Cuba's nationwide experi

In November 1992, a 20 member international scientific delegation organised by "Global Exchange" travelled to Cuba. The purpose of the mission was to report on changes that had taken place in Cuban agriculture since the 1990 collapse of the nation's trading relations with the socialist countries. The following information is based on the report of this mission "Two Steps Backward, One Step Forward. Cuba's Nationwide Experiment with Organic Farming" edited by Peter Rosset and Medea Benjamin.

Peter Rosset and Medea Benjamin

Before the collapse of trade relations with the socialist countries, Cuba's economy was characterised by rapid modernisation, a high degree of social equity and welfare and strong external dependency. Cuban agriculture was based on large-scale, capital intensive monoculture of agroexports and heavily depended on imported agrochemicals, hybrid seeds, machinery and petroleum. Some 80% of agricultural land was cultivated by relatively large state farms. Because of the favourable terms of trade for sugar Cuba got from the Soviet Union, its production far outweighed that of food crops. In the Cuban diet, 57% of the total calories was supplied by imports. Import coefficients for fertilisers, pesticides, herbicides and animal feed were higher than 90%.

Conversion

When trade relations with the socialist countries collapsed, pesticide imports dropped by more than 60%, fertiliser imports by 77% and the availability of petroleum for agriculture dropped by half. Food imports also fell back by more than half. Suddenly, an agricultural system almost as modern and industrialised as that of California in the USA faced a dual challenge: the need to essentially double its food production while decreasing its use of external inputs by more than half and at the same time maintaining export crop production.

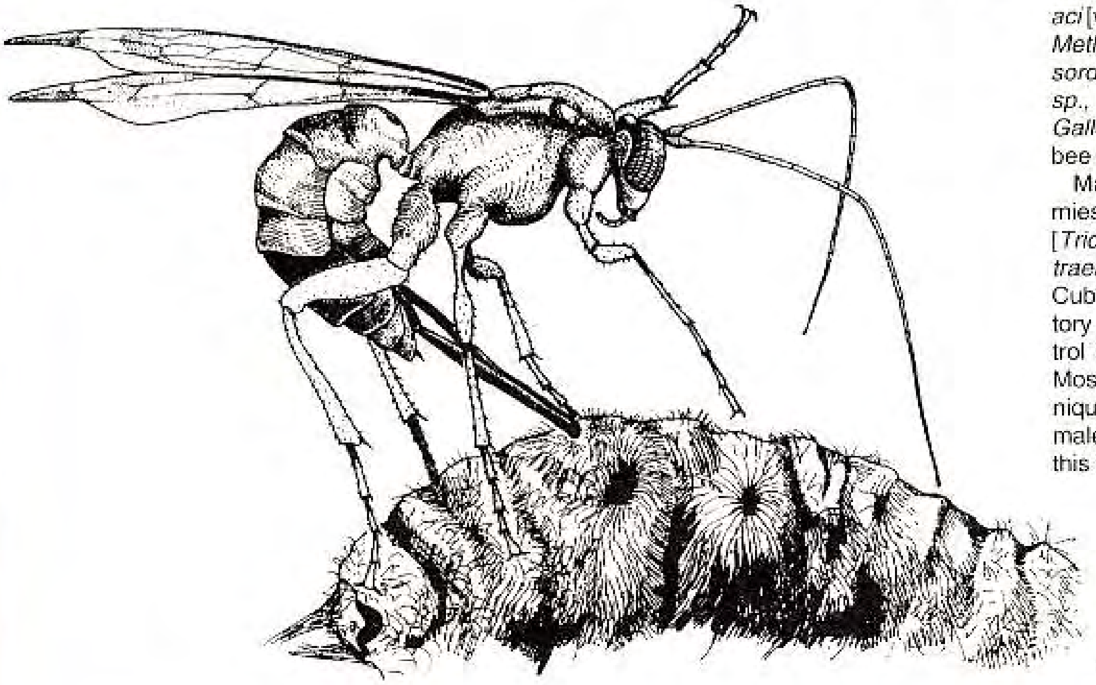
Cuba today is undergoing a large-scale conversion from export oriented, external-input dependent conventional agriculture to self-reliant, knowledge intensive organic and low-external-input agriculture.

The Alternative Model, as put forward in Cuba, promotes crop diversity rather than monoculture, organic fertilisers and "biofertilisers" instead of chemical ones and biological control and "biopesticides" instead of synthetic pesticides. Tractors are replaced by animal traction and planting is planned to take advantage of seasonal rainfall patterns in order to reduce reliance on irrigation. This shift requires the reincorporation of the population into agriculture, through both their labour as well as their knowledge of traditional farming techniques and their active participation in the generation of new, more appropriate farming systems.

Fortunately, Cuba was not totally unprepared to face the critical situation that arose after 1989. It had, over the years, emphasised building up human resources and therefore had a cadre of scientists and researchers who could come forward with innovative ideas to confront the crisis. At the beginning of the 1980s, within the agricultural ministry and the universities there were scientists who criticised the Cuban conventional model of agricultural development for its dependence on foreign inputs and its tendency to produce environmental degradation, like pesticide resistance and soil erosion. At a relatively early date scientists began to reorient their research toward alternatives, such as biological control of insect pests and biofertilisers. In 1985, after many years of research, those efforts were transformed into a major campaign and biological control began to replace pesticides as the conceptual basis for pest management.

After 1989, the new state policy to develop alternative agriculture increased the focus on integrated pest management like never before. By the end of 1991, an estimated 56% of the crop land was treated with biological controls, representing savings, after reduction of costs, of US$ 15.6 million per year. The areas that received most attention in the last few years have been the development and mass production of bioinsecticides based on insect pathogens such as *Bacillus thuringiensis* (to control eg. *Plutella xylostella* [diamond-back moth], *Erinnyis ello*, *Heliothis virescens* and *Mocis sp.*), *Beauvaria bassiana* (to control *Cosmopolites sordidus* [banana weevil], *Cylas formicarius* [sweet potato weevil], *Lissorhoptrus brevirostris* in rice and *Diatraea saccharalis* in sugarcane), *Verticillium lecanii* (to control *Bemisia tabaci* [white fly] in a wide range of crops) and *Metharhizium anisopliae* (to control *C. sordidus*, *L. brevirostris*, several *Mocis sp.*, *P. xylostella*, *D. saccharalis*, and *Galleria mellonella* [greater wax moth in bee hives]).

Mass production of insect natural enemies (mainly parasitic wasps [*Trichogramma*] and flies [*Lixophag diatraeae*]) is also being developed. The Cubans have pioneered the use of predatory ants (*Pheidole megacephala*) to control the sweet potato weevil (see box). Most recently they have worked on techniques based on mass release of sterile males to suppress pest populations, but this is still being researched. The develop-



Mass production of insect natural enemies such as parasitic wasps is being developed in Cuba.
Source: Insect Pest Control by R.Kumar

ment with organic farming

ment of natural pesticides based on plant extracts has grown in recent years, with particular interest in the neem tree. Finally, research on and use of chemical pesticides still continues, but to a limited degree.

A network of 218 Centres for the Production of Entomophages and Entomopathogens was built for decentralised "artesanal" production for local use on smaller farms. A network of over 30 brewers' yeast factories is being partly converted to mass produce biopesticides on an industrial scale for the state farms and large cooperatives.

Integrated Soil Management

Before switching to alternative agriculture, little was done to protect the soils from erosion, loss of fertility, salinisation and other forms of degradation. This is no longer the case. There is now great concern for implementing a sound and effective soil management programme that includes minimum tillage, rational fertiliser use, use of soil amendments, crop rotations and cover crops. Efforts to maintain and improve soil fertility have been based primarily on organic amendments and biofertilisers. Crushed zeolite rock is also part of the programme. Composting is now common. Urban garbage is increasingly collected, processed and used. Velvet beans, cowpeas, soybeans, sorghum and Sesbania are some of the green manures used in rotation programmes.

Nitrogen-fixing microorganisms, such as *Azospirillium*, are used to increase nitrogen availability to crops. Bacteria from the genus *Rhizobium* are used for legumes; *Azotobacter* is used for non-symbiotic N-fixation in grasses, including sugarcane. By 1991 the production of *Azotobacter* reached a level of 5 million litres, which provided 40-50% of the nitrogen needs of non-leguminous plants. Widespread use of bacteria of the genus *Bacillus* to promote the solubilisation of phosphorus is also unique to Cuba.

A vermicomposting programme started in 1986. Now there are 172 vermicompost centres that produced 93,000 tons of worm humus in 1992. The recycling goal at large pig farms is zero waste discharge. Liquid and solid waste is treated and used for a series of applications, including vermicomposting, biogas production, feed supplement, aquaculture and waterhyacinth growing to use as protein-rich animal food.

Labour mobilisation

The alternative model poses a dilemma for Cuban planners. While Cuban society is highly urbanised, currently available technologies for organic farming require more labour than the conventional practices they replace. Nowhere is this more obvious than in the national substitution of oxen for tractors, though other practices are more labour intensive as well. The short-term strategies in place to counter this problem include short- (2 weeks) and medium-term (2 years) voluntary service mobilisations of urban workers to provide supplementary farm labour and experimentation with both moral and financial incentives tied to productivity. They also have a new programme designed to promote the re-creation of a more intimate relationship between farm labourers and the land they work. Long-term efforts are geared toward the creation of attractive new communities in the countryside, which offer better housing than in the cities. It is hoped that these new communities will at least stabilise rural populations, if not actually reverse the trend toward rural-urban migration.

Biological control using ants

Based on an old practice of peasant farmers, Cuban researchers studied and further developed an elaborate and unique system of biological control of *Cylas formicarius* (sweet potato weevil) using the predatory ant *Pheidole megacephala*. The management system includes the establishment of reservoir areas where the ant is naturally abundant. In these areas, usually forested patches or areas with perennial crops, all pesticide application is prohibited. *P. megacephala* colonies are transported from the reservoirs to the fields where sweet potatoes are planted. Colonies are transferred in a variety of ways. A common one, requiring high labour input, is the use of banana stems. Banana stems are cut into pieces, which are placed on the ground in the reservoir area. Stems are baited with honey or a sugar solution and covered with a wet cloth or with banana leaves. Honey and humidity attract the ants which proceed to move their colonies to the stems. Colonised stems are then transferred to sweet potato fields where they are exposed to the sun, causing the stems to dry out and forcing the ants to relocate and construct their nests in the ground. Once there, *P. megacephala* prey on *C. formicarius* larvae.

This method controlled close to 99% of the sweet potato borer in the Pinar del Rio Province, with lower production costs and higher yields per hectare. The same control method is used in plantain production against the black plantain weevil (*Cosmopolites sordidus*), using *P. megacephala* and *Tetramorium guineense*.

Farmers participate

The de-emphasis of capital- and energy-intensive technologies requires new relationships between scientists, extension agents and farmers. The pre-existing role of scientists as generators of innovative technology packages and extension agents as conduits of their delivery to farmers is clearly changing in favour of a partnership between the three in the development and dissemination of new approaches. Towards this objective the Ministry of Agriculture now sponsors farmer-to-farmer and farmer-to-extensionist/scientist workshops in the provinces. Farmers from different regions facing similar problems are brought together for information exchange. The objective is to

- make technologies locally adapted or developed by farmers known to a broader audience
- facilitate the exchange of farmer knowledge of techniques and practices successfully used in other regions with similar crop complexes and
- promote scientific research and development of promising low-external-input innovations.

Cuban scientists have become increasingly dependent on farmer innovation and experimentation for research directions that complement their efforts to develop promising organic farming practices as well as adapt techniques developed outside the country.

Lessons for other countries

The mission of agricultural scientists and environmentalists concluded their report by stating that the experiment on agricultural alternatives currently underway in Cuba is unprecedented, with potentially enormous implications for other countries suffering from the declining sustainability of conventional agricultural production. They therefore recommend to pay close attention to the lessons we may learn from both successes and failures in Cuba.

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Reference

- Rosset P & Benjamin M. 1993. **Two steps backward, one step forward. Cuba's nationwide experiment with organic agriculture.** Global Exchange, 2017 Mission St. Rm. 303, San Francisco, CA 94110, USA. 67 pp.

Information on organic agriculture in Cuba
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