputs. Based on these factors, some tangible changes which could be made to increase ecological understanding emerged as follows:

- Substituting the term ‘low input’ or ‘resource poor’ with ‘appropriate’.
- Diffusing validated research results that support ecological agriculture. These may also require multiplying and scaling-up for further verification. This would provide a better basis for countering doubts and concerns about the suitability of mainstreaming ecological approaches.
- Recognising the potential capacity and capabilities of farmers and/or nature.
- Increasing understanding of the scientific basis for, or achievements of, ecological agriculture, and on the epistemological differences to industrialised approaches. This would avoid the current comparing of ecological agriculture management strategies and indicators to industrialised, rather than seeing the former as having a different *modus operandi*, as well address the current tendency to hold unsubstantiated views on either ecological or industrialised agriculture.
- Allowing for open debate on the interpretation of certain concepts such as product quality, in relation to their utility in the Cuban food situation.
- Education on the application of industrialised techniques and approaches in certain, appropriate times and places, such as in the face of a rare pest plague.

Supporting innovation and experimentation

Knowledge gaps would need to be filled by new research, and gaps identified through interviews for this study were for: non-chemical weed management, polycultures, water conservation, alternative energy, specific pests and diseases, appropriate diversification strategies, allelopathy, minimum tillage, and planting dates. Farmers also requested more strategic development projects to encourage a move beyond the use of inputs of any kind, to encourage both diversification and regional specialisation, and to develop alternative energy sources on-farm. Generating knowledge in-country was particularly important given the difficulties in its access from abroad, and recovering and incorporating traditional knowledge into the research process was suggested as being critical. Yet there was also the issue of appropriateness, and farmers would have to test for themselves whether, for example, it was appropriate to use oxen on compacted or dry soils, whether they could provide sufficient care and attention for these animals, or whether certain biological control products could be used when the weather was unfavourable.

Co-operative members identified two crucial factors to stimulate learning and innovation as being the presence of traditional knowledge within the work team, and the practice of ‘linking man to the land’- that the team be linked to a specific plot of land rather than be continually rotated around the farm as was the old system. Another way to support innovation was to provide a supportive environment for innovators. This would involve providing more scope for such within the planned production agreements. Further, and during field interviews, it was noticeable that the most successful and innovative efforts and projects were driven at least to start with by individual ‘pioneers’ who held clear-vision on appropriate ecological approaches to deal with a specific situation. These efforts and projects were continually held up as examples of success for others to follow. Such ‘ecological pioneers’ were found on farm, in research institutes, or as founders of whole organisations. Box 11.4 provides examples, and Box 11.3 has already described the Cuban organic movement which would also be classified as an ecological pioneer. Because by their nature they initially have to go against mainstream thought, a challenge would be to recognise and support these individuals and groups in their work, if ecological innovation is to be encouraged.

Box 11.4 Example of innovative ecological pioneers

Farmer pioneers

Specific farmers, working either alone or on co-operatives throughout the country, stood out as grassroots driving forces behind the spread and success of ecological agriculture on-farm and within regions. Some were recognised and used as demonstration farmers by ANAP and other groups, but many were not. One such 'farmer pioneer', for example, was instrumental in introducing intercropping techniques throughout the 479 ha co-operative on which he worked, long before the arrival of any government programme on such. This farmer demonstrated far more than simply a good technical understanding of ecological practices. There was an underlying sense-making, a process of observation and comparison, and an avoidance of accepting mainstream ideas if they did not fit with the surrounding reality of the situation.

Institutional pioneers

The promotion of participatory and other alternative development approaches rested on the presence of specific individuals. All had to take personal initiative and risk, and make substantial personal effort, to get such projects off the ground in the face of mainstream mandates and with few financial resources. For example, the first formal attempt since the crisis to encourage the development of alternatives to counter the under-performing State seed system was not instigated from within the seed supply system itself, but instead by a small group of pioneering researchers within the Ministry of Higher Education. One researcher in particular, back in 1989-90, saw that under such resource-restricted conditions it would be more efficient and effective to work with farmers and use their knowledge to develop more appropriate crop varieties, than to attempt to continue with conventional plant breeding protocol. Therefore rather than accept the situation, this research group changed their methodological strategy to undertake research relevant to the actual situation. These efforts have since grown to become an internationally-funded, interdisciplinary, participatory plant breeding programme which is leading the way for similar efforts not only in other regions of Cuba but also within Central America.

Developing appropriate methodologies

In Cuba, many of the pathways for dissemination of ecological techniques were the same as those for industrialised agriculture, and there was evidence that the reductionist and mono-disciplinary research approach was still effective to a certain degree. The top-down development and technology transfer of biological inputs provided a good example of this. However, a few examples were emerging where methodologies were starting to change. These early attempts to introduce and test out such methodologies resulted in some interesting insights and challenges by the projects themselves. These are described in Box 11.5 and provide useful experiences for their mainstreaming under the direction of the Science and Technology Department of MINAG.

Box 11.5. Challenges encountered to the introduction of participatory research and extension approaches

- The researcher requires re-educating prior to seeing any change in the field.
- Trained individuals encounter challenges in trying to explain and apply their new knowledge with untrained colleagues.
- Researchers remain distrusted by farmers, because of previous experiences.
- Participation is easier to introduce into the less hierarchical co-operative structures such as the CCSs.
- New approaches may threaten the establishment – both older individuals and institutions.
- Playing the role of facilitator makes it more difficult to take direct credit for successes and therefore to justify one's work.
- With participatory approaches comes the need to focus away from purely yield indicators.
- Farmers are less willing to experiment if they have to meet State production plans.
- Agricultural researchers do not understand social science.

Especially in terms of plant breeding, support professionals interviewed for this study also suggested increasing participatory breeding strategies in order for researchers to learn from the knowledge and experiences of farmers in terms of plant selection. Another suggestion was to increase lesson learning from the successful urban agricultural support system.

11.4.5 Increasing availability of and access to appropriate resources and technology

The second major consideration for ecological upscaling, prioritised by almost all farmers, was the need for increased access to organic inputs, such as biological pest controls and manure. This corresponds with the conjecture that Cuban agriculture was in the input-substitution phase of transition, and was also supported by the agricultural professionals interviewed who identified the need for a stronger dissemination of ecological techniques and especially for the rehabilitation of degraded soils. This was particularly important with the increasing re-availability of agrochemicals which were considered to be easier and faster acting albeit more expensive. In fact it was not only access but also availability, price and delivery which were of concern to farmers. Specific inputs, resources and technologies which currently posed challenges to farmers were as follows:

- timely availability of biological pest and disease control inputs,
- green manure seeds,
- appropriate crop varieties and good quality seed,
- simple receptacles for collecting biological inputs,
- transport/fuel for travelling to collect the input, such as to the CREEs, research centres, livestock farm or micro-plant factory, or to facilitate farmer seed exchange or crop-livestock integration activities between farms, or on-farm delivery,
- finances to purchase those inputs which had risen in price and in particular manure, or policy to maintain low price levels of these inputs,
- fodder for oxen,
- blacksmiths, yoke producers and ox-drawn implements,
- refrigerated storage for conserving soil activators such as *Azobacter*,
- a formalised network for the diffusion of soil fertility inputs.[304]

To back this up, agricultural support professionals recommended increased investment in the production and quality of biological inputs and their storage times, especially for the CREEs but also including green manure seed.

11.4.6 Ensuring conducive political and social factors

Ensuring political support

While in many respects the political responses to the crisis of the early 1990s favoured an ecological approach (particularly the emphasis on self-reliance), other elements of the political imperative served to constrain the widespread uptake of ecological practices and especially toward the end of the decade. The main elements, and the ways in which they could be turned around, are suggested as follows:

i) Environmental legislation > agricultural legislation. Agricultural policy referred to integration and sustainability but without further definition. Specific legislation was contained in some environmental laws emerging from CITMA[305] rather than from MINAG.

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[304] As Treto et al. describe (2002, p.179) “In spite of all the advances in the production and application of worm humus, bio-earth, compost, cachaza, and bio-fertilisers, we continue to have difficulties in substituting for all the chemical fertilisers. Often not enough raw materials are available when and where they are most needed. Moreover, taking a macro view, there simply are not enough of these materials to provide soil amendments for all agricultural production at a national level. Even if there were, transportation of such large quantities of material is costly and logistically complicated On-farm solutions will have to play an increasing role.”

[305] Through environmental legislation for example, agrochemicals were not recommended for use on organoponicos, and farmers found degrading their soils could be fined. As in many other countries, concerns about the environmental and health aspects of agriculture have been seen as separate from those related to production, and dealt with by separate ministries. Notably, CITMA and MES have supported more ecologically-oriented projects than MINAG.

With Cuba's international reputation for its organic agricultural policy, it would be leading the way if this were actualised. Interviews for this field study also identified the particular need for enforcement of existing laws such as on soil protection, and increasing fines for the mis-use of agrochemicals.

ii) Maximising yields > optimising yields. The nationwide objective of increasing yields in the short-term conflicted with sustainability objectives. In fact, there were implications that it was almost counter-government to promote strategies that may be lower yielding (see Figure 11.4). An ecological perspective, meanwhile, was one of optimising yields, and although by the end of the decade research results emerging from Cuba indicated the often superior performance of ecological over industrialised systems, these results had not been considered in agricultural policy decisions up to that time.

iii) Lack of petrol > renewable energies. The pervading, felt lack of petrol held back ecological development. Cuban farmers saw petrol as being pivotal to the success of their production systems. Drought-resistant crop varieties, for example, were seen as advantageous largely in terms of the petrol savings that would be made through the decreased need to irrigate. Unless ecological alternatives could address farmers' concerns of irrigation and traction limitations, they were less likely to be accepted.[306]

iv) Industrialised planning > ecological planning. The State production plan was based on tonnage and advocated crops that were not always ecologically appropriate. The plans were also often based on receipt of agrochemical inputs, including for seed production. Intensification also often worked against the use of green legumes, intercropping and fallows, and the long established and centralised seed distribution system worked against farmers developing their own skills and expertise in seed saving.

v) Quantity incentive > quality incentive. Food quantities were still unstable, and low cost and quantity were the most important factors on the market place. Yet improving quality in a low-input situation would arguably not detract from quantity. The majority of crops fed into the State production plan did not differentiate by quality nor provide financial stimulus for such (unless for the tourist market). Any quality differentiation was again based on product size and weight, and secondarily on pest residues. The ration system limited opportunity for development of farmer-consumer relations over quality produce.

As well as the above elements, a crucial factor was the policy connection with the organic movement. The original organic movement, ACAO, had a huge impact behind the scenes, but this was perhaps not so obvious outside the ecological sector. It had adopted a largely facilitative and participatory approach, with its partners often receiving the credit for projects that it helped instigate. Because the movement had emerged out of the research sector, ownership of ecological concepts by both farmers and policy makers was less advanced. Perhaps because of this, ACAO had received little direct financial backing and was therefore limited in its scale of operations. In 1999, ACAO's mandate to develop organic agriculture was transferred to the government-appointed Cuban Association of Agricultural and Forestry Technicians (ACTAF). ACAO became the Organic Farming Group (GAO), one of several sustainable project groups within ACTAF. This institutionalisation of the organic movement may represent a recognition by MINAG of the potential of organic approaches, yet it contrasts with organic movements in other parts of the world which tend to maintain more of a distance from government interests and especially over organic standards, principles and philosophy. In Cuba, it may be that the social goals of the State and of the organic movement strongly converge, yet this increased bureaucracy and institutional positioning may run the risk of weakening the progressive and pioneering spirit of the organic movement as well as its work efficacy.[307]

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[306] Pilot projects have indicated that Cuba could meet all its electricity needs from sugarcane bagasse, and a national NGO is researching and developing renewable energy projects, but by the end of the decade this work continued to rely on international donor support (Montanaro, 2000).

[307] Given that none of ACTAF's objectives mentioned organic or ecological agriculture, and its statutes described that "*ACTAF may work through a wide field of actions, mainly directed at balancing rational, sufficient and efficient use of*

Ensuring socially conducive contexts

Common rural issues

Certain social factors were identified as being crucial influences in the upscaling of ecological agriculture. One major disincentive, identified by farmers, was the incidence of theft from their fields or stables, which limited their crop choices, their seed drying and saving, and their keeping oxen on-farm if they could not afford a guard. Farmers were also unwilling to adopt technologies and practices that they felt were unproven, particularly in view of the previously top-down extension system that had, to some degree, inculcated dependency[308] and mistrust. The social issues of theft, mistrust and dependency were common rural problems of many countries and would require some time to turn around.

Organisational restructuring

The increased restructuring of organisations were also seen to facilitate ecological approaches, such as developing mechanisms for closer integration between specialised farms which did not require high fuel costs, and increasing autonomy of the UBPCs. Restructuring and decentralisation was also suggested for the State seed supply service.

Social recognition of the need for change

One of the recurrent themes to emerge from the interviews was that practical change required a corresponding change in mentality, and that "*attitudes take time to change*". This observation tended to inhibit any attempt to encourage change because of the anticipated negative responses. Nobody identified him- or her-self as requiring to make a mental shift; the resistance to change always lay with some other group or individual. Notwithstanding the cross-disciplinary, agro-ecological training efforts of CEAS, much of the general training emphasis was still on farmers, rather than support staff. Yet many groups of farmers were, if anything, further down the ecological path than the support staff. Given the directive nature of the institutional sector in Cuba, attitude change amongst agricultural professionals was critical for a more widespread change.

In fact, supporters of ecological agriculture in Cuba emphasised the need for a shift in consciousness, in order to move from the stage of input substitution to that of ecological management. Treto et al. (2002, p. 184) suggest that "*This will require a deep-rooted paradigm shift, already underway, allowing agronomists and farmers to view the soil as a living system of an agricultural ecosystem that operates according to the laws of nature*." Ríos Labrada et al. (2000) recommend that whilst significant technological change toward ecological agriculture has already occurred over a relatively short timescale, this needed to be accompanied by a campaign of environmental and health education. They conclude (p.16): "*it is more difficult to raise conscience than technology, and this is the challenge for the future*."

11.4.7 Driving forces for ecological up-scaling

Cuba's successes in improving food security and sovereignty, and agricultural productivity, suggest that if the political will is there, then the ability exists to develop joined-up policy measures and an enabling environment on a more sustainable agriculture. This would involve not only strengthening the ecological strategies already existing, but also reducing the tensions created by policies and strategies that conflict with these.

Cuba's transition in a period of just ten years from facing serious food deficits and shortages in calorific intake, to one in which more than one third of the population of Havana is considered to be overweight and western diseases are prevalent, may provide such a motivation. For while Cuba has

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chemical methods with organic and biological alternatives." (ACTAF, 1999 p.12-13). In 1999/2000, a financial prize awarded to Cuba's organic movement had been distributed amongst all ACTAF subgroups rather than re-invested in the Organic Agriculture Group.

[308] Some farmers, for example, were not attempting to use biological pest control products but were waiting for the State to introduce them.

(largely) solved the problems of adequacy of food supply, the focus on quantity (as opposed to quality) appears to have created counter-productive effects. Cuba has been able to ensure food for its people whether its domestic production is more industrial or more ecological, but it is the broader implications of these strategies that affect the health of the nation, and of the environment. Soil degradation remains a huge and restrictive problem for the agricultural sector, as do the recurrent droughts for which more adaptive, dynamic and resistant crops and cropping patterns, and water management systems, are required. As was pointed out by one agricultural specialist "*The tropical climate of an island like Cuba is inherently unstable, and on a large-scale model, the farmer cannot react in time to the change in climate*." (Roberto Caballeros, quoted by Sinclair & Thompson, 2001, p.27). The links that exist between the health of soil, plants, humans and the environment pervades ecological philosophy, and it is by looking through such an ecological perspective that long-term and sustainable solutions may be found. Certain wider benefits of the reduction in agrochemical use have already been noted by farmers. Research which has been forced to refocus on ecological approaches has come up with a number of sustainable innovations. The Cuban food system is already benefiting from a more diverse range of fresh food. Other benefits of ecological production, such as developing a commercially viable organic export sector and producing high quality produce for the growing internal tourist market, may also play a role. Given Cuba's commitment to promoting the welfare of its people, these might be seen as secondary considerations, but the revenue from, for example, promoting Cuba as an 'organic island' to tourists (as suggested by one interviewee in this study) would likely have beneficial repercussions for the whole nation.

There are also more fundamental reasons why Cuba in particular might wish to consider the ecological option as being an appropriate one. First, and following the point above, the industrialised agriculture it was practising up to the 1990s was developed by and for temperate agroclimates, where relatively large, flat land areas, stable soils, even rainfall, lower levels of biodiversity and sunlight, could support it. This system of agriculture is far less compatible with tropical conditions (Weischet & Caviedes, 1993). Second, industrialised agriculture, with its focus on the short-term and on maximisation, is arguably an appropriate strategy in emergency situations when a rapid response is required. Cuba is moving out of the crisis and is now able to cast a glance to the longer term. Industrialised approaches may no longer be necessary in its long-term strategy, nor compatible in a country that prioritises societal interests over fiscal accumulation.[309],[310],[311] As Castro (1993, p.10, p.24) pointed out "*If the deterioration of the environment is analysed from a historical perspective, it can be appreciated that the greatest harm to the global ecosystem has been done by the development patterns followed by the most industrialised countries…. The North's ecological deterioration has been exported – in large measure to the South, as part of a long process of capitalist development*."

[309] In a speech entitled 'Cuba's Green Path', the then Minister of CITMA explained "The profit motive plays only a limited role in Cuban agriculture, healthcare and energy programmes. As these programs are largely State-supported, society-wide needs of sustainability can take precedence over profit margins." (Montanaro, 2000, p.1).

[310] According to one Cuban researcher "Lenin went wrong on copying the industrialised agricultural model of capitalist countries - it does not work, especially centralisation."

[311] Developing this concept, Giddens (1985) talks of a post-scarcity economy, in which economic growth is no longer of overriding importance as the accumulation process is seen to threaten or destroy valued ways of life. In this model, industrialism is replaced by a humanist approach to nature.

12 CONCLUSIONS: FINAL COMMENTS ON POLICY AND THEORY

12.1 ROUND UP OF KEY THEMES

This thesis has examined the transformation of Cuban farming and food systems, seeking to draw out the lesson and implications for policy and practice on a broader, international scale. Cuba's experience is relevant to three contemporary global concerns: first, the rapidly dwindling supplies of fossil fuels which will, sooner or later, force the uptake of low-fuel, alternative systems; second, interest about the institutional and policy support required to encourage and facilitate a widespread shift towards more ecological farming systems; and third, the degree to which a low-petroleum-input agriculture can contribute to national food security.

Chapters 6 to 8 of this thesis identified in some detail the institutional and farm-level strategies employed by Cuba to cope with extreme shortages of fuel and other agricultural inputs, and how these strategies have, in turn, altered the farming and food systems. Subsequent, analysis of Cuba's strategy to maintain food security suggests the crucial importance of domestic political will and international sovereignty, combined with effective, cross-cutting and congruent policies. Chapter 10 focused-in on the factors influencing the development of certified organic production and of the Cuban organic movement, identifying their shifting relationship with the State as it attempted to find its own direction at the end of the decade.

Overall, this research has shown how, through an innovative and pragmatic mix of measures and mechanisms in its agricultural and food sectors, Cuba has managed to turn around a serious and nation-threatening crisis. It has substantially reduced its dependence on imported food and is now far closer to being able to meet national food needs domestically. Ecological approaches have played a role in this process and have been demonstrated as technically feasible components within a system that prioritises national food security. The experience shows the need to articulate mechanisms and policies for ensuring ecological agriculture; a reduction in access to fuel and agrochemicals will not alone lead to this. At the same time, no system of agriculture, sustainable – or otherwise, is sufficient in itself to ensure food security; a multi-sectoral approach is required. Nevertheless, agriculture can play a major role in providing food of sufficient quantity *and* quality, and in a manner which avoids external dependencies whether regional or international. The (re)emergence in Cuba of human and environmental health-related problems (particularly of the so-called "diseases of affluence") illustrate how a holistic approach provides a more balanced option than a productivist one which in overcoming one set of problems can often create another.

12.2 CUBA'S PARTIAL AGRICULTURAL TRANSITION

12.2.1 Institutional coping and learning experiences

Degrees of learning

Throughout the Special period, Cuba has adopted several of the key characteristics of a more ecological support system, (as described in Chapter 3). These include more location-specific strategies, a relative increase in participatory extension, institutional decentralisation, promotion of bio-inputs and more localised production-consumption chains. Other characteristics were starting to emerge: such as the focus on knowledge and learning over technology diffusion. Yet some, such as the application of holistic and systems principles, remained barely visible.

The mixture of institutional coping strategies employed by Cuba can perhaps be better interpreted in terms of the degree of learning and change that took place. Certain strategies underwent very little change from before, even if it was evident that they were ineffective and were stifling innovation and the emergence of new strategies.[312] Examples of this include continued attempts to breed (or import) high-input crop hybrids and clones, and continued publication of recommendations for high-dose inputs. Such practices continued, at least in part, because of a belief that the Special Period was temporary and that conditions would soon return to those of previous, more affluent times. This belief was to some extent State-promoted, alongside contrasting advice to adapt to the leaner conditions.

In other areas, considerable learning did take place, and led to a re-evaluation of ideas, and even of ideology.[313] This meant acceptance of the low-input conditions of the period. Examples include farm restructuring, the early development of urban agriculture, the opening of free markets, the reintroduction and promotion of oxen, the uptake of participatory methodologies, and the change to hardier crops. Some longer-term rethinking went one stage further (exhibiting characteristics of triple loop learning (Argyris & Schon, 1996), as described in Chapter 3). This meant accepting that the conditions were there to stay, and reformulating more intrinsic beliefs and structures to accommodate to that. Examples of this include the continued expansion of urban agriculture,[314] continued adjustments to the free farmers' markets, the further downsizing of UBPC farms and, in a few pioneering cases, putting farmers in control of research initiatives.

Hurdles in the transition process

These varying degrees of learning and change reflect in the transition stages of different institutions and actors, as diagnosed in Chapter 11, based on evidence from Chapters 6 to 8, and 10, with some remaining attached to the industrialisation paradigm, others moving to a substitution stage, and a small vanguard to the redesign of the production system and philosophy behind it. The transition model usefully highlighted the contextual importance of relative change. So that, for example, vanguard groups may have made less of a change of attitude or rethinking from their earlier position, compared to groups more embedded in the establishment mainstream. From the field interview responses, there appeared to be two points of change in attitude, or paradigm: the first at the point of 'acceptance' that organic inputs may, by and large, functionally substitute for agrochemicals, and the second (less frequent) where even organic inputs were seen as negligibly important in a system which had been intentionally managed so as to (re)gain its ecological equilibrium. If the transition process is assumed as given, then these 'paradigm hurdles' may explain why certain groups and individuals appeared to make more of an operational transition in real terms than others; the latter having pulled up to, or in the transit process, or avoiding, a hurdle.

[312] Röling (2005, p.100) interprets this as a lack of resilience or rapid deliberate learning, or "*the ability to note discrepancy, to adapt the reality world to feedback*." Based on the constructivist perspective, he explains "*We can build a cosy coherent reality world, in which our values, theories, perceptions and actions are mutually consistent. But this reality world can become divorced from its domain of existence; for example, it can fail to correspond to ecological imperatives*."

[313] In reviewing the farm organisational and market changes, Deere et al. (1994, p. 195-196) comment "*the Cuban government has demonstrated a good deal of flexibility with respect to long-held socialist principles regarding the organisation of agricultural production*." and further that "*Cuban officials have dropped their longstanding opposition to the holding of individual usufruct parcels on State farm land*."

[314] During the author's most recent visit to Cuba, in November 2004, researchers working in urban agriculture expressed conviction that this mode of production (including peri-urban farms) could and would supply the majority of foodstuffs for the urban population, on a permanent basis.

Levels of institutional engagement with farmers

Such differences in degrees of learning can be found within institutional and individual strategies. They have resulted in changes in institutional functioning, both in their levels of engagement with end-users (farmers), and in the overall co-ordination or operating mechanisms at play. The most obvious change in engagement with farmers is the increase in participatory approaches within research and extension. Although still in its conceptual infancy in terms of interpretation of meaning, there has been, if not a turnaround, then a conceptual adaptation of the traditional, rural, top-down approach. The urban case was more far-reaching, whereby farmers' needs and priorities were driving institutional support, and this successful urban model may still spread into the rural sector, particularly if plans materialise for farmers to pay for extension services. Aside from the new institutional mandate (e.g. of the New Paradigms Initiative) to develop more applied and multi-disciplinary research, more implicit incentives do little to encourage engagement with farmers. Within institutions, incentive schemes continue to encourage horizontal competition of yield-focused innovations. Meanwhile, the move toward financial independency has led to a greater focus on commercial product development rather than process research, which is itself of little benefit to farmers whilst these products lack marketing networks. Further, the innovative projects which have embraced multidisciplinary (such as the PPB Project) struggle to identify capable team members in more holistic socio-economic disciplines; this highlighting some shortcomings in training provision.

Changes in institutional operating mechanisms

Although ecological agriculture is not fully embedded in supportive institutions, there has been a considerable increase in the (unregulated) support available to those farmers who do wish to operate along ecological lines. Yet many of these measures have remained as rhetoric rather than reality, being paradoxically dependent on petroleum – specifically fuel to refrigerate and transport substitute products and to enable institute-farmer interaction. Owing to the paternal legacy, as well as to the substitutive nature of contemporary agriculture, farmers are still largely looking for off-farm inputs and frequently waiting for advice or instruction, rather than taking initiative themselves.[315] However, non-State farmers have acquired more influence over the period; partly as their bargaining power increased during the critical years when they proved themselves as a major supplier of food, and, following this, because the resilience and capabilities they displayed have encouraged expansion and strengthening of their sector, which is now seen as a viable, major production component for the future of domestic agriculture

Institutional co-ordination mechanisms have changed in other ways. The State is still the regulator and central planner over issues that it considers a public right or good, such as access to food. It has introduced socially-oriented incentive schemes to increase production, such as improved rural conditions, and access to dollar goods. It has also introduced market mechanisms; handing a degree of co-ordination and control to markets, while keeping a watchful, regulatory eye to ensure that these markets do not lead to excessive inequality.[316] Farmers' market preferences are not always toward the highest-priced. Their basic income is guaranteed through State purchases, after supplying which many prefer to sell surplus to outlets which are less competitive, more accessible (with assisted transport), or which do not entail extra labour investment. The combination of a guaranteed basic income, buoyant farm gate prices, shortfalls in supply and regulated markets protect farmers from getting trapped on the productivist treadmill.

[315] Problematic impacts of paternalism include blinding people to the need for solving their own problems, accustomising them to expect give-aways, and destroying the possibility of multiplier effects (Haverkort et al., 1991).

[316] As well as liberalising markets, a move away from regulation also came into place through the establishment of Peoples' Councils in the early 1990s, which provided an official channel for civil society to voice their opinions.

Box 12.1 Impacts of rapid introduction of liberalised markets on agriculture and rural livelihoods in post-Soviet Eastern Europe

Turnock (1996) summarises the East European experience with socialist agriculture, noting that although production had previously failed to meet plan targets (thereby giving the impression of a sector in crisis), there was steady growth based on substantial investments in buildings, machinery, fertilisers and irrigation systems which provided food for the population at affordable prices. Nevertheless, environmental pollution was a legacy of the communist era. "*The performance of every enterprise in Eastern Europe was mainly assessed by the quantity of goods it produced. Clean air water, and a pristine environment were considered free goods, without value. So polluting them was acceptable*." (Mnatsakanian, 1997).

After the collapse of the Soviet Union, transition to a market economy cast agriculture into a state of great uncertainty with the end of price controls, and the disruption of trade contacts with the former Soviet Union. Falling real wages reduced demand, while the overtures being made to the European Union (with its substantial food surpluses) indicated that reduced agricultural output may be a permanent reality. Another contrast to the Cuban experience, described by Csizinszky (2003), is that economic systems in the former Soviet bloc countries moved directly from state-owned, centrally planned and directed socialised systems to market-oriented private enterprises. As a result, the agricultural sector faced major problems during the transition period as they lacked the knowledge and experience in the organisation, finance and management of private enterprises. Molnar (2003) describes how nationalised land was returned to owners who lacked the skills and financial resources for intensive crop production, resulting in reductions in crop yields. In this sense, more important than the political will of the reformers was the willingness of the agricultural population and the widespread dissemination of managerial skills into the sector (Antonelli, 1990). More recently, efforts have been made to design new, low-input cropping systems and conservation tillage, and Molnar suggests that it may take till 2020 for Eastern Europe to become a significant exporter of agricultural commodities. Meanwhile, the agricultural research system in Central and Eastern Europe (including the former USSR) was, in 1998, still in the process of transition and lagging behind reforms in the agricultural sector (Csaki, 1998).

These changes have had profound social impacts. A household survey of the economic and psychological wellbeing in rural Russian villages following the collapse of the Soviet Union, showed that, while the introduction of more competitive economic development programmes had improved the material quality of life for certain households, it brought higher levels of stress which were exacerbated by the loss of social support through the previous collective organisation (Patsiorkovski & O'Brien, 1997). Little (1998) illustrates the alarming decline in public health in the Eastern bloc since its dissolution. Death rates have increased in most age groups. Life expectancy, especially among males, has decreased in many countries and the trend was forecast to continue; in Russia, male life expectancy dropped by six years between 1989 and 1994. Medical causes of mortality include cardiovascular disease, cancer, and injuries among adults, but are underpinned by a sharp increase in poverty, social disintegration and crime, combined with historically high rates of smoking, alcohol use, and psycho-social stress.

Thus Cuba has cautiously experimented with, and used, market mechanisms to stimulate production and food distribution. This represents an interesting case of restrained ideological flexibility, the outcomes of which compare favourably with the more rapid and widespread adoption of liberalised market approaches in Eastern European countries after 1989. Box 12.1 summarises the literature, highlighting the largely negative effects that have been experienced in the agricultural sectors of those countries. Cuba's agriculture has also been compared to that of a Caribbean neighbour, the Dominican Republic (Sinclair & Thompson, 2001). In the Dominican Republic, agriculture is characterised by deregulation, large-scale farms and foreign ownership. At 2000, and not surprisingly, Cuba's agriculture showed higher social indicator levels (such as equity and employment), and lower productivity levels.

12.2.2 Future directions and forces to consider

Need for further crystallisation of direction

Cuba's transition from food insecurity has been built on a patchwork approach to agriculture in which more ecological approaches have played a significant, but not exclusive, role. Cuba's experience has shown the potential of ecological inputs, and the importance of developing a more context-specific knowledge base. Future directions were still not completely clear, partly due to the dichotomy of productionist mandates versus sustainability ambitions. A large minority of farmers had the intention to become more ecological and many others were ambivalent about it, being open to this direction if moves were facilitated for them. As already mentioned, there was in many cases insufficient institutional capacity to support latent grassroots interest. Yet overall, the conditions of the Special Period had exposed many farmers to alternative directions who would not otherwise have looked for them. Although Cuba has been using low levels of inputs for a decade, at 2000 much of the mainstream continued toward replacing what was lacking – a single loop of learning - rather than consciously seeking a systems-wide reorientation – the double loop. Policy was becoming geared towards an integrated approach, yet use of the word was ambiguous and had several different interpretations, ranging from that used by the Cuban organic movement, to that of MINAG production planners or upstream scientists. Of more clarity was that Cuba's integrated approach (however defined) differed from that of other countries, because of the diverse range of cutting-edge and experimental components involved, and because of the external context which forced some ecological learning, regardless of choice.

Chapter 3 argued that ecological agriculture should be characterised not only by degree of husbandry practices but also by intent and by knowledge base. A simple reduction in the extent of industrialised agricultural practices would not, according to this argument, be sufficient to qualify. The agricultural sector in Cuba has, overall, reduced its industrialised practices. Almost all the key characteristics of ecological agriculture, discussed in Box 3.3, are visible in Cuban agriculture, either by default or intent. The main incongruency lies in Cuba's short-term productivity approach. Nevertheless, before holding Cuba up as a model of ecological agriculture, more clarity is required over the nature of its 'integrated' policy intentions, which would include, and be influenced by, more mainstreamed shifts in the knowledge base. [317]

Unravelling the different forces and factors at play

Investment in human capacity-building takes substantial time to fully manifest and it is likely that the full potential of the changes and experiences of the Special Period will continue to unfold in the coming years. Cuba has ideal conditions for mainstreaming ecological agriculture: with its high education levels and research capacity, an absence of conflicting interests from an agribusiness sector, protection of local agricultural markets, well endowed (if unevenly spread) natural resources, strong communication channels, a wide spread of extension agents, smaller farm sizes and more human-scale management, and an imbued socialist culture. Other countries with a less developed infrastructure, less collective cohesion and more entrenched corporate interests would seem to face greater challenges in achieving such a transition.

As argued in Chapter 3, ecological agriculture in other regions has been occasionally spurned from mainstream policy for three major reasons: conflicting economic interests (with the private sector), perceptions surrounding certified organic agriculture, and/or perceptions surrounding is yield ability. In Cuba, the lack of corporate interest seems to rule out the first factor. During the 1990s, certified organic agriculture was perceived by some as being in ideological conflict with the mandate for self-sufficiency, and ecological agriculture as being simply low-yielding. Nevertheless, although the Cuban organic movement (ACAO) had not prioritised or promoted certified organic agriculture, and was backing research on improved production performance, yet its agro-ecological vision was still effectively neutralised by its incorporation, in 1999, within the State's own administrative structure (ACTAF). Paradoxically, it was the State that then put organic standards and certification on the agenda, to enable market-oriented production.

Therefore, and notwithstanding the institutional dynamics between the State and ACAO (as discussed in Chapter 10), the hesitance to experiment with mainstreaming ecological agriculture in the rural sector (given its success in urban agriculture) appeared to be determined by other factors, including, but not necessarily exclusively, perceptions on yield performance. At an individual level,

[317] Still, at 2004 the notion of an organic Cuba continued being promoted. Rodriguez reports, for example, of "*The move to country-wide organic production*" in Cuba.

the field evidence identified a wide variation in cognitive perceptions over the performance of ecological agriculture, some of which were substantiated and others displaying a lack of what was termed in Chapter 3, "ecological literacy". These perceptions, as argued in Chapter 3, influence decisions and actions surrounding agricultural policy and practice. At an institutional level, policy makers' attention focused on the most immediately pressing problems (i.e. food shortages), paying less regard to the longer-term implications of different options for addressing these problems. There was also a degree of institutional reticence to change, given the jobs, structures and investments already built up around the industrialised model. This supposition is supported by evidence from a ministry interviewee (from CITMA, MST/2), who explained that "*Even in the absence of agribusiness, industrialised agriculture in Cuba supports a bureaucratic system which does not want to change*."[318] These institutional and individual factors interacted with, and some times reinforced, one another, and overall indicate that a further shift toward ecological agriculture may require broader changes in order to address them.

For international ecological movements, the rural transformation in Cuba raises three issues. The first issue concerns the possible need to shift emphasis away from the widely perceived constraints imposed by corporate agribusiness interests and focus instead on the challenge of the underlying industrialised mindset. In Cuba the first is virtually absent, but despite this the latter – characterised by certain cognitive perceptions and the institutional reticence to change existing structures, remains strong. Second, Cuba's interpretation of appropriate agriculture tends toward the Latin American model of agro-ecology, which may incorporate small amounts of agrochemicals and yet consider itself to be, as described by one interviewee, "*beyond organics.*" Given Cuba's substantial, nationwide learning experience, there is a strong case for better embracing this interpretation within internationally agreed principles and even standards. The third issue surrounds the institutional interplay between governments and grassroots, over management of a nation's organic movement. In Cuba, the State's close involvement may assist in its mainstreaming, or alternatively may only serve to strengthen its position as a niche activity and restrain further pioneering innovation. It may be in the interest of international ecological groups to keep a watch on developments in Cuba, as they affect the autonomous nature of the movement.

12.3 IMPLICATIONS FOR GLOBAL AGRICULTURE AND FOOD SECURITY

Cuba is fairly unique in its mode of centralised governance, and some might argue that because of this it is difficult to extrapolate from these experiences. Yet an equally compelling counter-argument can be made, since in many parts of the "free world" decisions over resources connected to agriculture and the food supply chain are highly centralised amongst a few corporations, reducing the extent of real choices made by many consumers or producers.[319] One feature of western farming and food systems in recent years has been an increasing level of mechanisation and homogenisation. These systems, with their ever-lengthening food supply chains, play a large role in current patterns of fossil fuel consumption. By contrast, Cuba is moving in the opposite direction, towards more decentralised, human-scale and bioregional production and consumption systems, with greater levels of autonomy, diversity, and complexity. In fact, the emerging food system in Cuba reflects most of the key characteristics of an ecological, low-fossil-fuel food system (described in Box 3.6).[320] If the predicted fuel supply crisis materialises, Cuba's example shows how it might be addressed. As Snyder, a US citizen reporting back from Cuba, states "*Few if any advocates for sustainable agriculture in our own country would wish to swap our government or*

[318] Supporting this, McRae et al. (1990) suggest that in the absence of explicit political objectives to promote ecological agriculture, there is a form of institutional inertia whereby decision makers tend to postpone action until there is either overwhelming scientific data to support it or overwhelming negative effects of the prolonged inaction.
[319] Finn (1998) suggests that centralisation is a practice promoted by old socialism as well as by competitive market-driven advocates, albeit that one is State-owned and the other private.
[320] Although certain characteristics, such as the internalisation of the wider impacts of production, and, to some degree, the prioritisation of health concerns, are still un(der)developed.

economic circumstances with those found in Cuba. But it sure doesn't hurt to see an example of how we might utilise the principles of sustainability in the United States to avoid our own Special Period in the future." (Snyder, 2003).

Cuba's achievement in moving from a highly vulnerable situation to one of reasonable food security within one decade also stands in stark comparison with the shortcomings of the international community, and governments of many less-industrialised countries, in addressing global food insecurity. As described in Chapter 3, it is widely accepted that the international community is unlikely to meet the - rather more modest - International Millennium Development Goal of halving the number of food insecure people in the world by the year 2015. Cuba's example shows that this is not an overly ambitious target – but is one that can be achieved by a firm political commitment to prioritise basic food rights, and a semi-regulatory approach, over an unregulated free market approach. Such commitment in Cuba has benefited from a strong degree of sovereignty and a range of cross-cutting mechanisms to maintain incentives for national production, while ensuring equitable distribution and accessibility. This is perhaps the biggest lesson that Cuba's experience of the 1990s has for the rest of the world.

APPENDICES

APPENDIX I (Chapter 4): Checklist of questions for municipal and provincial institutional levels

General questions:
1. What have been the main technology changes in production of maize/banana, since 1989?
2. How has your enterprise/institute coped with these changes in terms of:
   a) service provision strategies (incl. regional specificity)
   b) information provision
   c) linkages with other enterprises/institutes
   d) staffing and staff training
   e) internal organisational structure
   f) future strategies/priorities
3. What have been the costs of these changes?
4. What alternative technologies do you know of, and what are the main challenges to their widespread adoption and use?
5. What are your current input recommendations for maize and banana? What do farmers actually do in practice? Are current varieties appropriate for use with a low level of inputs, and if not, what is being done to remedy this?
6. What are the future possible directions under current conditions, and what will be your strategy when inputs become more widely available?
For research and extension:
7. What has been the impact of changes in technology on research strategies? (project type, duration, degree of participation, interdisciplinarity, selection of farmer target group, researcher training, monitoring and evaluation, diffusion, use of local knowledge)
8. Have you written/published any articles on this issue?
For input supplies:
9. How is the distribution of chemicals for maize and banana production regulated?
For collection/marketing:
10. What have been the changes in product quantity and quality?
For policy:
11. How have policy instruments changed to cope with the changes in production technologies, in terms of:
   a) regulation/taxes of inputs and practices
   b) farmer incentive/stimulation (subsidies)
   c) stimulation of appropriate research programmes
   d) monitoring and evaluation
12. What are the wider implications of these changes for:
   a) national food security
   b) trade
13. What is the future strategy under:
   a) current conditions
   b) conditions of more input availability.

APPENDIX II (Chapter 4): Quantitative questionnaire (revised version)

ENCUESTA CANTITATIVA: USO DE TECNOLOGIAS EN LOS SISTEMAS PRODUCTIVOS de maíz y de plátano fruta

Municipalidad .... Fecha ....

1.0 Finca Estatal [ ] UBPC [ ] CPA [ ] CCS [ ] CCS fortalezida [ ]

1.1 Nombre de entidad .... 1.2 Fecha de fundación ....

2. La entidad en general

2.1 ?Cuantos socios tiene? Total .... Hombres .... Mujeres ....

2.2 Año en que tenian mayor cantidad de socios .... ?Cuántos tenian? ....

2.3 ?Porque ha occurido cambios en la cantidad de socios? ....

....

2.4 ?A qué se dedica la entidad?

Pecuaria [ ] Frutales [ ] Flores [ ] Cultivos varios [ ] Tabaco [ ]

Cítricos [ ] Caña [ ] Otros (especificar) ....

2.5 Herencía de de las tierras:

Herencía	Cab.
Superficie total	
Del estado	
En usofructo indefinido	
Privado individual	

2.6 Uso de la tierra actual

Uso de la tierra	1998-99 (*ha or cab*)
Superficie total	
Superficie agrícola	
- cultivada con riego	
- cultivos permanentes	
- cultivos annuales	
- pastos naturales	

2.7 Producción por el año 1998-99

Productos (los 5 más importantes)	Area (*ha o cab*)	Rendimiento (Ton o qq/cab or ha)
1. ?		
2.?		
3.?		
4.?		
5.?		
Maíz		
Plátano fruta		
Plátano burro/macho		

3.0 Producción de maíz y de plátano fruta

3.1 ?Cuando y como se sembra el maíz y el plátano fruta?

	Por el maíz	Por el plátano fruta
Fecha(s) de sembra		
No. sembras por año/periodo		

3.2 ?Donde se sembra? En tierras mas fertiles [ ] En tierras menos fertiles [ ] Cualquier sitio [ ]

Otra criteria para la ubicación de la siembra (especificar) ....

3.3 ? Se cambiaron la criteria para la ubicación de la siembra desde los años ochentas? Si [ ] No [ ]

3.4 ?Existe un plan de producción del maíz y de plátano fruta?

Tipo de plan	?En qué consiste?	
	En el caso de maíz	En el caso de plátano fruta
Sobre la siembra/cosecha		
Sobre la comercialización		

3.5 ?Como/quien se decide ese plan? Usted [ ] El Comité de la entidad [ ] MINAG [ ] Otro ....

3.6 ?Por el año 1999, hubo incumplimiento o sobrecumplimiento?

Por el maíz: Incumplimiento [ ] Sobrecumplimiento [ ] ?Por qué? ....

Por el plátano: Incumplimiento [ ] Sobrecumplimiento [ ] ?Por qué? ....

3.7 Destino de la producción de maíz y plátano fruta en el año 1999 (*en cantidad: T o qq*):

Cultivo	ACOPIO	autocons. comedor	Autocons. Trabajadores	Mercado Agropec.	Empreza de Semillas	Frutas Selectas	Otros
Maíz							
Plátano fruta					-----------		

3.8 ?Cuánto pagan por los productos actual y en el año 1988? (*qq/MN o $)*

Cultivo	ACOPIO		Frutas Selectas/ mercado turistica		Empreza de Semillas		Mercado agropecuario/ privado nacional		Otra	
	1999	1988	1999	1988	1999	1988	1999	1994	1999	1988
Maíz (*mazorca or grano*)										
Plátano fruta										

3.9 ?Hacen selecciones segun la calidad del producto antes que venderlo?

Por el maíz: Si [ ] No [ ]

Por el plátano fruta: Si [ ] No [ ]

3.10 ?Ha escuchado del producto ecologico o orgánico? Si [ ] No [ ]
3.11 ?Para aumentar los rendimientos de maíz y de plátano fruta, qué medidas **técnicas** faltan?

Medida técnica qué falta	Para el maíz/plátano
Calidad de semilla/vitro-planta	
Disponibilidad de semilla/vitro-planta	
Combustible para riego	
Combustible para maquinaria	
Mas herramientos/maquinaria	
Mas fertilizantes	
Mas pesticidas	
Mas tecnologías alternativas/nuevas	
Mano de obra	
Mas tierra/area	
Otra (especificar)	

3.12 ?Para aumentar los rendimientos de maíz y de plátano fruta, cuales medidas **no-técnicas** faltan?

Medida que falta	Por el maíz/plátano
Información y consejo	
Intercambio con otros productores	
Dsponibilidad de crédito	
Mejor precios de compra	
Entrenamiento técnico	
Entrenamiento en organización	
Mejor incentivos por el productor/ trabajador	
Mas auto-control de producción	
Otra (especificar)	

3.13?**Con la disminución del uso de agroquímicos durante el período especial**, ha notado algún impacto (negativo o positivo) sobre producción en la entidad?

Impacto sobre el rendimiento de maíz/plátano fruta?: Si [ ] No [ ]
Impacto sobre la calidad/sanidad de los productos?: Si [ ] No [ ]
Impacto sobre el nivel de plagas y enfermedades en el campo?: Si [ ] No [ ]
Impacto sobre la fertilidad del suelo?: Si [ ] No [ ]
Impacto sobre la salud del trabajador?; Si [ ] No [ ]
Impacto sobre la salud de la ganadería?: Si [ ] No [ ]
Impacto sobre el nivel de conocimiento requerido por trabajador?: Si [ ] No [ ]
Impacto sobre el nivel de mano de obra requerida?: Si [ ] No [ ]
Impacto sobre el papel de las trabajadoras femininas en la producción?: Si [ ] No [ ]
Impacto sobre la naturaleza silvestre presente dentro de la cooperativa?: Si [ ] No [ ]
Impacto económico?: Si [ ] No [ ]

4. Fitomejoramiento de maíz y de plátano fruta

4.1 ?De dónde provienen las semillas que se utiliza?

De maíz: Empresa productora de semillas varias [ ] Vecino [ ] Tienda del agricultor [ ]

Usted las guarda/conserva [ ] Instituto de investigaciónes (especificar) ....

Otra fuente (especificar) ....

De plátano: Empresa productora de semillas varias [ ] Vecino [ ] Usted las guarda/conserva [ ]

Instituto de investigaciónes (especificar) ....

Otra fuente (especificar) ....

4.2 ?Por el plátano fruta, utiliza semillas de hijos omicroplantas?

Microplantas [ ] Hijos [ ]

4.3 ?Cree usted que guardar las semillas para la proxima siembra es útil?

Por el maíz: Si [ ] No [ ]

Por el plátano fruta: Si [ ] No [ ]

4.4 ?Cómo se llaman las variedades criollos que se usan (o usarán)?

De maíz ....

De plátano fruta ....

4.5 ?Cómo se llaman las variedades modernas que se usan?

De maíz ....

De plátano fruta ....

4.6 ?Por la producción, cuál es mejor, variedades criollos or modernas?:

Caracteristica	Maíz		Plátano fruta	
	Criollo	Modernas	Criollo	Modernas
Rendimiento				
Resistencia a la sequía				
Resistencia en suelos pobres				
Resistencia a plagas				
Resistencia a viento				
Sabor				
Otra (especificar)				

4.7 ?Hay diferencias en el nivel de aplicación de recursos por variedad?

De maíz: Si [ ] No [ ]

De plátano fruta: Si [ ] No [ ]

4.8 ?Como/quien se decide el tipo de variedad y de recursos que se usan?

Usted [ ] El Comité de la entidad [ ] MINAG [ ] Otra ....

5. Uso actual de recursos para maíz y plátano fruta

5.1 Uso de recursos **actual (en el año 1999**):

Insumo	Por maíz		Por plátano fruta	
	Cantidad se aplica (*kg, qq o litros*)	De donde proviene?	Cantidad se aplica (*kg, qq o litros*)	De donde proviene?
Fertilizantes químicos				
Fertilizantes orgánicos				
Herbicidas químicos				
Pesticidas químicos				
Biopesticidas				
Combustible (cual?)		-----------------		-----------------
Riego		-----------------		-----------------

5.2 ?El cantidad ha bajado or subido en relacion de los años ochentas? Bajado [ ] Subido [ ] Egual [ ]

5.3 ?Cuánto cuestan los insumos?

Insumo	Costo de insumo		
	Caro	Medio	Barato
Fertilizante químico			
Estiercol			
Fertilizante organico – especificar			
Pesticida químico			
Biopesticida			
Herbicida químico			
Combustible – gasolina			
Combustible – diesel			

5.4 ?Los precios ha bajado or subido en relacion de los años ochentas? Bajado [ ] Subido [ ] Egual [ ]

5.5 Grado de mecanización (actual y antes de 1988):

Tipo de mecanización	en la preparación de suelo		en la siembra		en el cultivo		en la cosecha		en el transporte	
	Actual	Antes	Actual	Antes	Actual	Antes	Actual	Antes	Actual	Antes
Tractores										
Bueyes										
Camiones										
Manual										

5.6 ?Hay diferencias en el uso de insumos para ventas a ACOPIO, Frutas Selectas, Mercado agropecuario, Empreza de Semillas o para autoconsumo?

Por el maíz: Si [ ] No [ ]

Por el plátano fruta: Si [ ] No [ ]

Fertilidad de suelos

5.7 ?Usted tiene un analisis de sus suelos? Si [ ] No [ ]

?Quien lo hicó? Usted [ ] Tecnico de MINAG [ ] Otra ....

5.8 ?Como son los suelos?:

Profundidad:	Profundo	[ ]	Poco profundo	[ ]		
Estructura:	Buena	[ ]	Regular	[ ]	Mala	[ ]
Textura:	Arenoso	[ ]	Limoso	[ ]	Arcilloso	[ ]
Productividad:	Buena	[ ]	Regular	[ ]	Mala	[ ]
Pedegrosidad	Si	[ ]	No	[ ]		
Color:	Rojo	[ ]	Pardo	[ ]	Negro	[ ]
Topografía:	Llana	[ ]	Hondulada	[ ]		

5.9 ?Para mejorar la fertilidad del suelo, cuáles de las siguentes técnicas no-químicos se usan actualemente? (*por el maíz – M, por el plátano – P*)

Rotación de cultivos [ ]; Intercalamiento [ ]; Uso de compost [ ]; Lombricultura [ ]; Uso de estiércol [ ]; Desechos [ ]; Abonos verdes [ ]; Rhizobium [ ]; Micoriza [ ]; Bio-fertilizantes [ ]; Rocas minerales [ ]; Permanencia de residuos del cultivo en el campo [ ]; Uso de los desperdicios de la cocina como fertilizante [ ]; Uso de desperdicios del baño como fertilizante [ ]; Leguminosas [ ]; Labranza minima [ ]; Cultivo en terrazas [ ]; Uso del buey [ ]; Control del drenaje [ ]; Reforestación [ ]; Cortinas rompevientos [ ]; Cultivos de cobertura [ ]; Uso de arrope [ ]; Aplicación de cachaza [ ]; Otra ....

5.10 ?Cuáles son los factores limitantes por el mayor uso de técnicas alternativas (no químico)?

Falta conocimiento/entrenamiento [ ]; Falta disponibilidad del insumo alternativo [ ]; Falta mano de obra para implementarlo [ ]; Falta credito para comprarlo [ ]; Mas costoso [ ]; Falta confianza en la técnica [ ]; otro (especificar) ....

5.11 ?Si tuvieras mayor acceso a fertilizantes químicos, los usarías?

Cultivo	Tipo de fertilizante químico	?Por qué?
Maíz		
Plátano fruta		

Control de plagas y enfermedades

5.12 ? Cuáles son las plagas y enfermedades principalemente?

En el caso de maíz		En el caso de plátano fruta	
Actual	Antes que 1988	Actual	Antes que 1988

5.13 ?Para controlar esas plagas y enfermedades, cuáles de las siguentes técnicas no-químicos usan actualemente? (*por el maíz – M, por el plátano – P*)

Rotación de cultivos [ ]; Policultivos [ ]; Cultivos repelentes en asociacion [ ]; Trampas de feromonas [ ]; Uso de variedades resistentes [ ]; Extractos de plantas repelentes [ ]; Control biológico con insectos [ ]; Empleo de Bacillus thurgencis [ ]; Pronóstico preventivo [ ]; Mantenimiento de áreas silvestres [ ]; Aprovechamiento de la lluvia [ ].; Otra ....

5.14 ?Cuáles son los factores limitantes por el mayor uso de estas técnicas alternativas (no químico)?

Falta conocimiento/entrenamiento [ ]; Falta disponibilidad del insumo alternativo [ ]; Falta mano de obra para implementarlo [ ]; Falta credito para comprarlo [ ]; Mas costoso [ ]; Falta confianza en la técnica [ ]; otro (especificar) ....

5.15 ?Como se llaman los controles biologicos (biopesticidas) para combatir plagas en el maíz y el plátano?

Cultivo	Plaga o enfermedad	Control biologico
Maíz		
Plátano		

5.16 ?Si tuvieras mayor acceso a químicos para el control de plagas y enfermedades, los usarias?

Cultivo	Tipo de control químico	?Por qué?
Maíz		
Plátano fruta		

Manejo del agua en sistemas agrícolas

5.17 ?Fuente de abasto de riego? Agua superficial [ ] Acueducto [ ] Pozo [ ]

5.18 ?Para conservar o manejar el agua disponible para los cultivos, cuáles de las siguentes técnicas usan actualemente? (*por el maíz – M, por el plátano – P*)

Sembrar en la temporada [ ]; Aumentar la materia organica en el suelo [ ]; Uso de variedades resistentes a la secia [ ]; seleccion de los cultivos mas adecuados para las condiciones actuales [ ]; Uso de arrope [ ]; Aprovechar de cultivos con raizes profundos [ ]; Uso de cultivos de cobertura [ ]; Policultura para estimular un ambiente humido [ ]; Uso de sistemas de riego mas eficiente [ ]; Captuar y almacenar del agua de lluvia [ ]; Otra ....

5.19 ?Cuáles son los factores limitantes por el mayor uso de estas técnicas alternativas?

Falta conocimiento/entrenamiento [ ]; Falta disponibilidad del insumo alternativo necesario [ ]; Falta mano de obra para implementarlo [ ]; Falta credito para comprarlo [ ]; Mas costoso [ ]; Falta confianza en la técnica [ ]; otro (especificar) ....

5.20 ?Si tuviera mayor acceso al sistemas de riego convencional, los usarian?

Cultivo	Tipo de sistema	?Por qué?
Maíz		
Plátano fruta		

Uso de maquinaria en sistemas agrícolas

5.21.?Para hacer mas eficiente el uso de maquinaria, cuáles de las siguentes técnicas usan actualemente? (*por el maíz – M, por el plátano – P*)?

Labranza minima [ ]; Uso del buey [ ]; Permanencia de residuos del cultivo en el campo [ ]; Intercalamiento [ ]; Uso de energia alternativa (viento/sol) [ ]; intercambiar maquinaria con otros productores [ ]: Otra ....

5.22 ?Cuáles son los factores limitantes por el mayor uso de estas técnicas?

Falta conocimiento/entrenamiento [ ]; Falta disponibilidad del equipo alternativo [ ]; Falta mano de obra para implementarlo [ ]; Falta credito para comprarlo [ ]; Mas costoso [ ]; Falta confianza en la técnica [ ]; otro (especificar) ....

5.23 ?Si tuviera mayor acceso al petroleo para el uso de maquinaria, los usarian?

Cultivo	Tipo de maquinaria	?Por qué?
Maíz		
Plátano fruta		

6.0 Asistencia técnica

6.1 ?Qué tipo de asistencia técnica reciben?

Tipo de asistencia técnica	Por el maíz/plátano				
	?Se reciben?	?De donde/quien?	?No. veces?		
			Semanal	Mensual	Annual
Fertilidad de la planta					
Plagas y enfermedades					
Semillas					
Riego					
Cultivación del suelo					
Procesamiento/ comercialización					
Otra (especificar)					

6.2 ?Hicieron cambios tecnologicas por otras fuentes de conocimiento?

Por sus proprios observaciónes [ ]; Por el conocimiento familia [ ]; Conocimiento de otros productores/trabajadores [ ]; Otro fuente ....

6.3 ?Estan o estuvieron involucrado en ensayos cientificos con algun instituto de investigación?

Si [ ] No [ ]

6.4 ?Se usaron los resultados despiués? Si [ ] No [ ]

6.5 ?Recibió usted (u otro miembro de la entidad) algún entrenamiento en:

Manejo de semillas [ ] Uso de bio-fertilizantes [ ] Conservación del agua [ ]

Uso de biopesticidas [ ] Agroecología [ ] Otra (especificar) ....

6.6 ?Cuál instituto/grupo conoce usted que promove la agroecología? ....

7. Labores, finanzas y bienestar

7.1 ?Se organisan los trabajadores por la producción del maíz y del plátano? Si [ ] No [ ]

?Como? : Vinculado por cultivo [ ]; Vinculado a la tierra [ ]; Rotando en brigadas [ ]

Otro (especificar) ....

7.2 ?Cuáles son las formas y sistemas de pago del salario/anticipación?

Vinculado a la producción [ ]; Todos recieben igual [ ]; Otra ....

7.3 ?Existen otros estimulos renumerativos? Si [ ] No [ ]

7.4 Los costos de producción se bajaron o subieron desde el año 1988? Se bajaron [ ] Se subieron [ ]

8.0 El encuestado

8.1 ?Masculino o feminino? M [ ] F [ ]

8.2 ?Cuántos años tiene? ....

8.3 ?Cuántos años lleva trabajando en esa entidad? .... años

8.4 ?Cuál es su papel principal en la entidad? Productor [ ]; Administrador [ ]; Otra ....

8.5 ?Cuántos años ha trabajado en la agricultura en general? ...... años

8.6 ?Sus padres provienen de familias de productores?

Padre Si [ ] No [ ] Madre: Si [ ] No [ ]

8.7 ?Que nivel escolar y/o estudios tiene?

Ultimo grado/titulo .... Tema .... Año de graduación ....

APPENDIX III (Chapter 6): Degree of awareness of alternative soil fertility and pest control techniques, amongst survey respondents in San Antonio de los Baños and Batabanó

Technique	Total no. respondents aware (%)	No. respondents as % total from Batabanó.	No. respondents as % total from San Antonio.
For soil fertility and soil conservation:			
Crop rotation	76	42	95
Manure	73	58	81
Green manure	64	50	71
Legumes	55	42	62
Intercropping	52	50	52
Plant wastes	52	17	71
Plant residues *in-situ*	52	17	71
Compost	48	42	52
Rhizobium	48	25	62
Minimum tillage	48	3	57
Oxen	48	17	67
Run-off control	45	17	62
Windbreaks	45	17	62
Reafforestation	42	17	57
Wormculture	39	8	57
Kitchen wastes	36	8	52
Mulch	36	8	52
Cover crops	30	33	29
Sugarcane waste	27	8	38
Terracing	24	8	33
Bio-fertilisers	21	8	29
Micorrhyza	18	8	24
Rock minerals	18	8	24
Bathroom wastes	18	8	24
Other: stone walling	3	0	5
For pest and disease control:			
Pheromone traps	67	33	86
Resistant varieties	64	33	81
Crop rotation	64	33	81
Bacillus thuringiensis	61	25	81
Biological insect control	58	33	71
Polyculture	58	25	76
Associations of repellent crops	52	25	67
Plant extracts	42	8	62
Maintain wild areas	39	8	57
Preventative forecasting	12	25	5

Source: This field study

APPENDIX IV (Chapter 6): Summary of perceptions on seed/crop systems of farmers from 5 CPA and 5 CCS co-operatives in the Municipality of Quivican, Havana Province, 13-18 January 2000

The municipality of Quivican was primarily a sugarcane production area, which also grows commercial crops for the capital. Because of its location, it previously received a high level of industrialised inputs and was highly mechanised. The survey of farmers in this area revealed the following characteristics:

- Overall, there was a low understanding of the concept of sustainable agriculture.
- Both CPA and CCS co-operatives had access to a small range of sources of seeds and varieties.
- The main breeding requirements were, according to farmers, for adaptability to different soil types, drought and pest resistance, and late season varieties.
- The most important constraints to production were fuel and fertiliser shortages and seed quality, low prices, low incentives and labour shortages.
- The production constraints of irrigation and traction were perceived as being more important than those of fertiliser and pesticide usage.
- The Special Period was generally perceived to have had a negative impact, with the exception of its impact on knowledge levels and soil fertility. This was linked to previous high dependency on inputs.
- The CPAs held a higher knowledge level of ecological strategies than the CCS farmers, correlating with the degree of training received.
- Both types of co-operative had received very little training on ecological production strategies.

Source: primary data, collected by KI/5

APPENDIX V (Chapter 6): Contrasting viewpoints held by interviewees and through scientific research results, on issues relating to ecological agriculture

Issue	Research result, personal experience or secondary evidence relating to the potential for ecological agriculture	
	In support of	Challenging
Performance of low input (appropriate) varieties	Low-input maize varieties under ecological conditions outperform State selected varieties under industrialised conditions (average 3.5 t/ha compared to 2 t/ha). (Research results, Ríos Labrada et al., 2000[a])	Low input varieties not useful because as inputs drop, so do yields. (Seed Enterprise MA/17; MA/R/22)
Potential of farmers to participate in varietal selection	Farmers displayed capacity to manage selection, multiplication, conservation and marketing of seeds. (Research results, Rios Labrada & Wright, 2000)	Farmers have difficulties in selecting varieties (Plant breeder MA/R/99)
Potential of farmers to participate in cross-pollination	"*I was taught in one session how to cross my own basic maize variety with another.*" (Personal experience, farmer F/C/5)	Farmers are unable to cross, because they would not be able to set aside the 7 fields necessary to cross parents and offspring. (Plant breeder MA/R/99)
Quality seed sources and on-farm seed saving.	94% thought seed saving this would be useful, largely to avoid dependency on the State and also to improve quality, economic efficiency, yields, germination rates and appropriateness. (Farmers, this field survey) Farmers are capable of maintaining quality control. (ANAP, MA/37)	Farmers are not capable of maintaining good seed quality. They're better off going to the Seed Enterprise, and the same goes for seed saving. (Seed Enterprise MA/14; MINAG MA/15; plant breeder MA/R/22)
Potential for intercropping	Found beneficial intercrops of in terms of land use equivalence and positive impact on pest control. Makes better use of land space, reduces pest and disease, protects soil, higher yields. (Research results, ACAO, 1999; farmers, this field survey; MSc thesis, F/P/2; personal experience, farmer F/P/7)	Induces crop competition, difficult for mechanisation, less ventilation, lower yields. More labour intensive so only appropriate on smaller farms. (Farmers, this field survey; secondary evidence, breeder MA/R/4)
Yields of ecological production	Yields on Lighthouse fincas were higher than industrialised by 7-14 t/ha. (Research results, ACAO, 1999) Maize yields reached 2.5-4.5t/ha under no-chemical input conditions. (Research results, Rios Labrada et al., 2000[a]) Average yields have increased from 1994-96 using ecological methods. (Personal experience, farmer F/P/2)	Farmers perceived lower yields on Lighthouse *fincas*. Production has decreased under low input methods. (Research results, ACAO, 1999; farmers, this field survey)
Conversion - time period and economics of	Within 3 years, Lighthouse *fincas* eliminated agrochemicals and increased crop diversity 4-fold, through rotations, polycultures and use of harvest residues. (Research results, ACAO, 1999) Income remains steady due to higher value crops chosen during conversion period. (Personal evidence, farmer F/P/2)	It takes many years to see good results (Farmer F/P/1) Incomes drop due to lower yields. (Farmers, this field survey).
Effectiveness of ecological soil fertility strategies	Maize does not require any chemical fertiliser, except if very high yields are required. (Personal experience, Farmer F/C/5) Good maize yields can be achieved with good ecological management including addition of 12-30t/ha manure. (Researcher MES/R/99)	Maize cannot benefit from organic fertiliser as it is a short cycle crop. (Plant breeder, MA/R/4)

Effectiveness of biological pest controls	Applying Bt at 1 month and frequently thereafter is sufficient control if combined with heavy rains. (Personal experience, farmer F/P/12) *Thrips* can be controlled by breaking the early life cycle with biological inputs. (Personal experience, farmer F/P/2; plant breeder, MA/R/15; personal experience, farmer F/P/12)	It is not possible to produce maize without the use of chemical biocides. (Farmer F/C/5) It is not possible to control *Thrips* only with biological controls. (Sanidad Vegetal, MA/16)
Production costs	Production costs decreased on Lighthouse *fincas* while rising on industrialised *fincas* of the same co-operatives. (Research results: ACAO, 1999)	Production is lower and therefore there is a bad economic impact. (Farmers, this field survey)
Labour requirements	Labour requirements decrease once the ecological basis is established. (Personal experience, farmer F/P/2)	Farmers perceived a higher labour input. (Research results, ACAO, 1999)
Future potential for ecological agriculture in Cuba	Had good experiences with increased production during the 1990s, given the right conditions (organic fertiliser, seed, rotations, etc). (Farmers, this field survey) Alternatives are the future. (MINAG, MA/15)	Technology is needed for development. More resistant pests continue to appear. Chemical inputs resolve problems. (Farmers, this field survey) Agrochemicals will continue to be used because ecological agriculture is confronted with difficulties. (Plant breeder MA/R/4) Large-scale production and high technology are required to meet national demand. (Seed Enterprise MA/14)

Source: field survey, interviews, secondary literature on PPB and Agro-ecological Lighthouse project

APPENDIX VI (Chapter 7): Selection of contrasting knowledge, opinions, and personal experiences on the impact of the Special Period and its relation with farming approach, including underlying issues at stake

Issue	Favourable to ecological production	Favourable to industrialised production	Underlying issues at stake
Yield levels as a result of lack of inputs	The secret of high yields is to take care of the crop and the seed. (Personal experience, farmer F/C/17)	Dropped (tomatoes) from 27t/ha to 17t/ha. (Personal experience, farmer F/C/25)	Yield drop during the transition process. Optimisation versus maximisation.
Incidence of pests and diseases	Some pest numbers have increased because of the loss of biodiversity. (Farmer F/C/16)	Pest numbers have increased. (Farmers, this field survey)	Increase in pest numbers differently attributed to the lack of pesticides or to the negative residual impacts of industrialised agriculture.
Product quality	Increased because of less use of chemicals. (Farmers, this field survey)	Decreased, because product size has decreased. (Farmers, this field survey)	Differing perceptions on quality.
Soil fertility	Increased, due to better treatment of the soil. (Farmers, this field survey)	Also decreased, due to previous poor soil management and lack of fertilisers. (Farmers, this field survey)	Lack of input availability and of knowledge of alternative strategies.
Economic status/ production costs	Improved - because of higher market prices, lower input costs and higher yields. (Farmers, this field survey)	Worse - because of lower yields, lower prices of some crops, deteriorating machinery, higher input and labour costs. (Farmers, this field survey)	Differing farmer contexts.
Intercropping	To obtain more profit and a more regular income. (Farmer F/C/2) To take best advantage of the land, save on irrigation, and for beneficial plant interactions. (Farmers, this field survey)	Monocropping results in higher yields. (Farmer F/C/7) Intercropping plants has negative effect and harvest times are difficult. (Farmers F/C/23)	Variable depending on level of knowledge and on farmer context.
On use of pesticides	Biological control is cheaper, better for human and soil health, easy to apply, effective, and we have good management practices. (Farmers, this field survey)	We are satisfied with pesticides. Biocontrols are for the longer term. In some cases there is no other way to control a pest. They are more effective and easier to apply. (Farmers, this field survey)	Different overall perspectives.
On increasing ecological practices	Possible, given the right conditions and the political will. Needs care and attention. (Farmers, this field survey.)	Yields would drop. Too much work. A risk. Soil fertility too poor. Insufficient organic inputs. (Farmers, this field survey).	All of the above.

Source: field interviews and survey

APPENDIX VII (Chapter 8): List of input recommendations for five different root and tuber crops from technical instruction leaflets provided by MINAG in 1998

Crop	Management of seed	Management of soil fertility	Management of pest control
Sweet potato	Instructions for establishing own seed bank.	NPK at 0.4-0.6t/ha 1-1.5lb/plant of organic matter Biofertilisers (mycorrhiza, *Azobacter*, fosforina)	Integrated control of weevil through: Use healthy seed and disinfect with *Beauveria.* Apply *Beauveria bassiana* Use pheromone traps Use ant predators Irrigation as control Avoid intercropping Rotate crops Eliminate host plants Harvest on time Eliminate harvest wastes. For red spider mite, apply Bi 1 l/ha and Malathion 1l/ha%. For Crisomélidos, apply Carbaryl 2kg/ha and malathion 1l/ha.
Malanga (cocoyam)	Use corms or vitroplants.	Apply 0.8 – 1t/ha NPK. Apply 19 t/ha organic material around the plant. Use biofertilisers: mycorrhiza 3t/ha *Azobacter* 20 l/ha fosforina 20 l/ha.	IPM, including fungicides and bio-preparations.
Yam (Discorea trifida)	Self selection of nodules or rhizomes.	Apply between 0.4-0.6 t/ha of NPK *Azobacter* at 20l/ha on planting and again at 60 days. Fosforina at 20 l/ha on planting. Mycorrhiza at 100g/plant at planting. Organic matter at 30t/ha.	To avoid nematodes, select out infected tubers before planting, and avoid planting in infected soils. Rotation interval at least one year. Use resistant clones e.g. Blanco do Pelú.
Pumpkin	Several commercial varieties. Can self save seed.	This crop responds well to organic matter prior to planting, at 15lb/plant. For seeds, apply 0.4t/ha NPK 25 days after planting. *Azobacter* 20 l/ha.	Several pests and diseases. Recommendations include insect predators, Bt, tobacco extract, plant barriers, inverting soil horizon, and chemical applications (Carbaryl, Malathion, Parathion, Bi, Tamarón, Thiodan, Zineb, Antracol, O. de cobre, Policarbacin, Azufre).
Cassava	Several commercial clones available. Can self propagate.	NPK at 0.6-0.7 t/ha, 2 applications. Or: Mycorrhiza 100g/plant *Azobacter* 20 l/ha Fosforina 20 l/ha Organic matter 1.5lb/plant (or 15-19 t/ha organic matter).	Various pests and diseases. Recommendations include timing of planting, selection of good planting materials, rotation, potassium fertilisation, eliminate pest hosts, liberation of parasites, Bt, and chemical control (Dipterex, Malathion, Bi).

Source: MINAG, 1998

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SUMMARY

The aim of this research is to contribute to the understanding and development of more sustainable agriculture and food systems, capable of meeting multiple objectives of food security, environmental and human health, and renewable resource use. This is achieved through a descriptive analysis of the experiences of Cuba in the 1990s as it struggled to cope with a dramatic loss in agricultural inputs and food imports upon which its production and food system had been dependent. In doing so, this thesis analytically reviews the nationwide change to a necessarily more self-reliant agricultural production and food sector that occurred in Cuba in the 1990s. It is intended as a contribution to the ongoing debate about sustainable agricultural and food security policies in the context of dwindling supplies of fossil fuel. As such it has relevance for both Cuba and other countries.

Cuba had never held autonomy over its food system. Prior to the Revolution of 1959, it was subject to a colonial pattern of agriculture, with much of the best land in a few foreign hands and oriented toward the export of commodity crops. From the 1960s onwards, Cuba then became increasingly dependent on a favourable trading relationship with the Council of Mutual Economic Assistance (CMEA) of Soviet countries. Under this arrangement, Cuba received above-market prices for its sugar and in turn received the inputs it needed to run a highly industrialised and specialised agricultural sector, while at the same time being dependent on imports for many essential foodstuffs. When CMEA collapsed in 1989, Cuba lost many of these essential supplies: including half of its supplies of diesel and food imports, and three-quarters of its petrol, chemical fertilisers, pesticides and livestock feed. Cuba’s agricultural output subsequently dropped by almost 40%, and its sugar harvests, upon which it was dependent for export revenue, by 60%. Overall calorific intake fell by 30%. By 1993, the nation was on the brink of a huge food crisis. The natural resource base, and especially the genetic resources and soils, were also in a critically poor state of health due to years of industrialised exploitation. Added to all this, the United States tightened its trade sanctions over the island.

International reporting of the 1990s indicated that Cuba had managed to overcome this crisis through becoming more self-sufficient in food, and did so through implementing an ecological agricultural production system on a national scale. This system included the substitution of imported agrochemical inputs with locally produced biological pesticides and fertilisers, the substitution of petrol-driven traction with oxen, the re-introduction of ecological husbandry techniques such as inter-cropping and rotations, and the development of organic urban gardens. These reports were of interest, for if such a change had been achieved, within only a decade, it would have far reaching implications for other countries and international efforts to increase food security through more sustainable, ecologically-based agricultural approaches.

The central lines of enquiry of this thesis are fourfold: first, the nature of the post-crisis production system(s) in operation in Cuba at the end of the 1990s; second, the coping strategies of the agricultural sector in developing and maintaining these systems; third, the specific factors involved in shaping the extent of more ecologically sustainable systems; and fourth, the strategies employed to resolve food security for the population in the context of the petroleum-scarce agriculture and food system. The enquiry is contextualised by discussion on the factors that trigger the uptake of, and transition toward, low-petroleum-based production systems, perspectives on institutional processes in managing adaptation and change, and contemporary concerns in food security including debate around the efficacy of ecological agriculture. A modified rural livelihoods systems approach is used to analyse the farming and food sectors in Cuba, whereby the internal and external forces and factors affecting the coping strategies of individuals and institutions, and their interplay in the resource-scarce situation, can be identified. This framework captures the role of centralised government in the country, and its subsequent moves toward management decentralisation.

Gathering information to analyse the production and food system over a whole, and relatively secluded, country was a complex task. Using an exploratory and opportunistic research approach, empirical data was collected in two main fieldwork phases during the years 1999 and 2001.

Undertaking research in Cuba required government permission, and this was granted by Cuba's Ministry of Higher Education, to work under the auspices of a new and innovative plant breeding programme. The first fieldwork opportunity looked at the case of seed and cropping systems on three farm co-operatives in the province of Havana. Following this, the second opportunity led to a broader study of agricultural coping strategies in a wider range of farm co-operatives over three provinces in Cuba. In total, 415 interviews, meetings and survey responses were undertaken. This included 86 farmers from 37 different farming units, as well as extension, research and managerial staff within government ministries and NGOs, and civil society. The field opportunities provided for purposeful sampling amongst farmers and institutional actors, with little secondary information available on national level statistics, institutional reports or scientific publications. For this, and other reasons, a descriptive, largely qualitative analysis was developed which reflected the contrasting perspectives encountered.

The evidence from this research shows that claims concerning ecological production in Cuba were to some extent exaggerated. By 1998, fertiliser and pest control inputs were increasing on an annual basis, although these levels were far less than ten years previously. Seventy five percent of farmers interviewed in this research were using chemical fertilisers, and 65% were using chemical pesticide and disease control measures. A further 83% would use more of these inputs if they were available. Yet at the same time, applications of worm humus and compost ran to 600,000t, and biological control agents were used over 900,000ha. A similar percentage of farmers would use more biological controls if they were available. In other words, industrialised, low-input and ecological agriculture co-existed at farm, municipal and provincial levels, and this in rather a patchwork effect. State agricultural policy focused on integration, and included the upscaling of successful small-farmer strategies that had shown to be the most resilient during the critical early part of the decade. Scarce agrochemical inputs were rationed by the State for use on certain priority crops, in certain priority farms and regions. For the rest, production was based largely on the substitution of chemical for biological inputs, and on zero-input use, with just a small number of farms and projects running along intentionally ecological lines, including urban agriculture. Yet both research and practice was showing that ecological production approaches were able to equal or outperform previous industrialised ones in the tropical context, both economically and environmentally.

This diversification of the production base was part of Cuba's overall strategy to successfully head-off the threat of long-term food shortages, and to meet its political commitments to maintaining food security for all citizens. Other parts of the strategy which contributed to this commitment included the provision of safety nets (through social food programmes), the emphasis of self-provisioning at farm, municipal, provincial and national levels, and localisation of distribution, storage and processing systems. Decentralisation of State land holdings, increased access to land, and emphasis on individual and community responsibility have all played a part in this, as has investment in more appropriate agricultural research, extension and training. This has occurred within a framework in which the State organises detailed production plans, and in which priorities remain focused on feeding the population over market liberalisation whether at the level of the individual farmer or of national import and export strategies. Yet in going through this massive learning process, institutions have become, on the whole, more responsive to farmers' needs, and have shown flexibility in balancing the centralised co-ordination approach with some appropriate market mechanisms. As a result, agricultural production doubled for staple crops between 1994 and 1999, calorific availability increased by 25%, wages for agricultural workers tripled, yet at the same time subsidies to the agricultural sector were reduced dramatically. By the end of the decade, the country was able to meet a far higher proportion of domestic food needs than at any time in its recent history and stimulate a far more innovative and forward looking agricultural sector.

Cuba has managed to turn around a serious and nation-threatening crisis through an innovative and pragmatic mix of measures in its agricultural and food sectors. This is a significant achievement, particularly in light of the failure of the world community and individual member states to come close to meeting the less ambitious Millennium Development Goals, of halving the number of food-insecure people in less developed countries. This achievement contains several other lessons. First, given the political will, food security may be achieved, even within the context of a crisis of production. Cuba shows the importance of the physical enactment of such will, in this case through a number of cross-sectoral policies and mechanisms, at national, regional and municipal levels. Second, it shows that ecologically-oriented agriculture can play a significant role within a nation's food security policy. Whatever its farming approach, Cuba has fed its people, but the widespread benefits and technical feasibility of ecological production are becoming clearer in the country. This is particularly relevant in the light of current patterns of over-consumption of fossil fuels and large contribution that agriculture makes to such consumption. If the predicted supply crisis ever materialises, Cuba's example shows how this might be addressed.

Yet similar to most other countries, Cuba still has challenges to confront in its agricultural and food sectors, and those identified in this thesis include the continued, though lessened, reliance on food aid and imports, the lingering feeling of food insecurity amongst the population, the resurgence of obesity to above pre-crisis levels, and the continued high levels of pesticide residue on crops still targeted for their use. The crisis had called for a survival strategy of maximising production, but as Cuba proceeds into a less vulnerable situation, there are signs that it may increasingly orientate policy support toward a more ecological agriculture, which would avoid further degradation of the country's natural resource base and, arguably, be compatible with its political strategy which places priority on food security rights and social issues.

Cuba is interpreting ecological agriculture in is own unique way, characterised by integrated, diverse production systems which include the smart use of agrochemicals alongside domestically-produced biological inputs, but which place more priority in achieving equilibrium and high yields, and which are underpinned by long-term stability over land tenure and financial reward. Several factors constrain the further expansion and mainstreaming of this approach, including the lack of resources – both physical and knowledge-based - and of a still inconclusive policy direction, the persistence of 'industrialised' thinking, misperceptions which undermine the potential of ecological agriculture in both the production and institutional support sectors, and the need for increased support by pioneering groups and individuals to lead such an expansion. This thesis concludes by suggesting ways in which these challenges may be overcome, based on evidence and outlooks from the field. What is clear is that a lack of availability of agrochemicals and petrol is insufficient to fully drive through such a change; that institutional will, and education, are also necessary requirements.

RESUMEN

El objetivo de ésta investigación, es contribuir al entendimiento y desarrollo de los sistemas agrarios de alimentación màs sostenibles, capaces de responder a múltiples objetivos, de seguridad alimentaría,medioambiente, salud y uso de recursos renovables. Lo cual se pretende mediante el análisis descriptivo de las experiencias en Cuba durante los años noventa, cuando ésta se encontró ante el conflicto de hacer frente a una dramática pérdida en inputs agrarios e importación de alimentos, de los cuales habían dependido sus sistemas de producción y alimentación. Con tal propósito,esta tesis examina analíticamente el cambio a nivel nacional que se produjo en Cuba hacía sistemas de producción agrarian y alimentación más independientes. Es intención de esta misma contribuir al debate que prosigue sobre agricultura sostenible y políticas de seguridad alimentaria en relación con la disminución de los suministros de combustible fósil. Por tanto, de importancia o aplicación para Cuba u otros países.

Cuba nunca había tenido autonomía sobre su sistema alimentario.Antes de la revolución de 1959, estaba sujeta a un modelo de producción agrarian colonial, en el que las mejores tierras se encontraban en pocas manos extranjeras, y sus cultivos orientados a la exportación. Desde los años sesenta, y en adelante, Cuba comenzó a depender altamente del acuerdo mercantile favourable establecido con 'Council of Mutual Economic Assistance, CMEA' de los países soviéticos. Bajo este acuerdo, Cuba recibiría precios por encima de mercado por su azúcar, y obtendría los inputs necesarios para manejar un sector agrario altamente especializado e industrializado, al mismo tiempo dependería de la importación de muchos productos alimenticios esenciales.

Cuando se produjo el colapso de CMEA, en 1989, Cuba perdió muchos de estos suministros esenciales, la mitad de su abastecimiento en diesel y alimentos, 3/4 partes de su combustible, fertilizantes químicos, pesticides y piensos. Como consecuencia los outputs de la agricultura cubana se redujeron en un 40% y la cosecha de azúcar de la cual dependía sus ingresos de exportación en un 60%. En su totalidad, el consume calorífico descendió un 30%. En 1993, la nación estaba al borde de una gran crisis alimentaria. La base de recursos naturales, especialmente los recursos genéticos y los suelos, se encontraban del mismos modo en un estado críticamente pobre debido a los años de explotación industrial.

Añadido a todo esto, los Estados Unidos ceñían aún más, sus sanciones comerciales sobre la isla. Documentos internacionales de los años noventa, indicaban que Cuba había conseguido pasar esta crisis siendo más autosuficiente en alimentos, mediante la transformación hacía un sistema ecológico de producción agrarian a nivel nacional. Este sistema incluye la sustitución de los inputs de agroquímicos importados por pesticidas y fertilizantes biológicos producidos localmente; la sustitución de maquinaria de tracción con uso de combustible por maquinaria de tracción animal, la reintroducción de técnicas de ecológicas de labranza como la asociación de cultivos y las rotaciones, y la puesta en marcha de huertos urbanos.

Estos informes eran de interés, porque si tal cambio había podido lograrse en tan solo una década, estas experiencias podrían ser de gran transcendencia para otros países, así como servir de guía para los esfuerzos internacionales de incrementar la seguridad alimentaria a través de enfoques agrarios ecológicos más sostenibles. Las lineas centrals de información esta tesis son cuatro fundamentalmente: 1) la naturaleza de los sistemas de producción postcrisis, operantes en Cuba en los años noventa; 2) las estrategias con las que el sector agrario hace frente para la puesta en marcha y mantenimiento de estos sistemas; 3) los factores específicos implicados en la expansion de los sistemas ecológicos sostenibles; 4) las pautas adoptadas para asegurar la alimentación de la población en unos sistemas agrario y de alimentación deficitarios en combustible.

La investigación se contextualiza por medio de la discusión sobre los factores desencadenantes, y su transmisión hacía sistemas de producción basados en el bajo uso de combustible, las perspectivas de los procesos institucionales en el manejo de la adptación y el cambio, las inquietudes contemporáneas sobre seguridad alimentaria, incluidas en el debate actual sobre la eficacia de la agricultura sostenible.

La aproximación a un sistema de vida rural modificado es empleado para analizar los sistemas agrarios y de alimentación en Cuba, donde se pueden identificar las fuerzas internas y externas, los

factores que influyen en el funcionamiento de las estrategias individuales e institucionales, y el papel que desempeñan en una situación carente de recursos. Este marco, recoge la function del gobierno centralizado en el país, y los movimientos posteriors hacía un manejo descentralizado. Recopilar información para analizar todo el sistema de producción y alimentación del país era una tarea compleja. Aprovechando una oferta oportunista de investagación, datos empíricos de campo fueron tomados en dos fases principales durante los años 1999 y 2001.

Para llevar a cabo trabajos de investigación en Cuba se requiere permiso del gobierno, el cual se consiguió a través del Ministerio de Educación, bajo el hospicio del el desarrollo nuevo e innovador de un programa de reproducción de material vegetal. El primer trabajo de campo se dedicó al estudio de semillas y sistemas de cultivo en tres cooperatives agrarias de la provincial de la Habana. A continuación, en la segunda occasion se realizó un trabajo más extensor sobre las estrategias de transformación en un número mayor de cooperativas agrarias, en tres provincias de Cuba. En total se realizaron 415 entrevistas, reunions y encuestas de interés, las cuales incluyeron a 86 agricultores, de 37 grupos agrícolas y extensions de terreno diferentes, directivos pertenecientes a los ministerios del gobierno,personal investigador, ONGs, y la sociedad civil.

Las oportunidades de trabajo proporcionadas por el resultado del muestreo entre agricultures y personal institucional; y la escasez de información disponible en estadísticas nacionales, informes institucionales o publicaciones científicas, junto a otras rezones, justificaban el desarrollo de un análisis qualitativo mayor que pudiese reflejar las perspectivas de contraste encontradas.

La evidencia de esta investigación muestra que la reivindicación acerca de la producción ecológica en Cuba era hasta cierto punto exagerada. Hacía 1998, los inputs empleados para el control de plagas y los fertilizantes estaban aumentando anualmente, aunque sus niveles eran mucho menores que durante los diez años anteriores. El 75% de los agricultures entrevistados estaban utilizando fertilizantes químicos y el 65% pesticides de síntesis química y medidas de control de enfermedades de los cultivos. Un 83% usaría más de estos inputs si estuviesen disponibles. Al mismo tiempo, las aplicaciones de humus de lombriz y compost se situaban en 600.000t y agents de control biológico eran empleados en 900.000 ha de terreno. Un porcentaje similar de agricultures usaría más controles biológicos si estuviesen a su alcance. En otras palabras, a nivel de campo, municipio y provincial coexistían industrialización, sistemas de bajo inputs y agricultura ecológica, a modo de efecto mosaico.

La política del agraria del estado se centró en la integración y la transmission a mayor escala de las estrategias de éxito empleadas por pequeños agricultures que habían mostrado ser más fuertes durante la crisis a principios de la década.

Los escasos inputs de agroquímicos fueron racionados por el estado para su uso en cultivos prioritarios, zonas de cultivo prioritarias y regions en especial. Para el resto la producción estaba principalmente basada en la sustitución de químicos por inputs biológicos, y "cero-inputs", con tan solo un pequeño número de fincas y proyectos manejados intencionalmente bajo lineas totalmente ecológicas, incluyendo los huertos urbanos.

Aún así, la investigación y práctica mostraban que acercamientos hacía la producción ecológica eran capaces de igualar o superar a los anteriores sistemas industrializados de producción tanto económica como medioambientalmente, en el contexto tropical de Cuba.

La diversificación de la base de producción fue parte de la estrategia global de Cuba para afrontar la amenaza de un largo período de escacez alimentaria para los ciudadanos. Como parte de ella se crearon redes de seguridad (a través de programas sociales de alimentación) y influyó en todo ello, el enfásis por el autoabastecimiento a nivel de finca,municipio, provincial y nación, la localización, distribución y almacenamiento de productos y sus sistemas de procesado, el enfásis por el autoabastecimiento a nivel de finca, municipio, provincial y nación; y la localización, distribución, almacenamiento y los sistemas de procesado.

La descentralización de las tierras del estado, incrementó el acceso a la tierra. El enfásis individual y la responsabilidad comunitaria jugaron tambien un papel importante en todo, asi como la inversion en investigación agraria más apropiada y su extension y la educación respecto a ello.
Todo ello, se ha ido desarrollando en un marco de trabajo en el cual el Estado organiza en detalle los planes de producción, en los cuales el objetivo prioritario es alimentar a la población sobre la

liberalización del mercado en lugar de en estrategias de importación-exportación a nivel individual o nacional.

Siendo así, a través del proceso de aprendizaje, las instituciones se han sensibilizado mas con las necesidades de los agricultures y han mostrado mas flexibilidad en el mantenimiento equilibrado de la coordinación central y apropiados mecanismos de mercado. Como resultado la producción agraria de cultivos básicos se duplicó entre 1994 y 1999, la cantidad calorífica disponible aumentó un 25 %, el salario de los trabadores agrarios se triplicó y disminuyeron drásticamente los subsidios agrarios. Al final de la década, el país era capaz de mantener una proporción de las necesidades alimenticias domésticas superiores a las anteriores de toda su historia reciente y estimular un sector agrario bastante más innovador y de futuro.

Cuba ha superado la amenaza de una crisis nacional, a través de una mezcla de medidas innovativas y pragmáticas en su sector agrario y alimentario. Es un logro significante, particularmente en sacar a la luz el fracaso de la comunidad mundial y individualmente sus gobiernos miembros en acercarse al encuentro de ‘Los Objetivos de Desarrollo del Milenio’menos ambiciosos de reducer a la mitad el número de personas en países en desarrollo que padecen de inseguridad alimentaria. Este logro,contiene además lecciones: 1ª, una vez que así lo quiera un gobierno,la seguridad alimentaria se puede alcanzar,incluso sin encontrarse en el contexto de una crisis de producción. Cuba muestra la importancia física de promulgar tal desarrollo, en este caso a través de mecanismos y políticas de cruce sectorial a nivel nacional,regional y municipal. 2ª, muestra que la agricultura orientada de manera ecológica puede jugar un paple significante en la política de seguridad alimentaria de una nación. Cualquiera que sea su alcance agrario, Cuba ha conseguido alimentar a su población. La generalización de los beneficios y la viabilidad técnica de los sistemas de producción ecológicos se están viendo mas claros en el país. Lo cual se hace de particular relevancia en dar luz a los modelos actuales de sobreconsumo de combustible fósil y la gran contribución que la agricultura hace de tal consume, si la predecida crisis de abastecimiento se materializace, Cuba sería un ejemplo a seguir en el manejo de la misma.

Como en otros países,Cuba aún tiene que afrontar cambios en su sistema agrario y de alimentación y aquellos identificados en esta tesis incluyen la reanudación, si bien en menor medida, de la dependencia en ayuda alimentaria e importaciones, la sensación persistente de inseguridad alimentaria entre la población y el resurgimiento existente de la obesidad por encima de los niveles anteriores a la crisis, y los altos niveles de residuos de pesticides que aún se encuentran en los cultivos derivado de su uso.

La crisis ha proporcionado una estrategia de sobrevivencia de maximización de la producción, pero tal y como Cuba se va aproximando a una situación menos vulnerable, muestra signos de aumentar la orientación de su política de apoyo hacía una agricultura mas ecológica, la cual evite la degradación de los recursos naturals básicos del país, que se podrian decir compatibles con su política de priorización en seguridad alimentaria y asuntos sociales.

Cuba está interpretando la agricultura ecológica de un modo único, caracterizado por sistemas de producción integrados diversos, que incluyen el uso exclusive de agroquímicos, a la misma vez que productos biológicos de elaboración doméstica, y que prioriza el logro de un equilibrio y altas producciones, los cuales se basan en la estabilidad sobre la ocupación de la tierra y su retribución financiera.

Lo que está claro, es que la falta de agroquimicos disponibles y el combustible, son insuficientes para realizar el cambio, y que el deseo del gobierno y la educación son tambien requrimientos necesarios.

SAMENVATTING

Het doel van dit onderzoek is bij te dragen aan de ontwikkeling van het begrip duurzame landbouw en voedselvoorziening. Deze moet in staat zijn voldoende voedselveiligheid, volksgezondheid, milieu- en duurzaamheidseisen te waarborgen. Dit is bereikt door beschrijvend onderzoek te doen naar de ervaringen van Cuba in de jaren '90. In die tijd kreeg het te maken met een extreme daling van import van diverse agrarische productiemiddelen en voedselproducten. Deze importen hadden het land in een afhankelijke positie gebracht en haar voedselvoorziening kwetsbaar gemaakt. Dit proefschrift beschrijft systematisch de globale verandering richting een meer zelfvoorzienende landbouw- en voedselsector wat zich in Cuba in de negentiger jaren voltrok. Het is tevens bedoeld om een bijdrage te leveren aan de nog steeds actuele discussie over de rol van duurzame landbouw en -voedselvoorziening in de context van afnemende toevoer van fossiele brandstof. Als zodanig is het relevant voor zowel Cuba als andere landen.

Cuba heeft nooit zeggenschap over haar voedselvoorziening gehad. Voorafgaand aan de Revolutie van 1959 was het afhankelijk van een koloniaal lanbouwsysteem, waarbij de beste gronden in handen waren van een kleine groep buitenlandse ondernemingen, geörienteerd op de export van cash-crops. Vanaf 1960 werd Cuba in toenemender mate afhankelijk van handel met leden van de *Raad van Wederzijdse Economische Bijstand* (*RWEB)* - ookwel bekend onder het acroniem *COMECON* of *CMEA*- van het voormalig Soviet-blok. Onder dit verdrag ontving Cuba hogere marktprijzen voor haar suiker in ruil voor inputs om een hoog geïndustrialiseerde en gespecialiseerde landbouw sector draaiende te houden. Daarbij maakte het haar voedselvoorziening tegelijkertijd afhankelijk van import. Toen de *COMECON* in 1989 ineenstortte, verloor Cuba veel van deze belangrijke externe toeleveranciers: inclusief de helft van haar supply aan diesel en voedselimporten, en drie-kwart van haar benzine-, kunstmest-, pesticide- en diervoedertoevoer. Cuba's landbouw-output daalde dientengevolge met ongeveer 40% en de suikeroogst, waarvan het afhankelijk was voor haar exportinkomsten, daalde met 60%. Het gemiddelde energieverbruik daalde met ongeveer 30%. Per 1993 was de natie op de rand van een enorme voedselcrisus. De natuurlijke hulpbronnnen, in het bijzonder zaaigoed en landbouwgronden waren in een kritieke toestand vanwege de jarenlange industriële roofbouw. Bovendien verergerde de Verenigde Staten de situatie nog eens extra door oplegging van een handelsembargo voor het eiland.

Internationale vakliteratuur uit de negentiger jaren geeft aan dat Cuba in staat bleek deze crisus te beheersen door meer zelfvoorzienend te worden op het gebied van voedselvoorziening. Dit deed zij door het op nationale schaal invoeren van een ecologisch geörïenteerd landbouwproductiesysteem. Dit systeem omvatte de vervanging van geïmporteerde agrochemische inputs door lokaal geproduceerde biologische pesticiden en meststoffen, de vervanging van gemotoriseerde tractie door ossen, de herintroductie van ecologische veehouderijtechnieken zoals combinatieteelt, teeltrotatie en de ontwikkeling van stedelijke biologische groentetuinen. Deze publicaties zijn van belang omdat indien deze verandering zich slechts binnen 10 jaar heeft voltrokken, dit een belangrijke les impliceert voor het verbeteren van duurzame, ecologische landbouw elders.

Dit proefschrift is gecentreerd rond vier onderzoeksthema's: ten eerste, de aard van de in gebruik zijnde landbouwsystemen, die na de voedselcrisus eind van de jaren 90 in Cuba aanwezig waren; ten tweede, de beheersstrategieën van de landbouwsector in het ontwikkelen en onderhouden van deze systemen; ten derde, de specifieke factoren die van belang zijn voor ontwikkeling ecologische, duurzame landbouw; en ten vierde, lopend beleid voor het oplossen van het voedselprobleem tegen de achtergrond van een sterk brandstof-gelimiteerde landbouw en voedselproductie. Het onderzoek behandelt factoren die aanzetten tot, en transitie naar een brandstof-gelimiteerd productiesysteem, geeft inzicht in institutionele processen van die aanpassing en verandering, en behandeld vragen over voedselveiligheid in samenhang met de effectiviteit van ecologische landbouw. Een aangepast, ruraal economisch levensonderhoudssysteemmodel wordt gebruikt voor deze analyse. Hierbij worden de interne en externe krachten, die van invloed zijn op de overlevingsstrategieën van individuen en instituties in een energie-schaarse omgeving geïdentificeerd. Dit beslaat tevens de rol van de centrale overheid, en haar streven naar decentralisatie.

Het verzamelen van informatie om de landbouwproductie en het voedselvoorzienings-systeem te analyseren in een geheel en tamelijk geïsoleerd land, was een ingewikkelde klus. Gebruikmakend van een inventariserende en opportunistische onderzoeksbenadering, werden emperische gegevens verzameld tijdens twee veldwerk perioden gedurende de jaren 1999 en 2001. Het doen van onderzoek in Cuba vereiste toestemming van de overheid. Dit werd toegekend door het *Ministerie voor Hoger Onderwijs* om onder toezicht te mogen werken bij een nieuw en innovatief plantvermeerderings-programma. Bij de eerste veldwerkperiode keek ik naar een 'case' van zaad- en teeltsystemen op drie coöperatieve boerderijen in de provincie Havanna. In het vervolg hierop, leidde naar de tweede mogelijkheid tot het doen van een bredere studie naar beheersstrategieën bij een grotere groep landbouwcoöperatieven in drie provincies in Cuba. In totaal werden 415 interviews, ontmoetingen en enquêtes afgenomen. Deze omvatte 86 boeren afkomstig van 37 verschillende agrarische cooperatieve productieunits, samen met voorlichtings-, onderzoeks- en directiestaf binnen ministeries, niet-governmentele organisaties en burgerinitiatieven. De veldomstandigheden boden geen gelegenheid voor een a-selecte trekking uit de populatie boeren en institutionele actoren. Verder was er weinig secondaire beschikbare informatie op gebied van nationale statistieken, institutionele rapporten of wetenschappelijke artikelen. Mede hierdoor werd een veelal kwalitatieve analyse ontwikkeld die ruimte bood voor tegengestelde meningen.

Feiten uit dit onderzoek tonen aan dat eerder geuitte claims over dat in Cuba landbouwproductie op ecologische grondslag zou plaatsvinden, tot op zekere hoogte overdreven waren. Vanaf 1998 stegen verbruik van kunstmest en gewasbeschermingsmiddelen jaarlijks al lagen de niveaus veel lager dan tien jaar daarvoor. Vijf-en-zeventig procent van de geïnterviewde boeren in dit onderzoek, gebruikte kunstmest en 65% gebruikte chemische pesticiden en gewasbeschermingsmiddelen. Een verdere 83% zou meer van deze inputs gaan gebruiken indien ze beschikbaar zouden zijn. Daarentegen liep tergelijkertijd het verbruik van wormhumus en compost op rond de 600.000 ton en bedroeg het gebiedsoppervlak waar biologische bestrijdingsmiddelen werden gebruikt, rond de 900.000 ha. Een vergelijkbaar percentage boeren zou meer biologische bestrijdingsmiddelen gebruiken indien deze aanwezig waren. Met andere woorden: geïndustrialiseerde, low-input and ecologische landbouw, co-existeerden op boerderij-, gemeente- en provinciaal niveau, en dit her en der verspreid over het land. Het staatslandbouwbeleid richtte zich op integratie en omvatte het opschalen van 'succesvolle kleine-boer'-strategieën, die zich het meest duurzaam hadden bewezen gedurende het kritieke, vroegste deel van het decenium. Schaarse petro-chemische input werden geransoeneerd door de Staat, bestemd voor gebruik op enkele geprioriseerde gewassen bij een aantal speciaal geselecteerde boerderijen en regio's. Voor de rest was productie voor het grootste gedeelte gebaseerd op vervanging van chemische door biologische inputs en nul-input. Slechts een klein aantal boerderijen en projecten werkten op ecologische grondslag, met inbegrip van urbane landbouw. Desalniettemin, lieten zowel onderzoek als praktijk zien dat de ecologische productieaanpak, de voorheen geïndustrialiseerde productie minstens evenaarde of zelfs overtrof- dit zowel in economisch opzicht als met oog op het milieu, in een tropische setting.

De diversificatie van de productiebasis was deel van Cuba's overall strategie naar het succesvol overwinnen van het gevaar voor langdurige voedselschaarste, en haar politieke wil om voedselvoorziening voor al haar burgers te waarborgen. Andere aspecten van deze strategie, die bijdroegen aan deze politieke vasthoudendheid, omvatte de opzet van sociale vangnetten (door middel van voedseldistributie-programma's), de nadruk op zelfvoorzienendheid, zowel op boerderij-, gemeente-, provincie- en nationaal niveau, en het opzetten van distributie, voedselverwerking en conserveringssystemen. Decentralisatie van agrarische Staatsbedrijven verbeterde toegang tot land. Nadruk op het verantwoordelijkheidsgevoel van zowel het individu als de groep heeft allemaal hierin een rol gespeeld, als mede investeringen in meer toegepast landbouwkundig onderzoek, voorlichting en training. Dit vond plaats binnen het kader waarin de Staat gedetaileerde productieplannen regelt en waarin het voeden van de bevolking voorrang blijft houden boven marktliberalisatie. Dit is ongeacht of het nu gaat om de individuele boer of om de nationale import- of exportstrategieën. Bij het doorvoeren van dit enorme leerproces, zijn desalniettemin instituties door de bank genomen meer 'klantgericht' naar de behoeften van boeren gaan luisteren. Hierbij waren ze pragmatisch in het zoeken naar balans tussen opgeleged centraal beleid en gebruikmaking van geschikte marktmechanismen. Als gevolg verdubbelde de agrarische productie voor voedselgewassen tussen 1994 en 1999, nam de energiewaarde met 25% toe, verdrievoudigde het inkomen van agrariërs, terwijl tegelijkertijd subsidies aan de landbouwsector drastisch werden verlaagd. Aan het einde van het decenium was het land in staat een veel hogere fractie van haar huishoudelijke voedselbehoeften te dekken dan enig andere moment in haar recente geschiedenis. Daarbij stimleerde het de ontwikkeling van een meer innovatieve en op de toekomst gerichte landbouwsector.

Cuba is in staat gebleken een ernstige nationale crisus het hoofd te bieden door invoering van een innovatieve en pragmatische maatregelenmix voor haar landbouw- en voedselsectoren. Dit is een belangrijke prestatie, vooral in het licht van het onvermogen van de wereldgemeenschap en individuele landen om zelfs maar in de buurt te komen van de veel minder ambitieuze Millenium Ontwikkelingsdoelstellingen waarbij het doel is het halveren van het aantal voedselgeriskeerden in de minder ontwikkelde landen. Deze prestatie bevat daarnaast een aantal andere lessen: ten eerste, onder voorbehoud van politieke wil, kan voedselveiligheid worden bereikt zelfs tegen de achtergrond van een lanbdbouwproductiecrisus. Cuba laat het belang van de fysieke daadkracht van die wil zien, in dit geval van een aantal sectoroverstijgende beleidsstrategieën op nationaal, regionaal en gemeentelijk niveau. Ten tweede laat het zien dat ecologisch-geörïenteerde landbouw een significante rol kan spelen bij een nationale voedselveiligheidsstrategie. Afgezien van de exacte aard van haar landbouwaanpak, heeft Cuba haar bevolking gevoed terwijl de voordelen en technische haalbaarheid van ecologische productie over heel het land evident zijn. Dit is met name van belang in het licht van huidige overconsumptie van fossiele brandstoffen en het relatief grote aandeel van de landbouw daarin. Als de voorspelde oliecrisus ooit werkelijkheid wordt, laat het voorbeeld van Cuba zien hoe dit het hoofd zou kunnen worden geboden.

Desalniettemin heeft Cuba, vergelijkbaar met vele andere landen, nog een belangrijke uitdaging voor wat betreft haar landbouw- en voedselsector. Deze -zoals geïdentificeerd in dit proefschrift-, omvatten de nog steeds voordurende alhoewel kleiner wordende afhankelijkheid van voedselhulp en –importen, het sluimerende gevoel onder de bevolking van gebrekkige voedselvoorziening, het opnieuw verschijnen van obisiteit tot niveaus van voor de crisus en nog steeds hoge niveau's van pesiticidenresiduen op consumptiegewassen. De crisus heeft aangezet tot een overlevingsstrategie van het maximaliseren van de productie. Maar terwijl Cuba zich verder ontwikkelt naar een minder kwetsbare positie, lijkt het erop dat het zich meer zal oriënteren op een ecologischer landbouwbeleid. Dit beleid beoogt het tegen gaan van een verdere degradatie van 's lands natuurlijke hulpbronnen en –alhoewel dit open voor discussie is- in lijn te liggen met haar politieke overtuiging dat nadruk legt op het veilig stellen van sociale rechtvaardigheid en basisvoedselvoorziening voor iedereen.

Cuba vult het begrip ecologisch landbouw op haar eigen unieke wijze in. Het wordt gekarakteriseerd door geïntegreerde en gevarieerde productiesystemen. Zij maakt daarbij verantwoord gebruik van chemische gewasbeschermingsmiddelen in combinatie met biologische huis-en-keuken middelen. Daarbij wordt meer waarde gehecht aan het bereiken van ecologisch evenwicht dan aan hoge opbrengsten. Verder wordt de landbouw gekenmerkt door hoge mate van stabiliteit van grondeigendom en individuële, financiële beloning.

Diverse factoren beperken de verdere uit- en verbreiding van deze benadering, met inbegrip van het gebrek aan middelen- zowel in materieel opzicht als qua know-how- en het ontbreken van een nog steeds niet-duidelijk uitgekristaliseerd beleid en de hardnekkigheid van 'industrieel denken', misvattingen die het potentieel van ecologische landbouw ondermijnen, zowel aan de productiekant als aan de kant van de ondersteunende diensten. Daarnaast is er een toenemende behoefte aan een avant-garde om zo'n expansie te leiden.

Dit proefschrift besluit met een aantal voorstellen hoe deze problemen zouden kunnen worden opgelost, gebaseerd op feiten en ervaringskennis uit het veld. Wat duidelijk is, is dat het gebrek aan gewasbeschermingsmiddelen en olie niet genoeg is om deze problemen vanzelf op te lossen; institutionele wil en voorlichting zijn hierbij mede vereist.

ACADEMIC BIOGRAPHY

Julia Emma Wright was born in Bromley, Kent, England, in 1963. She graduated from the University of Wales, Carmarthen, in 1985, with a B.A. in Studies in the Rural Environment. Subsequent academic studies comprised a Postgraduate Diploma in Land and Water Management from Silsoe College, University of Cranfield, in 1986, and later an MSc. in Sustainable Agriculture from Wye College, University of London, in 1993. Her professional experience in agriculture and development, including in Mexico, Peru and Brazil, for the UK Department for International Development and the CGIAR network, as well as her involvement in organic and permaculture networks, provided the backdrop for embarking on this doctorate research which was undertaken at Wageningen University in the Group of Communication and Innovation Studies, between 1998 and 1993. In 1993, she took up the post of Manager of the International Development Programme of Henry Doubleday Research Association (HDRA), Ryton Gardens, Coventry. This Programme undertakes development research and consultancy, and provides information and advice, on organic agriculture in the tropics.

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