

Experiences in Participatory
Technology Development
Edited by Bertus Haverkort,
Johan van der Kamp and
Ann Waters-Bayer



## JOINING FARMERS' EXPERIMENTS

### ILEIA READINGS IN SUSTAINABLE AGRICULTURE

# JOINING FARMERS' EXPERIMENTS

Experiences in Participatory Technology Development

Edited by Bertus Haverkort, Johan van der Kamp and Ann Waters-Bayer

**INTERMEDIATE TECHNOLOGY PUBLICATIONS 1991** 

Published by Intermediate Technology Publications 103/105 Southampton Row, London WC1B 4HH, UK

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ISBN 1 85339 101 8

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#### **PREFACE**

The central role of farmers in technology generation and diffusion becomes increasingly evident to scientists and development workers, as soon as they open their eyes to it. A growing number of reports, articles and books have documented how farmers participate in formal agricultural research by contributing their knowledge and labour. This book raises the question: if the generation of appropriate technology for smallholder farming is to be a sustainable process, who should be participating in whose research?

We have collected cases in which farmers are the prime researchers, and in which representatives of formal agricultural science - be they research scientists or agricultural advisers (conventionally called extensionists) - participate. Their roles are to strengthen a continuing process of experimentation and innovation in smallholder farming communities, and to help link up farmers so that they can learn from each other - thus 'joining' experimenting farmers in two ways.

This book is itself part of a continuing process of exchanging experiences about collaboration between farmers and outsiders in exploring paths to sustainable agricultural development. Out of the workshop on 'Farmers and Agricultural Research: Complementary Methods' conducted in July 1987 by the Institute of Development Studies (IDS) at the University of Sussex, UK, emerged the book 'Farmer First' edited by Robert Chambers, Arnold Pacey and Lori Ann Thrupp and published by Intermediate Technology Publications.

A follow-up workshop on Participatory Technology Development (PTD) in sustainable agriculture was held in April 1988 by the Information Centre for Low-External-Input and Sustainable Agriculture (ILEIA) in Leusden, Netherlands. Some of the papers prepared for this workshop appeared in a special issue of the ILEIA Newsletter (October 1988) published in both English and French. Abstracts of the workshop papers appeared in the proceedings published by ILEIA in 1989.

Some papers from the Sussex workshop were published in Experimental Agriculture, Vol. 23, Part 3, edited by John Farrington of the Overseas Development Institute (ODI) in London, UK, and still others appeared as discussion papers in the ODI Agricultural Administration (Research and Extension) Network. ILEIA and ODI have continued to publish articles, network papers and abstracts of reports on participatory approaches to agricultural research (see Selected Bibliography).

This volume includes three previously unpublished papers prepared for the Sussex workshop (Chavangi & Ngugi, Abedin & Haque) and Leusden workshop (de Jager) and translations or reprints of publications collected as background material for the Leusden workshop. In addition, some of the articles on PTD which appeared in the ILEIA Newsletter are reprinted.

We extend our thanks to:

 World Neighbors, Oklahoma City, USA, for permission to publish extracts from Roland Bunch's book "Two Ears of Corns' (1985); a revised version of Peter Gubbels' Case Study Ghana (1986); and most of the illustrations which appear in this volume;

- CELATER, Cali, Colombia, for permission to publish an abridged version of the booklet by Fernandes et al. (1989) 'Analisis de la contribucion de las organizaciones no gubernamentales (NGO) en los aspectos metodologicos relacionades con el mejoramiento de la producción agropecuaria campesina';
- FUNDAEC, Cali, Colombia, for permission to publish a translation of 'Busqueda de sistemas alternativos de producción agropecuaria' by Arbab & Prager;
- PRATEC, Lima, Peru, for permission to publish an abridged version of 'Agricultura y saber campesino' (1990);
- Chris Martin for translating the Spanish contributions from CELATER,
   FUNDAEC and PRATEC;
- MINKA, the peasant journal edited by Grupo Talpuy, Huancayo, Peru, for the drawings which introduce the South American articles;
- FAO, Rome, Italy, for permission to publish an abridged version of the article
   "The problem census', which was originally prepared under authors' contract with
   the Human Resources, Institutions and Agrarian Reform Division of the Food and
   Agricultural Organization of the United Nation, and appeared in 1984 in "Training
   for Agriculture and Rural Development";
- CDTF, Dar es Salaam, Tanzania, for permission to publish excerpts from their booklet on appropriate grain storage technology which originally appeared in 1977;
- Terd Charoenwatana of the Farming Systems Research Project, Khon Kaen University, Thailand, for permission to publish the 1986 report by Simaraks, Khammaeng & Uriyapongson;
- Clive Lightfoot, ICLARM, for permission to publish the paper that he and Dan Minnick prepared for the Symposium of the Association for Farming System Research/Extension, Michigan State University, East Lansing, 14-17 October 1990;
- Gordon Prain and his colleagues at CIP for permission to publish their paper written in 1989 and originally entitled 'The friendly potato'.

The paper by Maria Fernandez is based on her work with the Small Ruminant Collaborative Research Support Program in Peru, specifically the SR-CRSP Technical Report No. 75 (University of Missouri-Columbia, 1986) and the second chapter of the book edited by C.M. McCorkle, 'Improving Andean sheep and alpaca production' (University of Missouri-Columbia, 1990). The remaining articles originally appeared in the ILEIA Newsletter.

We wish to thank Ellen Radstake for typing the manuscript, Désirée Dirkzwager for lending us her skills in desktop publishing, and Sibylle Pich for editorial assistance. And we thank all of the staff of the ETC Foundation and ILEIA who assisted in organizing the workshop in Leusden, and all the participants for their valuable contributions and enthusiasm.

We hope that readers of this book will develop an eye (or two) for farmers' experiments and an ear (or two) for experimenting farmers, and will seek ways of participating in and supporting the huge research operation of smallholder farming. And we encourage you to share what you have seen, heard and experienced with others in your immediate and wider networks, including ILEIA, so that methods of strengthening farmers' experiments can spread quickly.

#### ABBREVIATIONS AND ACRONYMS

BAU Bangladesh Agricultural University

CAAP Centro Andino de Acción Popular, Equador
CATER Centro Andino de Technología Rural, Equador
CCTA Comisión de Coordinación de Technología Andina

(Coordinating Commission of Andean Technologies), Peru

CDTF Community Development Trust Fund, Tanzania

CELATER Centro Latinoamericano de Tecnología y Educación Rural

(Latin America Centre of Technology and Rural Education),

Colombia

CGIAR Consultative Group on International Agricultural Research
CIAT Centro Internacional de Agricultura Tropical (International

Centre for Tropical Agriculture), Colombia

CIED Centro de Investigación, Educación y Desarrollo, Peru CIMMYT Centro Internacional de Mejoramiento de Maiz y Trigo

(International Maize and Wheat Improvement Center), Mexico

CIP Centro Internacional de la Papa (International Potato Center),

Peru

CPES Centro Paraguayo de Estudios Sociologicos, Paraguay

EEC European Economic Community
ELC Environment Liaison Centre, Kenya

ENDA Organisation for Environment and Development

FAO Food and Agriculture Organization of the United Nations
FASE Federação de Orgãos para Assisténcia Social e Educação, Brazil

FPR Farmer Participatory Research
FSR Farming Systems Research

FSR/E Farming Systems Research and Extension

FUNDAEC Fundación para la Aplicación y Enseñanza de las Ciencas

(Foundation for the Application and Teaching of Science),

Colombia

GATE German Appropriate Technology Exchange
GIA Grupo de Investigaciones Agrarias, Chile

GRAAP Groupe de Recherche et d'Appui pour l'Autopromotion

Paysanne, Burkina Faso

GTZ Deutsche Gesellschaft für Technische Zusammenarbeit (German

Agency for Technical Cooperation)

IAC International Agricultural Centre, The Netherlands

IAE Institute of Adult Education, Tanzania
IARCs International Agricultural Research Centres

IASA International Alliance for Sustainable Agriculture, USA

ICLARM International Centre for Living Aquatic Resources Management,

**Philippines** 

ICRAF International Council for Research in Agroforestry, Kenya

IDS Institute of Development Studies, UK

IFW innovative farmers workshop

IICA Instituto Interamericano de Cooperación para la Agricultura

(Interamerican Institute of Agricultural Science)

IITA International Institute of Tropical Agriculture, Nigeria

IK indigenous knowledge

ILEIA Information Centre for Low-External-Input and Sustainable

Agriculture, Netherlands

INIAA National Institute for Agricultural and Agroindustrial Research,

Peru

IRRI International Rice Research Institute, Philippines

IT intermediate technology

ITK indigenous technical knowledge

KWDP Kenya Woodfuel Development Programmme LEISA low-external-input and sustainable agriculture

MOERD Ministry of Energy and Regional Development, Kenya NAES National Agricultural Experiment Station, Ghana

NGO nongovernmental organisation
ODI Overseas Development Institute, UK

OFRD/BARI On-Farm Research Division of Bangladesh Agricultural Research

Institute

OTA Office of Technology Assessment, US Congress

PRATEC Proyecto Andino de Tecnologías Campesinas (Andean

Agriculture and Peasant Knowledge), Peru

PTD Participatory (or People-centred) Technology Development

R&D research and development RRA rapid rural appraisal

SEMTA Servicios Múltiples de Tecnologías Apropiadas, Bolivia SR-CRSP Small Ruminant Collaborative Research Support Programm

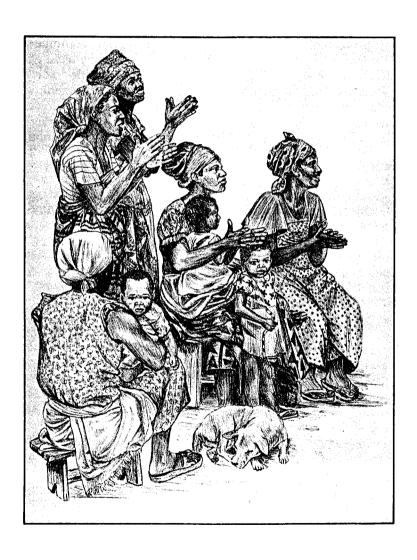
UNDP United Nations Development Programme

UNESCO United Nations Educational, Scientific and Cultural Organization

UK United Kingdom of Great Britain and Northern Ireland WCED World Commission on Environment and Development

WN World Neighbors

# INTRODUCTION



# FARMERS' EXPERIMENTS AND PARTICIPATORY TECHNOLOGY DEVELOPMENT

#### Bertus Haverkort

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Experimenting is part of farming as much as tilling the soil, planting seeds and caring for animals. Yet, in many cases, the agencies established to support agricultural technology development appear to have tried to expropriate this activity from the agricultural community and reduce the farmers to simple adopters of technologies developed by others.

Certainly, the present interest in the possible contribution of farmers to formal research and extension is an improvement to the conventional Transfer-of-Technology approach. Yet, unless much more attention is given simultaneously to farmers' technology development in their own right and to outsiders' possibilities of strengthening the experimental capacity of farmers, the gap between farmers and the outside world will remain, and the potential for improvements in agricultural technology will be underutilised.

Most of the recent publications about the role of farmers in technology development (Rhoades 1987, Gips 1987, Chambers et al. 1990, Farrington & Martin 1987, McCorkle 1990, Gupta 1987) focus on the important contribution farmers can make to the work of researchers. This book is a compilation of experiences and cases in which the farmers are the main actors in the process of technology development, with outsiders playing a supportive role.

#### Conventional research and development

Research and technology development policies have been criticised for being misguided and resulting in technological interventions that have failed to significantly improve low-external-input farming systems, as they focused mainly on irrigated agriculture and export crops (e.g. Chambers & Jiggins 1986; OTA 1988; Arbab & Prager, this volume). In some cases, interventions have actually upset the equilibrium of the old methods of land use without producing equally balanced new systems of farming.

These problems arise because introduced technologies are often inappropriate for resource-poor farmers and herders, whether for economic, sociocultural, managerial or environmental reasons. Too often, research efforts have focused on sophisticated systems that require high levels of external inputs (e.g. hybrid varieties, irrigation, agrochemicals, machinery), not taking into account that most farmers and herders

have restricted or no access to these inputs and usually cannot afford them.

The role of women in agricultural production, postharvest food processing and household chores has often been neglected, and many technical interventions have been inappropriate because they do not meet women's needs and priorities. Nonformal education for women most often covers their non-income generating activities, including home economics and nutrition, but women have limited access to training activities dealing with income-related activities such as cooperatives, agricultural production and animal husbandry. Considering the major role of women as food producers and caretakers of livestock, this is a serious failure of the system.

Another problem is that most extension services focus on providing information and inputs for export crops rather than food crops. In addition, the approaches used are generally 'top-down', with information flows supposed to be going through the extension agent to the male farmer.

Projects and extension systems in so-called 'low-resource' areas face special problems. They generally lack staff, supplies and technical support. Communication between researchers, extensionists, project staff and farmers is inadequate. There is also a lack of appropriate and profitable technologies to transfer.

#### Low-External-Input and Sustainable Agriculture (LEISA)

Conventional agricultural research and development methods have not led to the creation of durable agricultural systems and have not been able to increase productivity substantially in rainfed farming areas. The need for a new approach to technology development is now widely accepted: The Brundlandt Commission (WCED 1987), FAO (1983), World Bank (1986), CGIAR (1988) and many bilateral donor agencies, national governments and nongovernmental organisations (NGOs) put great emphasis on sustainability.

Although largely unperceived by mainstream agriculturalists, many farmers, sometimes supported by development workers, have been developing sustainable farming techniques. Systematic inventories in, e.g., the Philippines and Peru reveal numerous cases of farmers' experiences in site-specific agriculture, primarily based on optimal use of locally available resources (Padilla 1990; Gupta 1988; PRATEC, this volume). Also development support programmes give increasing attention to enhancing this type of agriculture, which is referred to here as Low-External-Input and Sustainable Agriculture (LEISA).

According to experience thus far, the following types of LEISA technologies show the greatest promise:

- multiple cropping, including agroforestry (Steiner 1984, Beets 1990, Gregerson et al. 1989);
- soil management methods which enhance organic matter and soil life, make use of natural processes such as N-fixation and mycorhizza, and maximise recycling (Lal 1987);
- use of improved hand tools and animal traction (Carruthers 1985);

- integration of cropping and animal husbandry including aquaculture (Bayer & Waters-Bayer 1989, FAO 1983, Lightfoot 1990);
- crop protection by natural methods (Stoll 1988);
- use of genetic diversity, including those crops and animals which are regarded as unconventional by mainstream agricultural scientists (ILEIA 1989); and
- techniques for harvesting nutrients and water (Wright 1985, Reij et al. 1988).

  Conventional research basically follows a disciplinary and reductionistic approach.

  In order to give research greater relevance and more perspective to enhance LEISA systems, conventional agricultural research may need to be complemented with the
- a holistic approach, i.e. giving attention to the whole system, including rather than externalising environmental and social effects:
- a focus on processes related to synergy, complementarity and integration rather than control and specialisation:
- building on indigenous knowledge, i.e. seeing research and farm advisory services as complementary to existing farmers' knowledge, and recognising farmers' own experimentation as the motor for site-specific technology development;
- generating general principles that can enhance further development of LEISA, identifying a number of site-specific options and technologies, and increasing the understanding of the conditions under which these options could be applied.

#### **Participatory Technology Development**

following:

In the continuum of basic/applied/adaptive research, adaptive research in tropical countries (contrary to the situation in most Western countries) generally appears to have been considered the exclusive domain of research scientists. The active role of farmers in actually developing technologies has been largely underestimated and underutilised.

Despite claims of researchers that they base their work on elaborate assessment of farmers' perceptions of constraints, despite on-farm research and farmer-first rhetorics in extension, the step to acknowledge farmers' role as technology developers in their own right has not been made by mainstream research and development organisations. Such a step would imply that, in addition to on-station research, on-farm research and extension activities, a separate domain of development intervention needs to be put in place, geared toward enhancing farmers' capacity to develop technology.

In LEISA, because of its site-specificity, farmers play a key role in technology development. The role of researchers, extensionists and NGO fieldworkers is to contribute to and improve local capacities to adjust to changing conditions through experimentation and adaptation of technologies. This approach is known under different labels such as Community-Based Experimentation and Extension or Local Management of Natural Resources. In this book, we use the term Participatory (or People-centred) Technology Development (PTD). This encompasses activities in

which the farmers' experiments are supported by outsiders with the goal to increase the effectivity and effectiveness of these experiments. The outcome of PTD is twofold: locally-adapted improved technologies and improved experimental capacities of farmers. Practical field experiences reveal that impressive results can be achieved when farmers and outsiders 'join hands'. These experiences have been built up by a host of NGOs, researchers and extensionists who had the courage to challenge the conventional approach.

#### **Participation**

One of the key issues in the process of PTD is the way participation is made operational, McCall (1987) distinguishes three levels of participation:

- as a means to facilitate the implementation of external interventions;
- as a means to mediate in decision making and formulating policy about external interventions;
- as an end in itself, to empower social groups to gain greater access to and control over resources and decision making.

In practice, participation is often only used as a means to legitimate top-down approaches. In the past, local 'participation' meant that local people were expected to provide their physical labour as their contribution to projects, the outsiders' contribution being not only finance but the whole design of the project. More recently, participation has come to mean that local people also assess their own needs and priorities.

In PTD, participation implies an acceptance that people can, to a large extent, identify and modify their own solutions to their needs. It means that researchers and development workers support farmers in order to increase their capacity to manage change in their farming systems. In promoting participation in this sense, there are numerous obstacles to be overcome:

- Local government agencies and bureaucratic forces, despite their rhetoric of support, have reasons to fear local participation and may contain the threat by diversion or incorporation. Prejudices exist among professional agronomists and development workers against the assumption that rural population may have something to contribute to the development of agricultural systems.
- The majority of the rural population women face special obstacles: heavy labour demands prevent them from taking part in meetings; cultural restrictions prevail against appearing or speaking at open meetings; there are also socio-psychologically inflicted senses of the inferiority of women's work and interests; the majority of development workers and state personnel communicating with villagers are men, and most traditional societies have a patriarchal culture, reinforced by the colonial and postcolonial ideologies of the peasant household.
- In most countries, certain rural minorities are marginalised on grounds of their race, tribe or religion. Participation of such minorities in local-level development initiatives is resisted by the dominant groups.

The poverty of certain categories means a lack of access to, or absolute scarcity of, resources and lack of hope of any improvement. Thus, the rural population may have developed a certain strategy toward dealing with risks; risk-aversion strategies have to be taken into account.

Professionals engaged in agricultural technology development will need a great deal of creativity and endurance to identify and overcome these obstacles. This requires not only agronomic qualifications but also special social skills and socio-anthropological techniques. There will be no specific guidelines for overcoming these obstacles; the diversity of the phenomena requires a diversity of solutions.

#### Indigenous Knowledge

The experiences with technology development have made clear that new technologies have to be imbedded in the local society, its ecological and physical environment, its (agri-)cultural experience and its socioeconomic structures. For people who have not grown up in the local society, it is very difficult to understand the entire livelihood system in all its complexities of physical, socioeconomic and cultural interrelations and in its historical context.

In the process of technology development, knowledge of the indigenous livelihood system is an indispensable resource which is possessed and can be managed by the local community. Indigenous knowledge (IK) is not abstract like scientific knowledge; it is concrete and relies strongly on intuition, historical experience and directly perceivable evidence (Farrington & Martin 1987). IK reflects the dignity of the local community and puts them on equal footing with the outsiders involved in the process of technology development. In this way, IK is the key to participation. The participatory process of technology development based on IK provides the initial self-confidence needed to counter the fatalism of poverty and leads to some form of self-development (McCall 1987).

IK also has its limitations: Biggs and Clay (1980) mention that IK is far from uniformly distributed within or across communities. This distribution depends on:

- the capacity of individuals to manage knowledge;
- monopolisation of knowledge by different social and gender groups;
- economic stratification, as richer people use and generate other knowledge and use other skills than poorer people.

Therefore, IK cannot be manipulated independently of the social, political and economical structures within which it occurs, e.g. manipulation of the knowledge/skills of men may directly affect gender interrelations, their power base and division of resources (Fernandez 1988).

In any specific case, there are bound to be areas of knowledge and skills which exclusively belong to IK, but there are also data and concepts which local people cannot possibly have because they depend on types of experimental work which are out of reach of rural peasants. There are also domains of knowledge within IK which can be added to by 'formal scientific' research.

#### Farmers' experiments

Rhoades and Bebbington (this volume) state that farmers, like researchers, are experimenters. They identify three types of farmer experiments: curiosity experiments, problem-solving experiments and adaptation experiments. Modern science rests upon the foundation of at least ten millenia of informal experimentation by farmers. The experimental methods used by farmers vary widely. As they are specific to the local communities and rooted in long history, their validity and limits will vary and may be difficult to assess.

Some strengths of farmers' experiments are that:

- subjects are chosen which are relevant for the farmers;
- they start with the farmers' own knowledge and could be directed to improving the use of locally available resources;
- their results expand and deepen farmers' knowledge;
- they use criteria which are directly related to the local values related to taste and utilisation:
- the observations are made from within, as they take place during actual farmwork, and are not only based on final outcomes such as yield.

However, farmers' experiments also have their methodological limits:

- the search for improved technologies may be based on limited scientific understanding of the processes involved;
- farmers may have the tendency to use a technology over their whole field, so that comparison can only be made with a crop of a previous year or in a neighbours' field:
- farmers may attribute crop performance to one obvious factor and not see the interrelatedness of factors or the intervening effects of less observable factors because of their limited theoretical understanding of biological or other processes;
- errors in experimental design such as replication of trials may lead to injustified conclusions:
- methods of measuring and weighing may not be adequate:
- communication about the results may be limited to certain geographical areas, gender and/or socioeconomic categories.

In the final analysis, the major advantage of PTD is the combination of complementary domains of knowledge: those of the farmers and those of outsiders.

#### **Experiences with Participatory Technology Development**

From the many case studies collected for the workshop on 'Farmers and Agricultural Research: Complementary Methods' held in July 1987 at the Institute of Development Studies (Chambers et al. 1990) and the ILEIA workshop on 'Operational Approaches for PTD in Sustainable Agriculture' in April 1988, it can be concluded that there is already a wide range of PTD approaches and methods. There is a growing number of regional networks of agencies and persons engaged in this

activity who exchange experiences and support each other in the further development of the approaches, methods and techniques. Some 200 cases with descriptions of practical experiences have been documented, and some of these have been outlined briefly in the matrices in ILEIA (1988). The experiences have been documented according to six categories of activities in PTD:

#### 1) How to get started.

Building up a relationship of confidence aimed at cooperation with local networks of farmers and other actors. Making a joint analysis of the existing situation, farming systems and problems.

2) Looking for things to try.

Identifying indigenous technical knowledge and relevant formal knowledge. Screening and selecting topics for further development, using criteria leading to optimal use of local resources and sustainable systems of production.

3) Design of the experiment.

Planning and designing experiments, based on farmers' criteria and measuring techniques, but improved with methodological suggestions of outsiders.

4) Trying out.

Actual implemention of the experiments and evaluation of the results.

5) Sharing results with others.

Communication of results with other local and scientific networks to scrutinise and interpret them, and to encourage others to adapt and test the results for their circumstances

6) Sustaining and consolidating the process of PTD.

Creating favorable conditions for farmers' organisations, local institutions and support at policy level. Establishing physical infrastructure and educational facilities to strengthen local experimental capacity and local management of the processes of innovation.

Some methods used in carrying out these activities and some examples are given in Table 1 and elaborated in more detail by Jiggins and de Zeeuw (forthcoming).

From the list of activities, it can be concluded that PTD is more than research. It combines the generation, testing and application of new techniques with the creation of the physical and institutional infrastructure to sustain the application and further innovation of the technology.

The descriptions range from scientist-dominated research to the support of farmer technology development entirely based on local initiative and oriented toward the farmers' needs and possibilities. The sequences of the activities undertaken vary, and rightly so. The sequence suggested by the above list of activities is an artificial one, produced only to be able to compare the many different experiences. In practice, a linear stepwise sequence does not occur; instead there are iterations, gaps and overlaps.

Table 1. Six Steps in Participatory Technology Development

Activity	Description	Examples of Operational Methods	Examples of Output Indicators
I Getting started	<ul> <li>building relationships for cooperation</li> <li>preliminary situation analysis</li> <li>awareness mobilisation</li> </ul>	<ul> <li>organisational resources inventory</li> <li>community walks</li> <li>screening secondary data</li> <li>community surveys</li> <li>problem census &amp; projective techniques</li> </ul>	<ul> <li>inventories</li> <li>protocols for community</li> <li>participation</li> <li>core PTD network</li> <li>enhanced agro-ecological awareness</li> </ul>
II Looking for things to try	<ul> <li>identifying priorities</li> <li>identifying local community and scientific knowledge and information</li> <li>screening options, choosing selection criteria</li> </ul>	<ul> <li>farmer experts workshop</li> <li>techniques to tap indigenous knowledge (case histories, diagramming, preference ranking, local 'repertoire' and indicators, critical incidents</li> <li>study tours</li> <li>options screening workshop</li> </ul>	<ul> <li>agreed research agenda</li> <li>improved local capacity to diagnose a problem and identify 'options for improvement'</li> <li>enhance self-respect</li> </ul>
III Designing experiments	<ul> <li>review existing experimental practice</li> <li>planning and designing experiments</li> <li>designing evaluation protocols</li> </ul>	<ul> <li>improvement of natural experimentation on 'the spot'</li> <li>design workshop &amp; prompting questions, slides/videos, case histories</li> <li>testing alternative designs</li> <li>farmer-to-farmer training</li> </ul>	<ul> <li>experimental designs which are manageable, evaluable, reliable</li> <li>protocols for monitoring and evaluation</li> <li>improved local capacity to systematically design experiments</li> </ul>

Activity	Description	Examples of Operational Methods	Examples of Output Indicators
IV Trying out	- implementation of experiments - measurement/observation evaluation	<ul> <li>stepwise implementation</li> <li>regular group meetings</li> <li>fielddays/exchange</li> <li>supporting activities</li> </ul>	- ongoing experimental programme - enhanced local capacity to implement, monitor and evaluate experiments systematically - enlarged and stronger exchange and support linkages
V Sharing results with others	- communication of basic ideas and principles, results, and PTD process - training in skills, proven technologies, and use of experimental methods	<ul> <li>field workshops</li> <li>visits to secondary sites</li> <li>farmer-to-farmer training &amp; hands-on training</li> </ul>	- spontaneous diffusion of ideas & technologies - enhanced local capacity for farmer-to-farmer training & communication - increasing number of villages involved in PTD
VI Sustaining the PTD process	<ul> <li>creation of favorable conditions for on-going experimentation and agricultural development</li> </ul>	<ul> <li>organisational consolidation</li> <li>development of resource materials</li> <li>participatory monitoring of impacts on agri-ecological sustainability</li> </ul>	- consolidated community networks/ organisations for agricultural self-management - resource materials - consolidated linkages with R&D institutions

#### Important questions to be answered

The activities related to PTD are still in a stage of development. Many questions still need to be answered as we proceed:

- To what extent can PTD make technology development more cost-effective?
   Most of the cases reported so far imply a high labour input from outsiders. With further development of the approach, the labour input required may diminish.
   Issues of cost effectiveness are very important if PTD is to be more widely applied.
- How can PTD be institutionalised?
   Most cases reported are project based, and many are carried out by NGOs. How can farmers' groups and organisations be encouraged to form networks for strengthening technology development? How can national agricultural research
  - can farmers' groups and organisations be encouraged to form networks for strengthening technology development? How can national agricultural research systems be encouraged to apply PTD? What will be the role of the agricultural extension services? Is the present institutional differentiation of tasks between researchers and extensionists beneficial or detrimental for applying PTD? How can organisational development and in-service training which stimulates the application of PTD be encouraged?
- How can sustainability be built in as an important aim of PTD? The use of local resources as such does not necessarily lead to sustainable agricultural systems. The approach offers some perspectives, but additional conditions need to be formulated and additional insights developed to ensure that new agricultural technologies coming out of the PTD process are not only based on low levels of external inputs but are also sustainable.
- How can agricultural education and training be reformed in such a way that the new generation of technicians will be able to communicate with farmers and understand their complex systems?

#### How to continue

It is advocated here that emphases in agricultural research and development be shifted away from commodity-focused or specific 'stand-alone' techniques toward the development of a more broadly based technology based on local resources and the use of linkages between components of a diversified system. In agricultural research and development, the complementarity of science-based knowledge and local knowledge must be optimised.

A change in emphasis by no means implies that present basic and on-station research should be reduced or abandoned. They should continue to play their role, inspired - in part - by questions which emerge during the PTD approach to LEISA development. Fundamental questions related to, e.g., the conditions under which linkages promote productivity and sustainability (i.e. factors explaining competition, symbiosis and synergy) require research of a type that cannot be carried out at field level alone.

If this type of research could be accomplished, assessments of the production

potentials of certain agroecosystems would most likely change, and investment programmes for agricultural development could be based on different assumptions. In this way, development opportunities would be provided for areas and populations which have not benefitted to date from conventional technological innovations.

Research and extension therefore need to adopt a different set of values (Chambers 1988):

- A philosophy of decentralisation, diversity and choice, emphasising the primacy of what people need, want and can achieve in their environment, stressing the importance of diversity and aiming to manage diversity through decentralisation and local initiatives.
- A new role for outsiders as development workers who instead of playing the role
  of missionaries who transfer exogenous technology should adopt the role of
  convener, catalyst, colleague and consultant. The outsider convenes discussions
  and analysis by farm families and speeds up reactions. He or she is a colleague of
  farmers in their experiments and acts as a consultant who can search for and
  supply ideas and technologies unknown in the rural community.
- A wider repertoire, not a new fixed model like Transfer of Technology but rather a
  fluid process in which a development worker is a performer who improvises and
  adapts for each situation. Just as diversity of environment and farming system is
  recognised as positive, so diversity of repertoire in interaction with farm families is
  seen as necessary and beneficial.

These changes may imply that existing entities for research and extension at international, national, regional and local level will have to ask themselves about the justification of their existence, the relevancy of their programmes and their staffing policies and, on that basis, reflect on possibilities to adjust and change in a new direction. History determined, to a large extent, the existence and functioning of research and extension agencies, but the present activities and output will determine their future.

#### About this book

This book is intended for persons who work together with farmers in technology development and for the supervisors and trainers of these fieldworkers. The experiences of others may create enthusiasm for them to design site-appropriate methods for supporting farmers' experiments in their own area.

The articles have been selected so as to give an overview of experiences of NGOs and individual projects as well as universities and formal research and development agencies of national and international agencies. Cases have been chosen from Latin America, Africa and Asia. Different farming systems and institutional contexts are represented.

Some contributions have not been published previously; others are reprinted with permission of the publishers. Some contributions have been translated from Spanish so as to enable anglophone readers to gain access to valuable materials and

experiences in Latin America. Further brief examples are illustrated by articles which were published earlier in the ILEIA Newsletter.

The articles have in common that they describe practical methods in an operational way and that the methods are site-specific. Some methods could easily be adapted for use somewhere else; others should be cherished as unique cases which could inspire others to seek equally innovative approaches. The selection has been made in order to give an overview of the richness of the practical experiences and to encourage fieldworkers to develop their own site-specific methods, taking into account experiences and ideas from others. The articles have been clustered as follows:

Experiences of NGOs. World Neighbors have well-nigh classic experiences of PTD. The articles by Bunch and Gubbels give a justification of their approach, describe their methodology and give practical cases from several countries, mainly in Latin America and West Africa.

Although largely unnoticed by the government-based development agencies and by anglophone development professionals, a large network of NGOs in Latin America have built up an impressive experience with PTD. CELATER has made a overview of the experiences, and the cases of FUNDAEC (Arbab and Prager) and Grupo Yanapai (Fernandez) give concrete examples of promising approaches in PTD in Colombia and Peru. Arbab and Prager reveal the experiences of learning on multiple cropping of the Rural University, and Fernandez shares her experiences of working with women in improving technologies related to small ruminants. The case of PRATEC illustrates a practical way of recording, reviving and communicating the knowledge of Andean peasants.

Chavangi and Ngugi describe the experiences with woodfuel development in Kenya, where the farmers' knowledge and culture had a major impact on the project activities. De Jager describes agronomic trials carried out by farmers in Northern Ghana. The case of the Tanzanian Community Development Trust Fund (CDTF) is a detailed revelation of village-based development of grain storage systems.

Experiences of national and international research and extension organisations. Abedin and Haque describe how others could benefit from the experiences of innovative farmers in Bangladesh. Crouch explains the methods used in problem identification and presents a case study from northern Thailand. Shorter contributions from different countries complement the picture and illustrate the creativity of fieldworkers and farmers. Simaraks, Khammaeng and Uriyapongson give an interesting case of Farming Systems Research and Extension in Thailand: farmer-to-farmer workshops on small-scale dairy cow raising. Experience of a 'minimalist approach to PTD' by extension agents in Thailand is reported by Connell.

Practical experiences of the International Center for Living Aquatic Resources Management (Lightfoot and Minnick) and the International Potato Center (Prain, Uribe and Scheidegger) are reported. These cases indicate the importance attached by international research centres to the role of farmers but also show the practical

value of this approach for the institutes concerned. Other international research centres such as IRRI, ICRAF, CIMMYT and CIAT carry out similar programmes, but space does not permit inclusion of more cases in this volume.

The book concludes with a selected bibliography of recent publications on Participatory Technology Development and farmer experimentation.

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#### PEASANT KNOWLEDGE - WHO HAS RIGHTS TO USE IT?

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What is knowledge and who has the right to use it? Academics have their reasons, but does that mean robbing the poor? Anil Gupta poses some important reflections for himself and those of us working with farmers. What game do we play and who defines the rules?

Whose knowledge? Who defines what is knowledge? Who has rights to knowledge? Who defines these rights? These questions become crucial as the value of peasant knowledge for generating techniques of sustainable agriculture and extending the frontiers of science is increasingly recognised.

There is no term more inappropriate than 'resource-poor' when talking about knowledge-rich peasants. Consider the ethical, political and cultural biases underlying the use of this term. Disadvantaged, yes; resource-poor, no. Or only if we don't consider knowledge about micro-environmental relationships as a resource.

If peasant knowledge is a resource and if scientists recognise its usefulness, according to what rules should this resource be defined and used? For example, a multinational (or national) corporation becomes aware of a herb useful for treating a previously incurable disease. It can:

 camouflage the end use to make it difficult for other possible users to enter the resource market;

- collect the herb excessively and deplete it in its natural habitat;
- generate other ways/locations for cultivating the herb so that, if people in the original habitat become aware of its value to the corporation, business will not suffer;
- place a very low value on the local people's research (identifying the herb and how
  to use it) and a very high value on the corporation's research (making it into a
  commercial drug), rendering the drug out of reach of the people who originally
  conceptualised its possibilities.

And what is the residue after the resource has been used in the knowledge 'industry'? Does the local way of using the herbs lose its validity because it is traditional, superstitious, 'unscientific'? Rights to knowledge, extraction by outsiders, and the dominating knowledge systems which give validity to only certain ways of using a resource - all are part of the same problem.

Take us, for example: scientists, academics, people working in voluntary organisations, funding agencies and international consultancy systems, editors of journals, civil servants, whether national or international, i.e. the outsiders. How do we relate to peasant knowledge and the question of rights to this resource? I can deal with peasant knowledge in the following ways:

- I engage in research, systematic studies and interactions with peasants, to find technologies still in use and ones that were functional but have been discontinued. I document this information and share it with fellow professionals as an academic activity. I may also ask possible users of this knowledge, including large agribusiness companies, to support my research in return for sharing the documented knowledge with them.
- I attend international meetings and gain esteem and other career rewards without giving details about the peasants who generated the knowledge. I can thus prevent other outsiders from locating the source, validating the findings or looking into other dimensions of the local knowledge. Otherwise, I would be de-mystifying my role: revealing myself to be a mere chronicler rather than founder of a new school or faith
- I don't mention the source of my knowledge because my professional peers ('noblemen') don't consider acknowledgement of the nameless-faceless poor to be a necessary professional act. In this case, I don't even realise that I have done anything inappropriate by not acknowledging the peasants.
- I hide behind the argument that the providers of knowledge are so numerous that
  it is impossible to acknowledge each one of them. I mention the study area,
  sometimes even the villages, but the particular individuals/groups who gave me the
  information remain unacknowledged.
- I want to give acknowledgement but think that the providers of knowledge don't
  care whether I do or not. Thus, absence of pressure not only from professional
  peers and gatekeepers of professional glory but also from the providers themselves
  makes me indifferent, lax or insensitive.
- I extract rent from the knowledge by helping set up a value-adding enterprise aimed at commercial profit. I share the due portion of the profits with my

employers, who made my study of peasant knowledge possible. In my contract, they may even have denied me rights to use my findings without their consent. But there is no legal pressure on me to obtain consent from the peasant informants, so I feel no obligation to do so. I hide my rewards from the peasants, so that none of them can ask me to account for the rent I have extracted from their knowledge.

- I gain consultancies to identify and extract the conceptual insights of Third World scholars and grass-root workers about peasant knowledge and convert these insights into 'new' technologies. I treat these disadvantaged informants like the peasants. I don't acknowledge their contributions, not even how they facilitated my entry into the peasants' villages and homes. I assume it's simply the duty of a Third World public servant. I also assume that the journals in which I publish will never reach those nondescript grass-root workers.
- I make it possible, for example, that genes for resistance against a particular disease, genes that peasants preserved in a particular ecological niche, are transferred into a new marketed cultivar. I claim that this gene had no value until it was combined with other genes. It is the instrument of gene transfer which is important, not the resource: the original ideas and skills of the peasants. Rights to the instrument override rights to the resource.

My peers judge that no injustice has been done to the providers. After all, didn't they get a new variety with a better combination of genes? When the cultivar needs replacement every other year, when terms of trade shift against the cultivators, when inputs becomes less productive because the soil nutrient balance has been disturbed, then subsidies can be demanded. The State provides these subsidies because it is difficult to withstand the combined pressures of the agribusinesses and the articulate, richer farmers who use agri-inputs. The resourceful people who provided the parent genes (often found in the most stressed environments, e.g. semi-arid, hilly or flood-prone areas) become 'resource-poor'.

• I plea for LEISA (Low-External-Input and Sustainable Agriculture), arguing that the future needs of the 'Third World' cannot be met through input-intensive, soil-depleting, pest-enhancing technologies. I re-import peasants' age-old low-external-input technologies under 'modern' labels given by well-meaning 'First Worlders'. I incorporate all this, including the labels, into official (low-budget) programmes of 'Technical Cooperation'. The peasant generators and providers of knowledge in disadvantaged rural areas remain 'resource-poor' and, thus, in need of external aid to cultivate with low external inputs.

While re-introducing LEISA (I have already been enslaved by this term) to its original inventors, I try to restore the pride of those 'irrational' resisters of change in rural areas whom I robbed in collaboration with colonial masters and post-colonial granters of professional esteem in the West. My reference point remains the same: the West.

But who said that poor people lacked pride in what they knew? If it were so, would they have maintained some of their sustainable technologies for so long? If pride has to be restored, it is my own and that of my peers in my own society.

As peasant expertise is site-specific and therefore limited in its diffusion potential, it does not lend itself to building up sociocultural institutions of rent extraction through secretiveness, private control and even manipulation, in the way that accumulation-oriented industrialisation does. On the other hand, some non-Western knowledge systems (e.g. the Ayurvedic of India) permitted, if not encouraged, local experts to retain control by family/kin over some popular recipes, i.e. over locally valued knowledge of using local resources.

If knowledge were truly a common property, the academic discussion about rights to it would be trivial. But if knowledge can be expropriated by free riders or rent seekers, rules of the game need to be evolved.

# PART I

# **Experiences of nongovernmental organisations (NGOs)**



#### PEOPLE-CENTRED AGRICULTURAL IMPROVEMENT

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World Neighbors is a people-to-people non-profit organisation working in Asia, Africa and Latin America. Programme priorities are food production, community-based health, family planning, water and sanitation and environmental conservation. World Neighbors affirms the determination, ingenuity and inherent dignity of all people. By strengthening these primary resources, people are helped to analyse and solve their own problems. Success is achieved by developing, testing and extending simple technologies at the community level, and training local leaders to sustain and multiply the results.

#### 1. GOALS OF AN AGRICULTURAL PROGRAMME

World Neighbors' experience is largely limited to small programmes. These can meet the specific needs of specific cultures, markets and microclimates and can build upon existing local resources, such as traditional knowledge, exceptional leadership or indigenous forms of organisation. They have the flexibility to be creative and to respond to changing needs without bureaucratic delays.

Small programmes also tend to be more sensitive to the people they are serving. For programmes working with traditional peoples, these qualities of specificity, flexibility and sensitivity are essential.

Agricultural improvement among small farmers is more an art than a science. Though general guidelines for programme design can be established, the final outcome of any programme will depend much more on good judgement and understanding than on a strict adherence to a set of guidelines. True artistry emerges only when the principles are applied with sensitivity, dedication and creative insight.

Increasing agricultural productivity is obviously a major immediate goal of any agricultural programme. Most programmes see their role as that of teaching farmers a set of innovations that will increase the areas's productivity. The assumption is that the people will adopt these practices and continue indefinitely to farm at the new, higher level of productivity.

A productive agriculture, however, requires a constantly changing mix of techniques and inputs. Seeds degenerate, insect pests spread and develop resistance, market prices fluctuate, new inputs appear and old ones become expensive, roads and water resources are improved, and laws change. Very few packages of practices will ever succeed in producing a permanent increase in production. Thus, programmes that only teach technological innovations are inadequate.

The goal of an agricultural programme should be, on the one hand, to train and

motivate the farmers to teach each other the innovations introduced and, on the other hand, to teach them how to improve on these innovations themselves. Through a process of small-scale experimentation, farmers can learn to develop and adapt new technologies. The goals should not be to develop the peoples' agriculture, but to teach them a process by which they can develop their own agriculture.

No programme should define the goals without the participation of the villagers. Broad areas of involvement of agricultural programmes may relate to basic human necessities, sociopolitical rights ('empowerment'), strengthening mutual support among the peasants, and enriching their spiritual lives.

#### 2. PATERNALISM, ENTHUSIASM AND PARTICIPATION

The principal cash crop along the lower Cauca River was rice, so the programme at El Naranjo, Colombia (a fictitious village name but a true account of the first programme World Neighbors supported in Latin America 20 years ago) bought the village a thresher and a huller along with a motor to run them and organised a cooperative to market the rice downriver. It also bought a tractor to help increase rice production and a generator to light the village. The first year, dugout canoes brought tons of rice to the El Naranjo cooperative, which hulled it and sold it at the highest price the farmers had ever received.

I visited El Naranjo about six years after the programme closed down to see how the work had continued. In short, it hadn't. El Naranjo had become a virtual graveyard of rusting equipment and abandoned hopes. The motor had broken down and had never been repaired, so the huller could not be used, either. The thresher had never been used because farmers preferred to thresh their rice in the field. The tractor had broken down, and no one had cleaned up the generator since the year a flood had covered it with mud. The cooperative had disbanded completely; its building, by far the largest in El Naranjo, was full of cobwebs. Yet, as I made my way through the village, a half dozen different people pleaded with me, 'But if World Neighbors would just come help us again, we could do so much!'

#### The paternalism of the give-away

The outcome at El Naranjo was shocking, but hardly surprising. The rusting hulks of well-intentioned but long-forgotten give-aways are scattered all over the Third World. I have personally seen tractors by the dozens, not to mention ploughs, cultivators, generators, threshers, pumps, scythes, lanterns and grain mills that were never repaired after the first time they broke down. There are donated granaries that were never used, free high-yield seed that was eaten, give-away breeding animals that were sold or slaughtered for meat, and forest and fruit tree seedlings that died while still sitting in their plastic bags. Tons upon tons of give-away food have either rotted, become infested with insect or rats, or been fed to cattle, pigs or household pets. Some have even been used to make commercial ice cream or to whitewash houses. Villagers themselves generally recognise the uselessness of giving things

away. Folk sayings in dozens of countries admit that people don't take care of things they never had to work for.

More and more organisations are also becoming convinced that give-aways are not only ineffective, but, in fact, are detrimental. Why? The reasons are numerous. First of all, when the only progress villagers see is accompanied by give-aways, villagers can easily become convinced that they are incapable of making progress by themselves. Typical is the feeling of the people in El Naranjo that they cannot do anything without more outside 'help'. This feeling of inadequacy, in turn, creates dependency and subservience, robbing people of their self-respect. Furthermore, when people feel incapable of doing anything for themselves, self-help projects become more difficult than ever.

Another problem arises because charitable agencies naturally try to channel their donations to those most in need. Bitter divisions have thus been created in community after community by the envy and jealousy that erupted when one group or one family received seeds, fertilisers or food and another did not.

People often become accustomed to give-aways, and even come to expect them. World Neighbors found it nearly impossible to work in northeast Honduras after the Hurricane Fifi relief effort because many villagers refused to work with anyone not dispensing charity. In Togo, half the women in a group attending nutrition classes quit because they felt cheated; they had heard that a similar group ten kilometres away was receiving free milk during its classes.

Give-aways can also blind people to the need of solving their own problems. In the terms of one well-worn metaphor, you can give people so many fish that they lose all interest in learning to fish. Give-aways can also divert people's attention from the underlying demographic, institutional or political problems that, sooner or later, they must face if permanent progress is to be made.

Give-aways can be as detrimental to programmes as to people. First of all, they are monstrously expensive. Supplying a family with half its wheat for thirty years can easily cost fifty times as much as does teaching a family to double its own wheat production. One tractor can easily cost more than it does to give a twelve-month series of weekly agricultural classes to over 500 farmers. Secondly, give-aways can hide people's indifference to programme efforts. Villagers anticipating an occasional give-away may faithfully attend classes for years without intending to adopt a single innovation. A nonpaternalistic programme will know at once if farmers lose interest in what is being taught because attendance drops immediately. Months of useless, expensive training can be avoided.

Lastly, give-aways destroy the possibility of there ever being a multiplier effect. If the people's adoption of some innovation depends on a gift, or people become convinced that it does, local farmers will not try to teach it to their neighbours.

In spite of all these problems, some programmes continue to justify give-aways on the grounds that a) they are faster; b) they can 'win over' more people; c) the people cannot help themselves; or d) the people are so poor that justice demands they be given a break. Experience shows, however, that good results achieved with simple, inexpensive technologies have very quickly 'won over' more people than programmes

could adequately train. Most of the people judged too poor to help themselves can help themselves after all. If agricultural technologies capable of making the people self-sufficient are available, people can either adopt them gradually or be given loans payable after harvest. If no such technologies exist (e.g., among landless villagers), cottage industries or political action may yield results. Lastly, justice demands not that outside agencies give things away, but rather that people be taught to help themselves, keeping their dignity and self-respect intact, and that these efforts cost as little as possible so that the maximum number of people can be reached with the funds available.

#### The paternalism of doing things for people

Two top-notch South American agronomists were asked to help the community of Yanamilla raise its milk production. By culling the herd, improving the irrigation system and planting new pastures, they showed the people how to raise production from 25 to over 100 litres a day. Six months after they had left Yanamilla, production had plummeted back down to 30 litres a day.

Once again, although the results were disappointing, they were not surprising. For the paternalism at Yanamilla is a close cousin to that of El Naranjo. It is that of doing for people as opposed to giving to them. Although this second kind of paternalism is admittedly more subtle than the first, it can do just as much damage. And because of its subtlety, it is even more widespread than the first and less often recognised as being harmful.

Yet this second kind of paternalism suffers from many of the very same problems as does its better known cousin. First of all, doing things for people seldom achieves permanence. The rusting hulks of abandoned development efforts done for the people, from marketing schemes and agricultural cooperatives to animal raising and reforestation projects, are as common as those of abandoned give-away machinery. Once there are no outsiders to make trips to town, do the accounting, make decisions, pay the bills, keep people working together or troubleshoot, the work halts as abruptly as it does when the give-aways end.

Secondly, doing things for people creates a sense of dependency and inadequacy. The 'Please, won't you give us something?' changes to the equally obsequious 'Please, won't you do something for us?' but the helplessness and dependency are the same. The people of El Naranjo were as dependent on programme personnel to run their cooperative as they were for programme funds to buy them a tractor. As a result, neither the tractor nor the cooperative provided them much sense of accomplishment or self-worth.

Most of the other problems with giving thing away pertain equally to doing things for people. People will seldom bother to work at solving their problems if a programme is solving those problems for them. Even less will they be inclined to face the deeper demographic, institutional or political problems that confront them. Doing things for people costs a good deal more than merely supporting the people's own efforts at doing them. Furthermore, programmes can, and often do, work on a project for years, spending a considerable sum of money, only to discover afterwards

that the people have no interest in carrying on the work themselves. Lastly, if programme leaders do everything, the people lose the opportunity to learn by doing. And what they have never learned, they certainly cannot teach others.

Obviously, though, programmes must do something for the people. Were the people able and willing to solve all their own problems, they would have done so ages ago. How can we who work in agricultural programmes distinguish between those activities we should do, and those we should not? It's very simple: we should do only those things that the people cannot, or in the beginning will not, do themselves.

It is, of course, easier to state this rule than to live by it. Finding out what the people can do will require some trial and error but, in the end, knowing what the people can or cannot do is part of the art of agricultural improvement.

It should be emphasised that anything we do that the people can do for themselves is paternalistic. Even courses in motivation, sensitisation, 'animation' or 'conscientisation', which usually help people avoid paternalism, can be paternalistic in this way. In one programme in Africa, women were complaining bitterly about having to carry firewood on their heads for five and six kilometres while the men's ox-carts stood idle. After much discussion, the programme leaders decided to investigate why the women were not using the carts, and then they paid a team of professionals to give the villagers a week-long 'sensitisation' course on how to solve the problem. It never occurred to the leaders that the villagers might have been able to discuss the problem and work out a solution themselves.

If we are to avoid paternalism, either giving to people or doing for them, our only course of action is to motivate the people to do for themselves. But how? How can these people who so often seem to be conservative, traditionalist and non-innovative become motivated to carry on their own development process?

Somehow, the people must acquire enthusiasm.

#### Enthusiasm - the driving force behind development

Enthusiasm,' as the word is used here, is known by a good many other names, too: determination, drive, commitment, motivation, inspiration, even love of one's work. It is the desire or willingness to work - to make sacrifices - in order to reach a goal. It is the willingness to step out into the unknown - to experiment, study, make decisions, cooperate with others, and work together toward a common end. Unlike its usual connotation, the word enthusiasm is used here to include even long-term, unemotional forms of commitment

When enthusiasm is lacking, experimental plots grow up in weeds, no one shows up for meetings, cattle destroy the improved pastures, cooperation between neighbours becomes increasingly difficult, and extensionists seem unable to convince farmers of anything. When enthusiasm is plentiful, farmers walk two full days to attend classes, innovations spread spontaneously from one farmer to another, and many former problems seem to solve themselves. In extreme cases, hundreds of farmers in Guatemala and El Salvador have done 30 to 35 days of backbreaking labour to conserve each 0.1 ha of their soil, while a youth in India spent six months

of his own salary on a programme building and walked 16 miles in one day for the programme while still recovering from smallpox.

Instilling enthusiasm (as the word is defined above) is the only plausible way of avoiding paternalism. It is, therefore, the basic dynamic of any true self-help programme - the driving force that is indispensable to all true human development.

The question, then, is the same one that Jawaharlal Nehru asked years ago: 'How to bestow on the villagers that sense of partnership, that sense of purpose, that eagerness to do things?' How can programmes be designed so that enthusiasm will grow and flourish? Each one of the following factors can be crucial in stimulating enthusiasm:

- The programme must work toward solving felt needs (i.e. the people must want the problem being worked on to be solved).
- The villagers must believe it possible for them to solve the problem (e.g. the solution must be simple and inexpensive enough to be perceived as within their means).
- 3) The people must believe that the programme personnel a) know enough to competently help the villagers and b) are working for the people's benefit (rather than to cheat or manipulate them).
- 4) The people should come to identify with the programme's work and its successes by being involved in programme planning.
- 5) They must participate in the programme's work, so that when success is achieved, they will feel a sense of accomplishment. The challenge must be simple enough at first that they can meaningfully participate, yet gradually become increasingly complex so they can grow in their ability to deal with problems and can feel an increasing sense of accomplishment.

The people's enthusiasm will be further enhanced by:

- the freedom to set their own goals when they desire,
- the freedom to be creative in their work,
- the opportunity to work together in an atmosphere of mutual support and companionship,
- the opportunity to continue learning about new subjects of interest, especially solutions to other felt needs, and
- the recognition, gratitude and positive feedback of fellow villagers, programme leaders and other programme workers.

#### Success - the source of enthusiasm

None of the above conditions will, however, inspire much enthusiasm in the absence of one crucial ingredient: early recognisable success. We define a 'recognisable success' as the solution of a felt need with results that are both readily observable and desirable according to the culture's own value system.

Recognisable success must exist for each of the above conditions to stimulate enthusiasm. For instance, if people work on a problem very long without achieving recognisable success, they will come to doubt that it is possible for them to solve the

problem. Villagers skeptical of the programme's competence or benevolence will change their minds only when they recognise that the programme has achieved successes of benefit to them. Identifying with or participating in efforts that never succeed will produce not enthusiasm, but pessimism, shame and disappointment. When long-term efforts lead only to failure, companionship and mutual support tend to degenerate into mutual recriminations and bitterness. And recognition, gratitude and positive feedback will be forthcoming only when the work is widely perceived as beneficial. In short, where there are no recognisable successes, there will be no enthusiasm.

Some programmes try to arouse interest and enthusiasm by holding competitions or offering prizes to those farmers who excel. Experience indicates, however, that competitions and prizes seldom produce good long-term results. People in many cultures do not regard individual competition favorably. Secondly, for each person whose enthusiasm is increased because he won, many other people's enthusiasm is decreased because they lost. Furthermore, prizes may distract attention from the real benefits that an innovation brings.

More fundamentally, if the technology brings success, the prize is superfluous. If it doesn't, the prize is useless; the practice will be discontinued the moment the prizes are.

#### 3. INCREASING PARTICIPATION - THE PATH

#### Constructive participation

While enthusiasm is the driving force that can move a programme away from paternalism, increasing participation is the direction the programmes must take. Quite simply, the opposite of doing for people is participation by the people. And this participation must occur in both decision making and programme execution.

Participation can provide tremendous advantages for a development programme. Involvement of local villagers helps ensure that the programme will respect local cultural values and will be continually oriented toward the people's felt needs. Obviously, no one can provide more understanding or two-way communication between the programme and the villagers than villagers who work in the programme. Salaries and transportation for small farmer employees are much less expensive than for professionals. Furthermore, the involvement of villagers helps them appreciate the difficulty of the programme's work and dispels suspicions as to its motives. Thus, villagers participating in a programme are more willing to commit themselves and their resources to agricultural improvement.

The most important reason for small farmer participation is that it may be essential to the permanence of a programme's work. During five or six years of studying by candlelight, slogging through the mud and teaching classes late into the night, villager extensionists can become tremendously committed to the success and continuity of their work. This committment, plus their know-how and teaching ability, will remain in the villages after the programme leaves. Furthermore, if small

farmers have not been intimately involved in the programme, they will probably be neither willing nor able to permanently continue the process of investigating and teaching the changing technology that high-yield agriculture requires.

Small farmer participation provides a whole series of benefits for the farmers, too. Through their own experience (which is their most effective teacher), they learn to plan, to find solutions to their problems, to teach others and to organise themselves to work together. They learn skills such as how to deal with the give-and-take within an organisation and how to correct each other without hurting feelings - skills that are essential if small farmers are to form and manage their own organisations successfully.

Villagers can, through their participation, gain self-confidence, pride and the satisfaction of having made significant achievements. They can also develop the ingenuity and creativity that will enable them to continue improving the life of their communities. These changes - the growth achieved through what we shall call 'constructive participation' - are crucial to the fulfilment of the broader human goals, of enabling the people to supply their basic necessities, live in brotherhood and achieve power. In fact, this growth through constructive participation is the very essence of development. Definitions of development abound, but most people would now agree that, among other things, development is a process whereby people learn to take charge of their own lives and solve their own problems. Development is occurring where people are gaining the self-confidence, motivation, character traits and knowledge needed to tackle and solve the problems they have by actually tackling and solving those problems.

If this process is, in fact, development, two corollaries immediately follow. First of all, giving things to people and doing things for people cannot be called development. On the contrary, they are the very opposite of development. Secondly, the developmental process, whereby people learn, grow, become organised and serve each other, is much more important than the greener rice fields and fatter coin purses that result. Although the two must go hand in hand, the 'how it is done' matters more than the 'what is accomplished'. And the 'how it is done' must include constructive participation.

# Destructive participation

Participation is not always constructive. In some programmes, a single leader emerges and takes control; everyone else learns to be submissive rather than to participate. In other cases, a lack of experience at making decisions as a group causes disagreements. Factions develop and organisations disintegrate. Even well-made decisions can lead to failure, causing disappointment and mutual casting of blame. Many cultures have no acceptable method of correcting the inappropriate or dishonest actions of leaders. When leaders misbehave, people merely sit back and gradually become convinced that organisations are ineffective, or even dangerous. And very often, too little is known about handling money. Financial losses because of either insufficient planning, poor decisions, graft or nepotism will also cause division and mutual recriminations.

Even if these more noticeable problems do not occur, programmes may merely fail to produce much recognisable success. As people become convinced that little is going to improve, whatever enthusiasm they had wears off. The best motivated and most talented leaders may go elsewhere. Those who remain do so for the only reasons left - their salaries or graft. Tremendous pressures for deceit and manipulation can be produced by situations in which the continuation of salaries depends upon superiors believing that successes exist where, in fact, they do not.

These kinds of participation teach people that other villagers are not trustworthy, that getting involved in organisations only causes them problems, and that villagers are not capable of solving their own problems. These kinds of participation teach manipulation, deceit, exploitation, individualism, hopelessness and dishonesty. They are destructive rather than constructive. They do not produce development; they preclude it.

Participation, then, is not innately good, as is often assumed. It can divide and tear down just as well as unite and build up. Our job is to help keep it as constructive as possible.

#### How can we improve the quality of participation?

1) We must recognise that constructive participation is learned - gradually. Some development agencies, in trying to avoid the suffocating paternalism and 'outside expert knows all' attitudes of the past, have swung to the opposite extreme of providing almost no outside input whatsoever. They merely form a local committee or directive board and start sending it programme payments. Though many of us at first welcomed this style of operation, it unfortunately appears to have produced far more destructive than constructive participation.

Why? In most cultures, participation is a learned art. Colonising nations found out the hard way that one does not give birth to a democracy merely by organising a parliament and pulling away the gunboats. Likewise, we do not produce constructive participation merely by forming a committee. Instantaneous democracies spring forth as rarely among programmes as they do among nations.

Many of those who have worked in development at the village level have found that constructive participation requires a surprising number of skills. People must learn how to express themselves in public, analyse and verify information, make decisions and resolve conflicts. They must also learn how to criticise their companions constructively, acquire and use power, maintain vertical channels of communication, keep accounts and use money wisely, and avoid such common problems as favoritism, nepotism, gossip, manipulation and autocratic leadership. Constructive participation also requires a certain minimum of mutual trust, honesty and concern for others. Agricultural programmes require, in addition, that people know what increases in agricultural production are possible, how those increases can best be achieved, how to teach each other, and how to administer the necessary supporting services.

We do not expect a first-grader to begin learning arithmetic by tackling

differential calculus. By the same token, we should not expect villagers to begin learning participation by running an agricultural development programme.

Outsider personnel, either foreign or national, may therefore be necessary to get the programme started. The amount of outsider input, however, will vary from one group to another. Some groups of small farmers that have already learned to handle participation, either through previous work in development programmes or by themselves, will need no outsider input at all. Others will need a good deal. In any case, programmes should avoid providing any more outsider input than any specific group needs at any given time. And they must, forever and always, work toward the day when the villagers will no longer need any programme input whatsoever.

2) Early recognisable success is a crucial ingredient in making participation constructive. Success can attract the highly concerned leaders that constructive participation requires. It can strengthen bonds of companionship between the workers and earn them positive feedback from their neighbours and friends. Success eliminates the pressure to claim deceitfully results that were never achieved. And success alone will overcome hopelessness and convince the people that they are capable of solving their own problems.

In the end, success is as crucial to making participation constructive as it was to creating the enthusiasm that motivated the participation in the first place.

3) There must be conscious and constant efforts to help people learn how to participate constructively. Both through short courses, when possible, and through constant attention to what the day-to-day experience in the programme is teaching those involved, programmes must make sure that small farmer participation is as constructive as possible.

#### How can we increase the amount of participation?

The problem in small, nongovernmental programmes has not been so much a lack of desire to increase small farmer participation as it has been a failure to realise how many aspects of programme design must go into this participation. The major question is usually not whether to increase participation, but how.

The following list, by no means definitive, offers a few ideas as to how some programmes have succeeded in increasing villager participation. The most important ideas are listed first.

- Create enthusiasm. As noted above, the amount of constructive participation in a
  programme depends on the amount of enthusiasm it can generate. Programme
  salaries can bring about some participation, but they should never overshadow
  enthusiasm as the principal driving force behind a programme.
- 2) Start the programme small and simple. Undoubtedly the most common error affecting villager participation is that of organising programmes so large and

complex that meaningful participation by the villagers is impossible. Once this error is committed, programmes invariably take one of two courses of action. The first is that of outsiders running the programme in perpetuity. Local representation may be set up, but the real 'power behind the throne' remains in the hands of outsiders. The second alternative is to turn the programme over to the villagers before they are at all capable of running it. The result, whether it be a Caribbean canning operation, a rabbit cooperative in Guatemala or a fishing cooperative in India, is invariably the collapse of the work within a year or, perhaps even worse, the survival of the work through ever-deepening crises until the leaders finally give up in humiliation and exhaustion.

Programmes must start absolutely as small and simple as possible while still being capable of producing recognisable successes early on. Expansion should come only as villagers become enthusiastic and capable enough to take over the jobs previously held by outsiders within the programme.

3) Be careful with the role of outsiders. Outsiders, both nationals and expatriates, should be chosen for their willingness to live close to the people and their ability to establish friendships of mutual trust and candid two-way communication with the villagers. And they must understand and appreciate the village people's traditional knowledge and cultural strengths.

In their actions and ways of expressing themselves, outsiders must be careful that they leave the villagers room to discuss, disagree and be creative. In all too many ostensibly democratic programmes, the ranking expatriate or professional is the de facto boss. Out of either respect, a belief in certain prerogatives of status, a feeling that foreigners or professionals always know better, or a reluctance to face disagreements in public, the villagers participate only marginally in the making of decisions.

This domination by outsiders can be so overwhelming as to long survive the physical presence of the outsiders. Two full years after one African programme had been totally 'Africanised,' the size of each resident trainee's plot of land, the exact acreage to be planted in each crop and the specific techniques to be used were all still dictated by rules laid down by whites. Albeit unconsciously, the whites had established a virtual tyranny of rules - of attitudes that 'this is how development is done' - that no Africans cared or dared to question.

4) Plan for the phase-out of outsiders and of the programme itself. One over-present goal of all programmes should be the eventual takeover by small farmer management. Thus, from the beginning, every activity should be organised in such a way that villagers will learn how to manage it and, if necessary, how to sustain it once the programme closes down. We should keep in mind always that the purpose of each activity, apart from its own results, is that the villagers learn to handle it themselves.

The phase-out must be gradual. Villagers can, step by step, move from deciding when and where classes should be held to gathering people for the

classes, to presenting the classes, to organising a series of classes, and eventually to administering the entire programme. As a general rule, no outsider should hold any particular job for more than two to four years.

As small farmers take over the programme, some mistakes will be made. However, outsiders must have the humility to recognise that they themselves made an occasional mistake, and that some of the villagers' methods will, in fact, represent improvements on the outsiders' methods. Furthermore, mistakes can be valuable. As long as they are not so frequent or so major that they drastically reduce the programme's total enthusiasm or faith in local leadership, they can serve as unforgettable lessons.

- 5) Teach farmers to conduct small-scale trials. Only when small farmers know how to experiment with new technology will they achieve maximum possible independence of outside sources of information and be able to participate in the development of the steadily changing technology required by a productive agriculture.
- 6) Don't flaunt the moneybags. Programmes that inform the villagers early on that, say, \$100 000 are available for the programme will confront a good number of problems. Such sums, astronomical by village standards, tend to attract those villagers interested in graft. They can also produce considerable pressures for everyone to receive inflated salaries. Costs are thereby inflated and voluntarism reduced or eliminated. High salaries and the absence of voluntarism complicate employee selection because of the difficulty of distinguishing between those people genuinely concerned about others and those merely concerned about landing a high-paying job. High salaries and low voluntarism reinforce also the feeling that outside money, not the people's own efforts, has made the programme successful. Thus, the growth of pride and enthusiasm is stunted. And very likely, when the money is spent, the work will come to a screeching halt.

As villagers work their way up into programme management, they obviously must learn about the budget and increasingly decide how it will be used. Nevertheless, their knowledge and control over the budget, like their participation in general, should not come all at once, but increase gradually over time.

7) Don't try to meet all of the people's needs. At the outset, programmes normally have to expend a good deal of effort to motivate people to try out recommended innovations. In time, however, well-designed programmes will have people from an ever-widening area knocking at their doors. Such programmes face two alternatives: to decline, at least temporarily, to meet all the demand or to expand rapidly enough to meet it.

Experience indicates that the first alternative is preferable. The benefits of refusing to answer every call for help are illustrated by the experience of a World Neighbors programme in Guatemala. Swamped with requests for help,

the programme decided to work only in those villages from which a group of at least 15 farmers requested classes. Thus, by the time the programme began working in a village, its leaders had convinced a number of farmers that they needed agricultural classes; the farmers had organised themselves into a group; and the group had committed itself to attending weekly classes. In the process, community leaders had become committed to the classes' success. Groups of people had thereby begun to generate, by themselves, the motivation and organisation essential to agricultural improvement. Once again, the programme had not done for them what they could do for themselves.

The second alternative, that of expanding the programme to meet the growing demand, may force the programme to become large and complex all too quickly. Takeover by small farmers will become improbable, if not impossible. And the inefficiency caused by trying to do everything at once, so widely observed among the better-motivated programmes, becomes almost inevitable.

8) Remain constantly aware of the level of villager participation. We must ask ourselves every few weeks: How many villagers were in the last planning meeting? How many of the last five programme decisions were made in ways originally suggested by villagers? How many villagers participated in solving the programme's latest emergency situation?

All the above rules of thumb are, of course, easier to formulate than to follow. How small and simple should a programme be? How soon should local leaders take over programme administration? How soon should village leaders participate in budget planning? No prescriptions can be given. Resolving these questions amid the dust and fury of each unique programme is part of the art of agricultural improvement; it will take understanding, sensitivity, good judgement and generous amounts of feedback from the villages.

In summary, neither giving things to people nor doing things for people will be of much long-term benefit, and both may have serious negative side effects. Development is basically a process whereby people learn to participate constructively in the solving of their own problems. The driving force behind this participation is enthusiasm; the direction in which the people must move is toward gradually increasing participation; and the goal is that the programme itself gradually be lost in, and replaced by, a totally participatory movement of the people, by the people and, eminently, for the people.

#### 4. SMALL-SCALE EXPERIMENTATION

Our job is not just to teach people technology, even less to be 'salesmen' of technology. Much more important than selling any particular technology is teaching the people a method of village research with which they can continue to try out new innovations year after year. Once again, we are not here to develop their agriculture, but to teach them a way in which they can develop their own agriculture.

In this role, we should never try to convince a farmer to change over entirely to some new practice (except in the rare, usually avoidable cases in which the nature of the technology requires it). Instead, all we need to do is to convince the farmer or group of farmers to try out an innovation on a small piece of land, usually 1/20 ha or less, or on two or three animals, and to keep a simple accounting of the results.

The temptation always exists to try to introduce an innovation on as large an area of land as possible. It makes our programme statistics look better. But we should not be any more interested in one person's innovating on 100 ha than we are in one person's learning 100 ideas. Objectives and results expressed in areas of land rather than in numbers of farmers exert pressure on a programme to work with the larger, more prosperous farmers.

There are many reasons why we should promote small-scale experimentation rather than large-scale adoption.

#### Why teach small-scale experimentation?

Teaching small-scale experimentation provides advantages for everyone involved: the small farmer, the villager extensionist, and the programme.

Advantages for the small farmer. The first advantage for the small farmer is that it reduces his or her risk; it protects him or her against major economic failure. Innovations can fail for many reasons. They may not have been tested sufficiently by the programme. Those that have been well tested can fail because of differences in weather, topography, microclimate or soils between the time and place the innovation was tested and the time and place it was put into practice. An innovation can also fail because of the specific situation of the individual farmer, such as his or her seasonal labour availability, the possibilities and cost of transportation to market, his storage capability, or the presence of disease organisms or stray neighborhood animals. Furthermore, farmers may not have accurately understood or remembered the extensionist's recommendations or may make any of dozens of possible mistakes in applying them.

Any of these errors, whether caused by the programme, the extensionist, the farmer or nature, can result in the farmer's losing not only a crop or some animals, but all the capital invested in them. When a subsistence farmer loses a year's harvest, it is a deep personal tragedy. It can mean that his family will go hungry for weeks or even months. It can also mean he will have to borrow money or food that will take years to repay, often at usurious rates of interest.

On the other hand, if the farmer starts by trying the innovation on a limited quantity of land or with two or three small animals, he can make sure he knows how to do it and what the probable results will be before he risks an entire year's income. If there is a loss, it may hurt, but it will not affect his well-being for months and years to come.

A second advantage of small-scale experimentation is that a farmer can learn much more in this way than by experimenting with his entire crop. If a farmer makes a change in his entire crop or all of his animals, he can try out only one change or one combination of changes each year. If, however, he devotes just 1/20 ha to small-scale experimentation, he can do as many as ten different  $5 \times 10$  m experiments each year. I have seen a single small farmer experiment with three different vegetables, five varieties of pasture grass, three or four soil conservation methods, and various plant populations for his corn all at the same time.

Thirdly, a farmer who makes a change in an entire crop or with all of his animals has no way of comparing the results of the new production system with those of his previous one. If the harvest or the animals improve, the farmer may never be sure whether the improvement is due to the innovation itself or to fortuitous circumstances, such as good weather or less disease. On the other hand, even a very good innovation can fail when conditions turn bad. If, however, a farmer tries out the innovation on a small scale, he has a natural control plot: the rest of his farm.

Advantages for the extensionist. With so much at stake, small farmers are much more likely to try innovating if they can do so on a small scale. Thus, the extensionist can get a much larger number of people to try out innovations. The extensionist's job is less frustrating and difficult, and his rewards are greater.

Secondly, small-scale experimentation helps the extensionist preserve his credibility and prestige. In order to convince a farmer to adopt an innovation wholesale, an extensionist must usually assure him that the innovation involves very little risk. In practice, the extensionist usually promotes it as being a sure success. On the other hand, if all he needs to do is convince the farmer to try it out on a small plot, he can present the innovation as an idea worth trying. After all, it presumably has already been tried out successfully by the programme, by other small farmers and by the extensionist himself. The extensionist can even afford to admit, as he should, that there is a chance the experiment could fail. After all, most farmers will understand that the possibility of learning about an innovation that can improve all their harvests of a given crop for years to come is well worth the risk of losing just once the harvest on a 5 x 10 m plot. Thus, farmers try out the innovation because past experience has proven it an 'idea worth trying', not because it is a guaranteed success.

When a farmer loses his entire crop or his animals die, he has failed in his responsibility to his wife, his children and, often, the entire extended family. He has failed in what is often the one thing he prides himself in doing well. He may have to watch while his family members reduce the quantity or nutritional value of the food they eat, perhaps endangering their health. And he loses prestige. Such a failure usually causes intense feelings of hurt and frustration, which in turn create a deep emotional need to blame someone for the failure. Any extensionist even partially responsible for such a failure should not be surprised if his reputation is attacked with a vengeance. Those he caused to fail may become enemies overnight. In the case of a villager extensionist, these new enemies may well have been his best friends, his relatives and those with whom he had the most influence. Furthermore, if the extensionist promoted the guilty innovation as a sure success, the villagers' own experience has proven to them that he is either ignorant or untruthful.

The extensionist has lost his credibility, his prestige and his friendships. Even though the fault may lie with the programme rather than himself, he has lost much of his value as a leader.

On the other hand, an extensionist who promoted an unsuccessful innovation as an idea worth trying out on a small scale, and who had warned farmers it might fail, has not ruined his credibility. Nor has he caused major economic failure, hunger or suffering; presumably, people have risked what they could afford to risk. Furthermore, a crop failure on a 5 x 10 m plot, although unfortunate, will cause no major hard feelings. Thus, the extensionist has likely retained all of his credibility and a good part of his prestige.

Small-scale experimentation also protects the extensionist from being blamed for a crop failure caused by unfortunate circumstances, such as bad weather or insects. Since the rest of the crop will have suffered equally, farmers will realise that the innovation itself was not responsible for the loss.

Advantages for the programme. A programme whose extensionists have been protected against a loss of credibility, prestige and friendships is, of course, immensely benefited itself, as is a programme whose technology is reaching a wider audience because farmers risk less in trying it out. Furthermore, since farmers are prevented from losing an entire crop or herd of animals, the programme avoids being responsible for villagers' suffering major losses. The programme thus avoids seriously damaging both the people's good feelings toward the programme and their enthusiasm for agricultural improvement.

But still further advantages accrue to the programme. First of all, it is able to reach the poorest farmers because small-scale experimentation makes it possible for them to begin innovating with a very small initial investment. Nor need they feel ashamed for starting on a very small plot.

Secondly, should a loan service be provided by the programme, it will be greatly simplified. By using small-scale experimentation, most farmers will be able to try out technology without a loan. For those who do need a loan, a maximum of \$30 should be enough for any small-scale experiment with a truly appropriate technology. Frequently, \$5 to \$10 will suffice. Not only is the programme thereby able to assist more farmers with a smaller outlay of money, but smaller loans tend to be easier to collect. We also avoid the danger of inadvertently getting small farmers into debt over their heads.

Thirdly, as farmers do more and more experiments, the programme will get more and more feedback about its technology. Increasingly, it can learn from the villagers about new solutions to its technological problems and new ways of adapting its technology to different farm conditions and to the particular needs of the small farmer. In South America, a programme promoting the transplanting of clover for pastures learned from the villagers' experiments that the clover would grow better if it was pastured down to a height of 20 cm just before transplanting. Programme leaders also learned that if they planted clumps of three to four stems rather than single-stemmed plants, the clover would be ready to pasture a month or two sooner.

In a World Neighbors programme in Guatemala, villagers using improved techniques for growing black beans discovered a native variety capable of producing up to 3200 kg/ha. After this variety proved itself superior to scores of varieties imported from the seed bank in Colombia, the national basic grains programme began recommending it as the best variety for the western highlands of Guatemala. The improvement of technology by villager farmers not only increases a programme's effectiveness, but increases the farmers' sense of self-esteem as they realise they have turned the tables and are now teaching technology to the programme.

Even more important, however, for villagers, extensionists and programmes alike, is that the villagers are learning an attitude of experimentation, a method of scientific inquiry. They are learning a way of mathematically evaluating innovations so they can make increasingly precise farm management decisions in the future. The programme is thus achieving what is at once the most difficult, least often accomplished, and most important goal of agricultural improvement work: to teach people to carry on, by themselves, the never-ending process of developing their own agriculture.

And this is happening. In some programme areas, whole villages or clusters of villages are taking off on their own, developing technology far beyond what the programme taught them. In San Martin Jilotepeque, Guatemala, wild rabbits were wiping out programme-introduced soybeans. One day a local farmer smelled a horrible odour as he was walking by a drugstore. It was iodine. He bought a pound, mixed it with water and spread the solution around the borders of his soybean field. The rabbit problem was eliminated. Some of his neighbours discovered that burning sulfur at the edges of their fields provided the same happy results. Another farmer found that he could intercrop peanuts among his beans. The beans matured before the peanuts needed the space, increasing his per hectare harvest by 50% over that of separate plantings. Still another villager found that he could construct simple trellises over his coffee trees and grow passion fruit on them. The passion fruit not only shaded his coffee but also more than doubled the net income from his coffee field. Meanwhile, other villagers near San Martin are experimenting with cauliflower, cabbages, native herbs and native root crops. Successful innovation creates enthusiasm, and the increasing enthusiasm pushes people to innovate more and more. The process gathers a momentum of its own.

#### How to teach small-scale experimentation

In the beginning, villagers only need to learn to:

- 1) measure off several plots of land or separate out two or three animals,
- plan experiments so that only one production factor varies between each two plots or groups of animals,
- 3) weigh or measure the results, and
- 4) write down and add up all the expenses and income of both the experimental crops or animals and the controls.

Farmers of nearly any educational level can learn to do this. Even illiterate farmers have been taught to read and write numbers and then use mimeographed

sheets with drawings that depict the various cultural practices and inputs. In time, as they become willing to learn and able to understand more, they can keep more exact accounts and use more complex, scientific experimental designs.

Small-scale experimentation should be an integral part of the programme's training process. No technology should be taught or classes given unless the students are experimenting with the technology on their own farms. Once again, our goal is not merely to impart knowledge, but to help villagers learn how to improve their own agriculture. The first step in that process is for them to learn about an innovation and try it out through small-scale experimentation.

## Start slowly, start small

There are several reasons that programmes should not tackle too much work the first year or two:

- 1) The need to get to know the people and the area. It takes time to come to know an area, to get a good feel for all the cultural, social, economic and agronomic conditions that affect agricultural improvement. Especially those of us from Western cultures must remember that traditional cultures are very personalistic. Personal relations form an important part of everything that is done. If a programme is to gain the necessary trust and confidence, its staff must have time to do such things as walk through the villagers' fields, send them a note of appreciation, enjoy a meal at their homes or play awhile with their children.
- 2) The need to learn to run a democracy. It also takes time to become accustomed to running a programme democratically to learn to both participate and allow others to do so, to formulate and express ideas, to consult with co-workers instead of making spontaneous decisions, and to handle the give-and-take of working as a team. Democracies take more time than dictatorships, but they allow the participation that is the essence of development.
- 3) The need for close supervision. During the first year or two, time must be allowed for very close supervision of the villagers' experimental plots. This supervision is needed because villagers may not be familiar with the method of experimenting, and they may have little understanding of the innovation in the beginning.
- 4) The need to keep one's promise. In much of the Third World, villagers have been cheated and deceived time after time and, consequently, they have become skeptical of everything they hear. A cardinal rule for all programmes should be to promise something only when the programme has absolute certainty it can keep its promise. In an environment where neither transportation, communication, supplies nor the promises of other organisations can be relied upon, it is best to promise as little as possible.
- 5) Overcoming the 'inertia of disbelief'. Extra time is needed to overcome the 'inertia of disbelief'. Complacency, fatalism and apathy have often been noticed among traditional societies. After centuries of suffering, during which life in millions of villages has never really improved, but rather deteriorated, the people have become demoralised by their own history. Significant success can break this

vicious cycle, but time is needed to make sure an adequate level of success is achieved.

#### Criteria for appropriate technology

World Neighbors' experience has led us to believe that farmers are better served, and the goals of the agricultural improvement better fulfilled, if we seriously limit the amount of technologies included in the experiments.

It is all too easy to get excited about one innovation after another. There is always the temptation to introduce one more innovation that will boost the yields even higher. To keep us working on a limited technology, we must keep our sights set on the thousands of farmers we have yet to reach. It takes time to find one or two innovations that raise income significantly, but the search is well worth the time. In the past, the individual innovations that raised incomes most dramatically were improved seeds and fertilisers. Now, scattered, little-known programmes are achieving equally impressive results with a wide variety of other innovations.

World Neighbors' experience indicates that there are a number of widely applicable criteria that can guide us in choosing the appropriate technology for any particular area:

- 1) Is the technology recognised by the poorest farmers as being successful?
  - Does it meet a felt need?
  - Is it financially advantageous?
  - Does it bring recognisable success quickly?
  - Does it fit local farming patterns?
  - Does it deal with those factors that most limit production?
- 2) Will the technology benefit the poor?
  - Does it utilise resources the poor people already have?
  - Is it relatively free of risk?
  - Is it culturally acceptable to the poor?
  - Is it land- or labour-intensive rather than capital-intensive?
  - Is it simple to understand?
- 3) Is the technology aimed at adequate markets?
  - Are market prices adequate and reliable?
  - Is the market available to small farmers?
  - Does the market have sufficient capacity to absorb increased supply without appreciable decreases in price?
- 4) Is the technology safe for the area's ecology?
  - Does it avoid or reduce nutrient drain or erosion?
  - Does it conserve resources such as groundwater and natural vegetation?
  - Does it avoid or reduce contamination of water, soil or air?
- 5) Can the technology be communicated efficiently?
  - Does it require a minimum of on-site supervision?
  - Is it simple to teach?
  - Does it arouse enthusiasm among the farmers?

# · Is the technology widely applicable?

Often the first reaction to the list of criteria is: 'That's all fine, but it may be downright impossible to find technology that will fit all those criteria'.

Although no one can know for sure what the potential for increased yields and incomes is in the Third World, we have good reason to believe that a tremendous potential exists. One indication is the wide variation in current levels of production in different countries. Furthermore, a large number of simple, inexpensive innovations look very promising. Among these are simple soil conservation measures, the use of native green manure crops, the use of blue-green algae in irrigated rice, planting in rows rather than broadcasting, intercropping and multiple cropping, bringing back native herbs and food plants in danger of dying out, organic pest control, better water use and drainage, agroforestry, the storage and processing of grains and vegetable, pasture improvement, animal vaccinations and countless simple cultural improvements in traditional crops. We have hardly begun to investigate most of these possibilities, much less to pass them on to small farmers.

#### Sources of innovations

Ideas for potential technologies can be supplied by local farmers, research stations and other programmes in ecologically similar areas. Good local farmers often produce two to three times what neighboring farmers do. Furthermore, through a natural selection process, they have chosen their methods according to the criteria for appropriate technology. By teaching these farmers' methods to others, we can achieve significant increases in production. Though many technicians doubt the value of this methodology, it was used in Western Europe, the United States and Japan.

Regional, national and international research stations may also be a source of technology. But this has to be looked at critically, as most of their technology is not at all what the small farmer needs. Conventional research methods and selection criteria have usually not been geared toward small farmers' realities and values. Fortunately, however, there is a growing movement toward 'Farming Systems Research', in which the experiments are carried out on small farmers' land by the farmers themselves, and their subsequent adoption of the technology is increasingly used as a criterion of success.

Agricultural programmes in the area or in comparable environments may also have accumulated valuable experience as to why some innovations will work or will not work.

#### 5. OVERALL PROGRAMME DYNAMICS

#### Programme phases

Table 1 gives a general idea of the four phases through which most agricultural programmes evolve. Each programme will progress through these stages differently. Some programmes, because of previous work nearby, know of an appropriate

technology from the start, thereby eliminating the need for experimentation. Such programmes may finish the first stage in just three or four months. Other programmes may spend three years finding a truly appropriate technology.

According to the chart, an agricultural programme's total duration would be 5-12 years. Nevertheless, since few programmes need the maximum time for every stage, most programmes should probably last for 5-8 years.

## Interrelatedness of programme characteristics

Figure 1 shows a few of the more important ways in which the five major principles of good agricultural work can help us achieve our basic goals. The goals in the figure are assumed to be goals of any agricultural programme:

- 1) that villagers develop the ability to solve their own problems;
- 2) that they learn about and adopt improved technology; and
- 3) that the programme achieve the first two goals with maximum efficiency.

The arrows indicate the ways in which each principle works to help the programme reach its goals.

Not only are these principles of good agricultural work important in reaching our goals; they are vitally related to each other (see Figure 2). It is almost impossible to follow one or two of the principles without the others.

One fact worth noting is that the use of a limited technology, probably the principle least often applied in agricultural programmes, is the one that is most crucial in helping us to put into practice the remaining principles.

When all five principles work together, the resulting programmes can achieve such levels of success that it often surprises the programme leaders themselves.

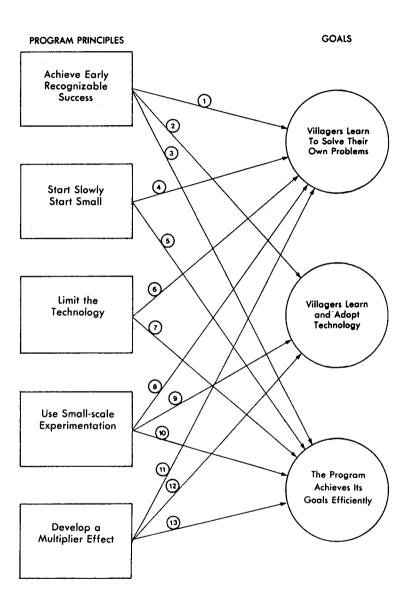


Figure 1: Good programme principles enable the programme to achieve its goals

# Notes for Figure 1: Good programme principles enable the programme to achieve its goals

- Early recognisable success will give the villagers enthusiasm, self-confidence and
  the feeling that they are capable of solving their own problems. Their enthusiasm
  will motivate them to put more effort into learning to solve their own problems.
- 2. Success will give villagers the desire to learn more agricultural technology.
- 3. A programme that has generated plenty of enthusiasm is more efficient because it spends little time motivating farmers. The people's enthusiasm also motivates them to apply their knowledge more widely and put it into practice sooner.
- 4. Villagers have a much better chance to participate constructively in programme decisions and implementation if the programme starts small and simple. The villagers thus learn more about how to work together and organise to solve problems.
- 5. Programmes that start small are often more efficient because they can eliminate errors and find more efficient operating methods before they spend too much money on mistakes. Programme personnel have more time to think of how things can be improved and to reflect on past experience instead of spending all their time running the programme.
- 6. Villagers master a limited technology faster and have more confidence in their ability to learn things well. They can also learn to teach a limited technology better. The technology, the self-confidence and the communication skills the villagers learn will all help them in facing future problems.
- 7. When we work with one or two innovations rather than twenty, one or two inputs will be sufficient for all of our work. At the same time, less technological backstopping is needed. The supervision of experiments is simplified, and villagers can do much of the supervision because they have learned the innovations quickly. Also, fewer lessons need to be planned and fewer audiovisual aids made.
- 8. When villagers experiment, they learn how technology is developed. Thus they are learning a solution to many of their problems. They are also learning the scientific approach to problem solving, which can have wide-ranging applications.
- 9. Obviously, while the people experiment, they learn about the innovations that work in their area, as well as some that don't.
- 10. The programme is more efficient because it does not need to run an experimental farm, with all the time and expertise this requires.
- 11. As villagers become extensionist multipliers, they learn many skills in agriculture, communication, and organisation that will help them solve other problems.
- 12. One never really knows anything until he or she has taught it to others. The villager leaders learn even more technology as they prepare for and give their classes.
- 13. A programme nearly doubles its impact per dollar spent if half the programme's classes are taught by volunteers.

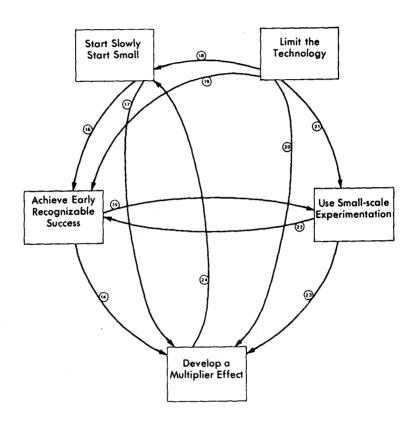


Figure 2: Programme principles are interrelated and interacting

## Notes for Figure 2: Programme principles are interrelated and interacting

- 14. The enthusiasm that results from early success is the driving force that keeps extensionist multipliers on the move.
- 15. The success of the first experiments creates enthusiasm for continued experimentation.
- 16. When programmes start slowly, they have time for careful, intensive supervision to assure the highest possible rate of success.
- 17. When programmes start small, they also have a better chance to choose and train their leaders well and can provide them better support and supervision. Leaders are also more able to participate in programme planning and implementation.
- 18. The only way to truly start a programme small is to start with a limited technology.
- 19. It is virtually impossible to get scores of farmers to experiment with a complicated or multifaceted technology and assure a high rate of success. The needs for wide-ranging technological backstopping and for many potentially vital inputs are two of the possible sources of problems.
- 20. When we work with a limited technology, villager leaders become confident of their ability to apply and teach it well. Self-confidence and personal success with an innovation are, of course, prerequisites to a villager's becoming a good multiplier.
- 21. The experimental design and mathematics necessary to experiment with even five innovations as separate variables are tremendously complicated. On the other hand, trying out a package of practices as a unit violates the principle of changing one variable at a time, and it tends to make the villager feel dependent on the programme to develop new sets of complementary innovations.
- 22. The technology that results from small-scale experimentation brings more success because it is usually more appropriate to the villagers' conditions and capabilities.
- 23. Villager leaders acquire technical knowledge as they experiment. They are later protected against the loss of credibility and friendships while teaching the technology because their students are risking very little in their experiments.

Table 1: Programme stages

Stage	Time required	Principal activities	Personnel	Budget
Finding the technology	3 months to 3 years	Choose and get to know the area. Establish and plan the programme. Find and choose an appropriate technology.	Very few, probably 1-2 professionals and 1-2 villagers	Low budget
Training in the first technology	1-2 years	The first technology is taught.  The first village groups are organised. Villager leaders teach their first classes. A second technology is tested. Simple institutions are begun, if needed.	Increasing numbers of villagers become extensionists	Expanding budget
Expansion	3-5 years	Multiplier effect. Health and other areas of work may start. More complex institutions begun, if needed.	All agricultural extension work is done by villagers. Professional phasing-out, moving into nutrition etc.	Largest budget
Phase-out	1- 2 years	Making sure villagers are capable of taking over everything. Close-out outside funding for agricultural work. Health and other work may continue.	Villagers take over the administration of the agricultural work	Decreasing budget for agriculture as villagers take over the services and the training function

# AN APPROACH TO PROMOTING TREE GROWING IN AFRICA: THE WORLD NEIGHBORS EXPERIENCE IN NORTHERN GHANA

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Garu District, one of the most densely populated rural areas of Northern Ghana, is located in the upper northeast of the country, just south of the Burkina Faso border. The Kusasi farmers who inhabit the area typically cultivate one to two hectares around their mud compounds on a permanent basis.

In past generations, the villagers have been cutting trees for firewood and clearing the remaining available land for farming. The resulting scarcity of trees has contributed to declining soil fertility and lowered resistance to drought. Indeed, trees have become so scarce that the villagers are forced to rely on their millet stalks as fuel for cooking.

Since March 1983, World Neighbors has been supporting the efforts of John and Denice Kleindouwel, working under the sponsorship of the local Catholic church, to promote the planting of trees in the area. Although they operate on a modest budget of USD 9,000 per year and have been in the area only three years, John and Denice

have motivated people in at least 30 villages to make tree growing an integral part of their everyday life.

The significance of the Garu project is not only that it is one of the few successful tree-growing programmes in Northern Ghana; its significance is due also to the extension-oriented approach employed to promote tree growing. This approach is based on awareness-raising, training of trainers, and encouraging local responsibility and self-reliance.

#### 1. BACKGROUND

Tree planting is increasingly being recognised as a sector which is a key to any strategy of long-term development. In 1985, a consortium of international agencies, including UNDP, the World Bank and World Resources Institute, unveiled a far-reaching strategy to halt the destruction of forests in the Third World. The plan advocates the doubling of spending on forestry. The report stresses that the destruction of forests is having a profound impact on Third World food production. This type of impact has been highlighted in Ethiopia, where scientists say that widespread cutting of trees has reduced the soil's ability to hold moisture, and has thereby intensified the effects of drought and worsened the famine.

One of the report's recommendations (aside from increased spending) is that policies should be established to encourage local participation in rural tree-planting programmes and natural forest management. The implication is that government reforms designed to reduce widespread deforestation have to be complemented not only by large-scale reforestation programmes but, as importantly, by small-scale, village-based tree growing.

It is important to distinguish between two different concepts when discussing tree growing in the Sahel. Reforestation is the massive replanting of forests which have been cut down to make room for loggers, ranchers and farmers. Social forestry (also called community forestry), on the other hand, is the use of trees as a development tool to help improve living conditions. It involves villagers in selecting, planning, and implementing tree-related activities.

Many of the initial schemes to promote tree planting were massive government-managed 'industrial' plantations of the first category. Such schemes were often inappropriate because they involved large-scale expropriation of land (often at the expense of the villagers), were extremely costly for the amount of wood produced and provided few, if any, benefits to the local population: the first action taken by these projects was to bulldoze all the indigenous trees in the plantation area to make room for the exotic species.

The next phase was the promotion of village-based woodlots. These programmes also had problems. The exotic species chosen for the woodlots were usually not appropriate, and there was little, if any, local participation in the selection of the sites or of the species to be planted. In effect, the village woodlots were government mini-plantations, and suffered the same problems as the larger-scale programmes.

As it became increasingly clear that plantation-style tree growing was expensive and did not do much to provide for the basic needs of the rural poor, different development agencies started to re-orient their tree-planting activities in line with the concept of what came to be called 'social forestry'.

In social forestry, tree planting is measured not according to the surface area covered with forest, but rather according to the number of individual trees planted and protected, regardless of how widely spaced. Social forestry aims at providing villagers with the assistance and training necessary to create a tree-rich landscape, where trees play an important role for providing shade and fruit, and individual woodlots for roofing poles and firewood.

One type of social forestry is agroforestry, the combination of tree planting with crop raising. All agroforestry is social forestry, but the reverse does not hold. For example, the planting of small woodlots or roofing-pole plots by villagers has nothing to do with crop raising, but definitely is considered social forestry.

Within the agroforestry concept, trees are planted for soil and water conservation as well as to help restore soil fertility. Because, with the increase of human population in the Sahel, cropland occupies more and more of the terrain, trees in farm fields will be the key element in a future tree-rich landscape. Villagers need to be helped in selecting the best adapted and most suitable species of trees for a variety of production and conservation purposes.

African farmers have traditionally practised a type of agroforestry. When they cleared their lands for crops, they left undisturbed the useful trees such as Acacia albida (Faidherbia albida), sheanut (Butyrospermum parkii), baobob (Adansonia digitata) and dawa-dawa (Parkia biglobosa, P. clappertoniana) species. Many forestry schemes in the past, however, neglected to strengthen villagers' existing knowledge and tree conservation practices.

The advantage of social agroforestry is that it can usually operate on a level easily managed by individual families without much outside help. It is based on traditional knowledge, but the whole idea needs to be properly encouraged and expanded in order to gain acceptance by villagers. With local support, small-scale interventions can produce significant results for the poor in terms of increased wood, crops and animal production, as well as adding an important conservation element to the natural resource base.

#### 2. METHODOLOGY

Over the past three years, World Neighbors has helped create a network of volunteer tree promoters and tree-growing committees in over 40 villages in the Garu area. These promoters and committee members have been trained in how to establish village-based tree nurseries, in which they produce seedlings for sale to their neighbours. They are also taking responsibility for the promotion of tree planting, and for training people who buy tree seedlings in how to plant and protect them.

The number of trees planted by individual farmers is increasing every year, but the significant success of the programme is that, in over 40 villages, the attitudes of the people toward tree growing has dramatically changed, and the activity of tree growing is becoming a part of everyday life.

Because the programme employs a participatory approach and is set up to help people meet their own perceived needs, most villagers have opted to plant fruit, firewood and roofing-pole trees around their homes. This is what they see as the priority at the moment, especially in consideration of their resources and time.

The following steps outline the methodology used to implement the Garu programme:

- 1) Awareness raising. After making contact with a village through leaders or interested individuals who have seen friends in other villages plant trees, a series of awareness-raising sessions using GRAAP flannel boards, filmstrips, and problem-posing techniques are held. The purposes of the sessions are to build on the people's existing knowledge about the importance of trees in terms of their economic livelihood and the environment, and to begin a dialogue about how to address the problems caused by the lack of trees. Awareness-raising serves to motivate the villagers to take action, and it is a continuous process.
- 2) Determining the villagers' felt needs. The dialogue is continued to help the villagers assess their priorities in terms of tree planting in consideration of their resources, time and local constraints. Various solutions to prioritised needs are discussed and analysed, and a plan of action decided upon.
- 3) Recruiting volunteer tree promoters. In each interested village, one or more 'contact persons' are designated. Usually, they are school teachers or prayer leaders, or other influential persons in the village who have taken a keen interest in the idea of tree planting. The contact person takes responsibility for promoting tree planting, makes a list of those who show interest and organises the distribution and sale of tree seedlings.

As the idea gains more acceptance in a given village and several farmers gain practical experience in tree planting and protection, the project encourages the formation of a Village Tree Committee, comprised of local farmers who assist the contact person to spread the idea and who usually begin local tree nurseries in their own home compounds.

- 4) Training of trainers. Once a year, usually just before the planting season, all contact persons are invited to take part in a training workshop. Techniques on how to plant trees, establish and maintain nurseries, and protect tree seedlings against fire and animals are covered or reviewed. The contact people share their experiences with one another, and practical problems are discussed. The contact persons are responsible not only for training all the villagers who have ordered trees in the proper techniques for planting, but, together with the Village Tree Committee, also for helping continue the process of awareness-raising in the village.
- 5) Establishing local responsibility and self-reliance. The aim of the programme is to establish tree growing as an activity that will become self-sustaining with a

minimum of outside support. The creation of Village Tree Committees is one aspect of this strategy. As the movement grows to an ever-increasing number of villages, it is hoped that the various Tree Committees can form an association that can take responsibility for obtaining its own seeds and sacks. More immediately, the aim of the project is to establish village-based tree nurseries so that the programme will not be entirely dependent on the central tree nursery run by the programme leaders.

- 6) Identifying the limiting factors. As the programme succeeds in motivating farmers to plant a number of trees around their compounds, the next step is to determine what the constraints are to increasing the number of trees each farmer can plant. The most limiting factor is often the lack of easy, inexpensive means to protect trees against cattle, sheep and goats in the dry season. This problem effectively makes the idea of agroforestry (i.e. planting trees in the fields) quite difficult, given the tree species, protection technologies and level of resources currently available.
- 7) Testing and evaluating new technologies. On a small scale, the programme leaders and participating farmers are testing various new 'protection technologies'. Constructing millet-stalk cages, using mud walls and broken pots, identifying animal-resistant species of trees, planting thorny hedges and using animal dung are some examples.

#### 3. RESULTS

Over 35 000 tree seedlings have been produced, distributed to villagers and planted. Education on planting and protection techniques has led to a survival percentage of about 50% (according to the World Bank, 30% is average). Forty villages have been reached by the programme and have taken up tree growing.

There are 22 village-based nurseries run by Tree Committee members, with each nursery having between 20 and 200 seedlings. On one village, there are over five nurseries.

Forty contact people have been trained to train their neighbours in techniques of tree growing. There are over 120 Village Tree Committee members in 31 communities who are promoting tree growing.

Some approaches to tree growing adopted by villagers include:

- planting fruit trees such as mango, cashew, lemon, grapefruit, tangerine, orange, papaya and guava; these account for about 50% of the total number of trees planted around compounds;
- firewood and roofing-pole trees are the next most popular category of trees; some are planted around the house, while other farmers have attempted to make small plots of 20-50 leucaena seedlings;
- roadside tree planting of animal-resistant species such as Acacia aureculiformis, teak and eucalyptus has been done in four villages;
- 4) schools, clinics, hospitals, churches and other public institutions have planted neem and other trees in lines on their property;

5) in some villages, the people have taken action to protect the natural tree cover in selected areas by prohibiting the cutting down of trees; to quote the elder of one village: 'Before, we thought that the land had to be bare, but now we realise that life depends on trees'.

Local volunteer leaders have been motivated to encourage their neighbours to plant and protect trees. When asked what methods they found to be most useful in promoting tree growing, some of the replies were: "The best method is by example ... you have to start planting trees yourself and the people will see." 'Do not do too much at once to convince many people ... just start planting trees, and talk to interested people." 'Start your own nursery, and bring your tree seedlings to the market and pito houses, and give talks about how good it is to plant trees.'

#### 4. FUTURE

The Garu programme is the only extension-based tree-growing programme in Northern Ghana. It has attracted the attention of many nongovernmental organisations in the area, who come to Garu not only to buy trees but also to receive advice on how to start their own extension programmes in promoting the planting and protection of trees. There is a good potential that other projects might take up a similar type of programme, inspired by the success of the Garu programme.

The greatest accomplishment of the programme so far is that, true to the basic premise of the 'social forestry' approach, villagers in the area now have a vision of a tree-rich landscape which they are practically making a reality, using their limited means and resources. Even if the Garu programme stopped tomorrow, the villagers who have been reached have the motivation and the technical training to continue to plant trees on their own.

However, much effort and time has to be spent to find appropriate ways to overcome the problem of protecting trees from animals and fire. Other tree-growing projects in Burkina Faso and elsewhere will be visited, an exchange of information and experiences will be facilitated, and new protection techniques will be tested by the villagers.

# NGOs AND THE IMPROVEMENT OF PEASANT AGRICULTURE: METHODS AND ORGANISATIONAL ASPECTS

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#### 1. INTRODUCTION TO CELATER

CELATER (Latin American Centre of Technology and Rural Education) originated out of a series of discussions held by a group of Latin American nongovernmental development organisations (NGOs) between 1983 and 1986. These joint deliberations led to a better understanding of the possible role of NGOs in Latin American development. CELATER was then founded in order to join forces with this ever-increasing number of organisations, especially in their educational efforts and attempts to influence development policy. It was convinced of the possibility of forming a scientific community devoted to rural development and to the peasantry. This community would be able to combine its knowledge to bring about social and technological change in a more fruitful way than had earlier examples of interdisciplinarity. This would involve self-reflection by each organisation and pooling their respective resources to seek rural development alternatives in a systematic way. CELATER would act principally as a guide in the mutual learning of the embryonic community of individuals and institutions.

CELATER is currently concentrating its energies on four areas: peasant agricultural production, small rural agroindustrial enterprises, rural education, and institutional aspects of development organisations. In each area, the following activities are pursued: research, training, systematisation of existing knowledge, and its diffusion at different levels.

Official development policies have tended to favour large-scale agricultural production. In spite of the fact that the peasantry has continued to be the major producers of agricultural products, their legal insecurity with respect to land tenure and their deteriorating socioeconomic condition has placed them on the margins of society. NGOs have, with some success, addressed this situation. CELATER analysed the contributions of these NGOs and discovered many common features in

their approach to development and their way of working. CELATER then organised a meeting of the various NGOs in Lima in April 1988, entitled 'Latin American Meeting of Development NGOs for Analysing and Systematisating Approaches to Improving Peasant Agricultural Production'. The overall aim is clear from the title of the meeting. The main themes were:

- Identification and analysis of problems of current peasant agricultural production in the different Latin American countries, with a view to seeking alternatives to existing rural development patterns.
- 2) Peasant participation in the research on and with peasant production systems.
- 3) Investigations of existing peasant production systems.
- 4) Searching for solutions on the basis of the results of the above.
- Generating and diffusing knowledge among the peasantry and other development institutions.

Participating organisations came from Bolivia, Brazil, Colombia, Chile, Equador, Paraguay and Peru. A complete list of these institutions is given at the end of this article. In addition, the International Potato Center (CIP) and Peruvian National Institute of Agricultural and Agroindustrial Research (INIAA), both of which have much experience in research and intervention geared to the improvement of peasant agriculture, took part.

#### 2. MAIN PROBLEMS IN THE RURAL SECTOR IN LATIN AMERICA

On the basis of the experiences in the seven Latin American countries, it could be concluded that - in spite of specific social, economic and political differences - the agrarian conditions display remarkable similarities. This could be due to the lack of a structured agrarian policy or the partial nature of state involvement in the rural areas, as these are directed mostly to the most dynamic enterprises, which tend to be run by the larger farmers.

This situation has led to the increasing deterioration of the living conditions of the peasant population, whose main features are as follows:

The agrarian reform implemented in the different countries has not resolved the problem of land concentration. In general, peasants have received the worst land (in terms of both soil quality and location). However, even in the cases where good plots were redistributed, the lack of adequate technical advice and infrastructure thwarted the most advantageous use of land and the improvement of production. The nonavailability of credit when required and of market outlets weighed heavily on the peasants, who - in many cases - had to sell their land to pay off their debts, or face land deterioration after some years.

The implementation of complex technological packages, which included the use of high-yielding varieties, pesticides and a high level of mechanisation, significantly improved production in large-scale agricultural enterprises. However, when those packages were applied on small-scale farms, there was an increase in production but the costs were beyond the peasants' reach.

Official extension services have focused their attention on transferring modern production techniques to the small farmers, and training them in modern farm management like that used in the large farm sector. They did this without taking into consideration the logic of peasant production. Instead, they sought to inculcate a new and inappropriate production model which has pauperised the peasants even more.

The deterioration of living conditions among the rural population has marginalised it from the rest of society. In these conditions, the NGOs' programmes to improve the lives of the peasants become increasingly important.

For this reason, it is essential to systematise the most important contributions of these NGOs in order to gain the knowledge needed to establish a scientific community that could strengthen the peasantry and support initiatives of new NGOs.

The conclusions based on the working experiences of the NGOs will now be described under the following headings:

- · Identification of agricultural production systems
- Research and search for alternative production systems
- · Education and the search for alternatives
- Community participation
- Evaluation
- Networking: needs and possibilities for further exchange.

#### 3. IDENTIFICATION OF AGRICULTURAL PRODUCTION SYSTEMS

#### Preliminary considerations

One of the main advantages of NGOs is their freedom to work at the micro-level, something which has given them more flexibility of action and closer contact with and a greater degree of commitment to the peasantry than official organisations.

Development initiatives should be people-centred. This means that the ultimate goals of development should not be improved production, conservation of resources and community organisation, but rather improvement in the quality of life of the rural people.

As the search for solutions to peasant problems of production must be holistic, the problems cannot be addressed by rapid, short-term actions.

Modern science can make a valuable contribution to the kind of development work that NGOs carry out.

Notwithstanding the advantages of the micro-approach to development, NGOs are anxious to spread their development initiatives more widely. To this end, organisational exchanges, periodic meetings and diffusion of literature are needed. In addition, collaborative action on many fronts should be attempted.

#### Specific issues in identifying production systems

Given the skepticism with short-term solutions, the systems approach to peasant agricultural production recommends itself. Although there are disagreements about

how to understand production systems, there are core areas of consensus. Production systems should be seen as dynamic. Any change in one element produces a change in the whole system. An immediate practical implication of this is the virtue of locating modifications in a part of the system where it is most conducive to bringing about benefits in the production system as a whole.

There is agreement on the value of simultaneously recognising the specificity and complexity of a particular region in order to formulate viable solutions to the problems encountered there. Solutions should be holistic rather than focusing narrowly on, say, economic profitability, a typical measure of success in big business.

Some consensus exists also on what 'production system' refers to. It is widely understood as a concrete entity, usually as the plot of land (or set of plots) the farmer owns, be it individually, collectively or according to traditional land tenure arrangements. Some NGOs take the community rather than just the plot as the focus of the production system. The production system consists of component subsystems which include the household, the soil system, the mix of crops cultivated and the animals kept. Other organisations divide the production system into the following aspects: ecology, economic system, technology used, use of labour and so on. Still other organisations have emphasised man as the active centre or owner of the system.

#### Working styles of the NGOs

Which farmers are involved. Regarding the choice of people with whom to work, there is general agreement that: a) a potential for technological improvements must exist, and b) the group selected must be representative of the population of the area, so that benefits can later be diffused to a wider population. Some organisations focus on only one or two regions because of previous commitments. Regardless of geographical coverage, the subjects of development interventions are individuals or groups possessing similar productive characteristics.

In all cases, the farmers are living in difficult socioeconomic conditions, but the NGOs consider that such groups should possess some level of organisation, e.g. through unions or cooperatives, for development initiatives to bring rewards.

The role of rural appraisal. On this aspect, different points of view are evident among the NGOs. Some believe rural appraisal to be essential, being a preliminary kind of research to get to know the area in which work will be done. Others think it unnecessary to make a formal assessment of the communities, since the inhabitants of these know their situation well enough, even if they may have difficulties explaining it to outsiders. Within those NGOs which treat rural appraisal as important, there are those who opt for formal research methodologies involving standardised questionnaires, surveys and sampling techniques applied to ecological, economic, agricultural and social dimensions of the community. The other approach claims that the most reliable assessment is one in which the community itself is involved, assisted and facilitated by the NGO personnel. An example of this method is that of FUNDAEC, described in detail below. Here, as with other NGOs, the assessment serves not only to acquaint the intervening institution with the life of the

community, but also to encourage the peasants to think carefully about the resources they possess and their potential for improvement.

Actions improving production systems. Broadly, this objective has generated the following strategies:

- agricultural research on the plots of the intervening institution as well as on those of individual farmers;
- educational activities deriving from the results of the research; the education should also strengthen social organisation capacity in order to bring about desired changes in the overall life of the community;
- priority to community organisation as the basis for attainment of lasting rural development.

Shortcomings in the activities of the NGOs. Two shortcomings have been generally recognised in the NGOs' search for alternative systems of production. The first is the failure to have elaborated evaluation mechanisms related to the specific technologies with which they have worked. In spite of this, significant advances have been registered not only in terms of production increases but also in other aspects of rural development. The second fault noted is the lack of continuity in projects. This has led to peasants losing confidence in the institutions concerned.

#### 4. RESEARCH AND SEARCH FOR ALTERNATIVE PRODUCTION SYSTEMS

#### General principles

It should be recalled that the NGOs treat research simply as one of various means of seeking viable production alternatives for the rural population, rather than as something isolated from the other development activities. Although differences exist in what and how the various organisations investigate, they share certain basic principles:

- research is not merely for generating knowledge but for seeking solutions to the real problems of rural communities;
- research should go beyond the search for short-term solutions; instead, it should be one of the bases of social change;
- research should treat the peasant condition as a whole without losing sight of key elements influencing it;
- research should not be separated from educational and organisation initiatives, but rather should enrich them;
- research should value peasant knowledge and management of production, immersing itself in peasant life, not just to 'play at democracy' but to understand the way peasant farmers understand and deal with their problems;
- even though research should address itself to specific problems, it should produce findings which can be generalised;

 despite the failures of conventional agricultural research to address peasants' problems, its findings should not be ignored.

#### Main approaches

Beyond the above areas of agreement, approaches to research vary. Most of the NGOs favour interdisciplinarity. Many think it necessary to involve their personnel in the community worked with, either in the 'action research' perspective or in 'development research' activities. Both methods emphasise the farmer as the active subject of production and the mutual learning benefits of both community and researchers in terms of the overall aim of working out effective solutions.

Organisations differ in their foci of attention, e.g. some study patterns of technology, others, the management of space. Techniques employed include group study and workshops, sometimes involving farmers, open interviews, ethnographic methods and formal surveys.

An area of some debate is whether experimentation in production alternatives should be carried out on the farmers' own plots or on those of the institution. Some think that the former option unjustly places the responsibility of the research and the possible risks on the shoulders of the farmer. Others argue that it is only on the farmers' plots that a realistic knowledge of problems and solutions can emerge. FUNDAEC has arrived at something of a compromise, in that it experiments on a communal plot worked by farmers alongside the researchers. Nevertheless, FUNDAEC and other NGOs have to face the fact that considerable time and effort is needed for this approach, if reliable results are to be obtained with regard to solutions to peasants' problems.

# 5. EDUCATION AND THE SEARCH FOR ALTERNATIVE PRODUCTION SYSTEMS

The guiding principles of practical relevance, non-academicism, respect for and knowledge of peasant agricultural practices, and dialogical learning are central to the understanding of the NGOs' educational work. Distinctions are frequently made between training, education and formation. Although the first is more specific than the second two, all should be two-way learning processes between farmers and NGO personnel. Communication has also been much debated and the need to recover the 'commune' dimension of its original meaning is of particular relevance for development initiatives.

The NGOs whose main work is educational have particularly tried to abandon one-way models of learning, stressing the need for reflecting on the implications of the practical activities carried out. Other organisations have differentiated levels of learning such as the training of professionals, farmer training, and learning by farmers from farmers.

Techniques include workshops, sociodramas and theatre, national radio programmes, and field days and courses of varying length. With demonstration plots,

there has been a tendency among many organisations to use these more as educational resources in which the farmers may play a leading role, rather than merely points of diffusion of pre-set techniques. Communication via brochures, pamphlets, magazines and films is used by most organisations. Inter-institutional links are also stimulated, most notably by GIA.

The NGOs are aware of the need for greater structuring of the information they have gathered and of their educational work in general. They also see the importance of more thinking on teaching/learning methods, particularly those which involve greater farmer participation.

#### 6. PARTICIPATION AND COMMUNITY ORGANISATION

Community participation is a term referring to one of the central principles of the NGOs discussed here. The concept emerged as part of a reaction against the conventional philosophy of development agencies prevalent in the 1970s, seen by the NGOs as static and one-sided. Alternative ways of working with communities were sought which valued the people's own knowledge and practical skills, and which promoted reconsideration of the existing situation and methods of transforming those communities in ways beneficial to them.

Participation has been interpreted in various ways according to the different circumstances in which the institutions work. The idea is multidimensional and closely linked to the concept of development. Diverse levels and types of participation exist, from local contributions to development programmes to active participation in decision-making by the local population. Equally, the way in which participation is encouraged varies from the strengthening of existing organisations such as local committees, unions and perhaps mothers' or childrens' groups, to promotion through meetings to discuss development proposals. Either way, the importance of free discussion from all sides is considered paramount. Where community organisations are weak, or unrepresentative, new forms of organisation are sought.

Participatory interventions, like any others, must build on a firm foundation of systematic research, education and organisation. A central area of debate is the extent to which participatory perspectives can adopt the methodologies of conventional, usually large-scale organisations without sacrificing their principles. A special methodology is therefore needed that permits, on the one hand, a healthy degree of interaction between farmers and researchers and, on the other, an infrastructure organised to guarantee participation.

Unfortunately, the instruments and mechanisms to proceed with participatory methods are still unclear. Much must be done on questions related to the minimum structures that need to be established to allow participation, and on how to link the peasant organisations with those of existing institutions in technology, development and production.

#### 7. EVALUATION

Through the NGOs' close involvement within the communities concerned, a profound understanding of the processes of rural society has emerged. Through their emphasis on man as the central reference point for development and the search for alternatives to existing programmes, NGOs have made unique contributions to rural development. Yet an urgent need for evaluation of these efforts is generally acknowledged. One of the problems is that it is difficult to use customary modes of evaluation, which focus on specific aspects, such as those measuring increases in productivity, since the NGOs take a holistic view of development. Consequently, a new set of parameters must be developed which will look, e.g., at the impact that development interventions have on employment, nutrition, community health conditions and conservation of resources. There remains much work to be done here, not least because many of the phenomena to be evaluated are qualitative by nature, resisting normal types of measurement.

#### 8. FURTHER EXCHANGE: THE INSTITUTIONS' POSSIBILITIES AND NEEDS

During the seminar, the NGOs indicated the areas in which they had most expertise and on which they were willing to provide information. They also signaled where they needed it. The organisations listed what they can offer and what they need, as follows:

ARARIWA (Peru) offers documents on:

- agricultural systems in valleys
- soil classification
- fodder
- seeds
- health
- · methods of rural appraisal.

CAAP (Equador) offers documents on:

- research on productive systems on the northeast Andean region of Equador
- · forestry: native species and seed propagation
- · irrigation: canal clearance
- · regional historical research
- · regional appraisal
- research findings on the process of learning and communicating Andean culture.

#### CAAP requires information about:

- actual experience of production systems
- · management of drainage areas
- · infrastructural work on farms
- trade systems
- · cattle farming.

# CATER (Equador) offers information about:

- · organic as compared to chemical fertilisation
- soil conservation and irrigation
- how to make bean and maize seeds last from one harvest to another
- systems of cattle farming.

### It requests:

case studies with specific findings on participatory research.

#### CCTA (Peru) offers:

- evaluation of the progress of different groups working on the Andean area
- a document on the methodology of systematic analysis of microdrainage areas.

# EL CANELO DE NOS (Chile) offers:

- · pamphlets on various topics
- · experience in organisation and participation
- · register of technologies
- methodology of popular education, with special reference to women
- a thesis on the experimental plot.

CPES (Paraguay) offers its support to NGOs on research methodology and a forum for publishing field experiences in the Paraguayan Journal of Sociology.

# CIED (Peru) offers documents on:

- · soil management
- a range of studies on agricultural systems in humid tropical areas undergoing transition
- · doing evaluations
- a list of possible commercial and directly consumable crops for humid tropical areas

# It needs information about:

· involving women in community work.

#### FASE (Brazil) offers:

- a document which gathers experiences of seed banks in Brazil
- · methodology for operating experimental centres.

GIA (Chile) offers all its materials on methodologies to understand the place of peasant production in the context of the wider economy.

#### It is interested in:

- · anything to do with soils and soil conservation
- · anything to do with mechanisation with animal power.

# CENTRO IDEAS (Peru) offers to share experiences on:

- vegetable production (how to combine different crops)
- guinea pigs
- bees
- terraces
- · management of organic plots
- · work with schools on productive activities.

#### SEMTA (Bolivia) offers:

- its experience and documents on production in protected environments
- documents on health, crafts and traditional medicine
- · socioeconomic research and appraisals.

#### It needs studies on:

- potatoes
- irrigation.

#### TALPUY (Peru) offers:

- experience of diffusing knowledge among the peasantry, particularly on seed storage
- experience in the use of language (in the journal MINKA).

It needs information about:

· composting.

YANAPAI (Peru) offers its work on the technological knowledge of women on cattle.

Apart from the NGOs, INIAA (Peru) offers exchanges of genetic material of Andean crops with other banks of germplasm, research on guinea pigs, and experience with improved ploughs and participation of women in various aspects of development. CIP offers information on potato production and has noted differences in information collected about water and cattle as a result of not taking the role of women into account.

## SEARCHING FOR ALTERNATIVE SYSTEMS OF AGRICULTURAL PRODUCTION: THE EXPERIENCE OF THE RURAL UNIVERSITY

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### 1. INTRODUCTION AND INSTITUTIONAL BACKGROUND

FUNDAEC (Foundation for the Application and Teaching of Science) was established in 1974 by a group of scientists and professionals attempting to make science and technology more relevant to rural development. In its first decade, it concentrated its efforts on the North Cauca region of Colombia. It has since extended its research and practical activities to other ecological and cultural conditions.

Through the creation of what has become known as the Rural University, FUNDAEC has set in motion a series of learning activities in the region. It has set its sights on the search for strategies which enable the region's inhabitants to define their own development path. This path would be quite distinct from existing ones, which - in many parts of the world - have only led to the disintegration of rural society and to increasing destitution and desperation.

This paper describes those aspects of the Rural University's experience concerned with the quest for alternative systems of production on small farms. This is a difficult task, given the integrated approach used by the University. We will focus on methodological aspects and some of the research findings on peasant production and, where necessary, refer to other related activities.

#### 2. METHODOLOGICAL PERSPECTIVE

Basic concepts on which the methodology is based are the agricultural rationality of peasants, the peasants' view of change as a natural process, peasants' learning through on-farm experiments, and the timing and sequence of peasants' planning.

## Peasants' agricultural rationality

Peasant production is generally carried out according to a logic distinct from that of the modern agricultural enterprise, aimed at maximising profit, or that of state farms (individual or collective), aimed at providing cheap food for the industrial sector. Although the particulars of peasant mentality may vary from place to place, some general features can be identified.

In most areas of the world, the rural population is highly diverse: it ranges from traditional farmers to landless labourers and is penetrated by a complex combination of market relations, state bodies and private institutions. At the same time, survival in adverse conditions has taught rural producers to adopt certain aspects of modernisation while retaining, to a greater or lesser extent, some of their traditional orientation.

#### This includes:

- the tendency towards self-sufficiency (the ability of a farming economy to produce both for direct consumption and for the market, thereby reproducing and improving the conditions of rural life without becoming dependent on other sectors of society);
- a deep awareness of the risks of confronting unfavorable circumstances, be they natural or social;
- optimal utilisation and conservation of local resources;
- maximisation of family labour, attempting to combine on- and off-farm work; peasant production is essentially a social process in which social relations with similar households as well as relations of exchange and reciprocity among various types of households are intertwined;
- a tendency to look for stability and resource conservation;
- a consciousness of long-term changes of the ecosystem;
- an appreciation of diversity;
- · complex management of time and space.

There are abundant examples which testify to peasant rationality. As one example, faced with the choice between a venture offering high but uncertain returns and one which promises low but certain rewards, the peasant opts for the latter because it involves no risks. Another example is the peasant who decides to sow a low-yielding crop variety because it leaves him/her free time to engage in another money-making venture. There is the producer who is about to benefit from an extraordinarily good harvest, but who calls on an unnecessarily large number of relatives to help bring in the crop. This may appear to be bad management to the extensionist but, to the peasant, it constitutes an act of solidarity.

The search for alternative production systems should, therefore, acknowledge the logic of peasant production and strengthen its most desirable features. This is not to endorse romantic notions of subsistence economies; there is no reason whatsoever to sustain this kind of economy, nor does the peasant wish it. There is no suggestion that we simply insert the peasant economy into the modern one. Instead, we are looking for a new type of rural economy, the exact features of which are not yet known, but which definitely differs from existing capitalist, socialist or peasant economies.

Given the lack of a viable economic theory, the only thing to do is to be aware of the problems in economic theory, to respect the thinking of the peasants and not to rely on conventional wisdom about selecting a technology without first examining the suppositions behind it.

## Peasants' view of change as a natural process

In spite of all that has been said about peasant conservatism, change is something natural for human society of whatever kind. It is a fact that peasant societies have undergone change which continues into the present time, often in abrupt ways. What is seen as peasant resistance is directed at those types of change so obviously damaging for any population. But even resistance cannot always hold back change, which often means economic disintegration and the destruction of traditional social structures without their being replaced by viable alternatives.

The proposal to seek alternative systems of production in the Rural University undoubtedly constitutes change. The aim is not just a search for technologies to improve existing systems, but rather the search for change of a particular type:

- 1) Peasant rationality is respected, not as a static entity but as something dynamic.
- 2) The transformation we favour is not simple technology transfer but continuation of the scientific culture of the peasantry. In fact, it would be desirable to reinforce this culture, which can be helped by the intervention of modern science. Ruptures and impositions which lead to disintegration must be avoided. What is suggested here is an integrated unity of modern and peasant science and technology. At the beginning of the process, the University personnel possess one part of the knowledge and the farmers, the other part. A healthy interchange ought to promote a systematic grasp of a complex social and technical situation of development.
- 3) In order that the progress come from the peasants themselves, participation of the peasantry in developing and applying knowledge is indispensible. In other words, there will be no 'playing at democracy'. On the one hand, the staff of the University should participate in all aspects of the farmers' lives, learning to see the world from their point of view. On the other, the knowledge must not remain at the level of ideas but be translated into action. This may range from informal talks between extensionist and farmer or some shared farmwork, through to group discussions, visits to the farms of participants and collective farm trials. Learning may also occur in formal settings, e.g. in a class given by the agronomist and a group of young people.

## Peasants' learning: on-farm experiments

The methodology does not contemplate research being done in experimental stations. All technical advances are to be tried out together with the peasants individually or collectively in the farmers' own holdings. When the results of the alternative practices set in motion indicate real advances, some of the peasant holdings are gradually made into so-called 'Community Educational Plots', in which the Rural University basically helps these households establish certain infrastructural elements which provide a focus for the participation of other farmers in planning and development.

#### Peasants' planning: timing and sequences

The clear-cut compartmentalisation of successive stages of appraisal, technological development and dissemination, known to established extension practice, is not compatible with the methodology proposed here. This is not to deny the need for appraisal in concrete situations or for wider dissemination of scientific advances made by a group of farmers. What happens when one takes the farmers' perspective is that the whole concept of time acquires a meaning altogether different from that assigned to it under the requirements of external development agencies, private or public. In the approach taken here, on the one hand, there is a sense of urgency; on the other, the stress on advancing the scientific and technological culture of the population underscores a continuous long-term process occurring over several generations.

Every farmer beginning to learn something enters the process with his/her individual needs. There is no question of an external agent making an appraisal of the farmer's life for him/her. But there is value in assisting as large a group of farmers as possible to make explicit their conditions, their knowledge and their decisions with increasing precision. Basically, this is an appraisal, though one with no fixed timespan; it is continuous, running alongside technological advances and dissemination. Neither does dissemination have to await the ultimate alternative technology to emerge, since what is being disseminated is really knowledge and skills rather than final results. The trick is to lay down structures which are appropriate to the community and which encourage ever greater participation.

In the context of dissemination, the texts which FUNDAEC is continually drawing up for the *Bachillerato* (University Entrance Level) play an important role. These texts represent an innovation in teaching about science, maths, language, agricultural technology and community life. They integrate the disciplines - both theory and practice - and, most pertinently, knowledge of the area and the inculcation of a commitment to service. Other elements of dissemination are involvement in the work itself, participation in discussion groups and workshops, and various forms of community education.

#### 3. METHODOLOGY

#### 3.1 Mutual learning

As explained above, the general perspective of the Rural University is to align educational activity with the most fundamental aspects of the life of the people. The very organisation of the University is geared to adapting itself to the changes in the rural development in which it is involved. Thus, a team of experts from various disciplines grows in line with the increase in the number of farmers, fieldworkers and students from the region participating in the project. There are no formal or fixed authority structures. There is, rather, a gradually expanding nucleus of persons around which others get involved in one or more activities. All those comprising the

nucleus are involved in a mutual nonhierarchical learning process which, because of its intensity, needs to be flexible, changing according to circumstances and needs. The search for alternative agricultural systems involves at least one professional agricultural scientist, plus social scientists and other specialists. Economists interpret peasant economy and culture, analyse statistics in the light of the broader national economy or calculate minimum production rates under adverse conditions. In all this, it is vital that an open attitude of cross-disciplinarity is maintained.

#### 3.2 Activities

The approach to the work could be described in terms of three parallel groups of activities:

- recognising and following the rationality of peasant culture and farming techniques;
- 2) developing farming subsystems;
- 3) strengthening community structures that encourage replication and enrichment of the knowledge thus far attained (community learning plots).

## Recognising and following the logic of peasant culture

FUNDAEC devoted 3-4 years to this series of activities before formulating the concept of subsystems (explained below) and a coherent methodology for working with them.

Established formal research techniques are useful instruments to grasp and take peasant culture seriously. Nevertheless, the initial task is more a question of acquiring experience and feeling one's way into the work. It is absolutely indispensable that the researchers immerse themselves in the everyday life of the people, learning to see things from their point of view. The peasants know their own circumstances better than anyone else; for both groups (the peasant community and the action research team) it is necessary to make explicit the knowledge systems of the people together with the possibilities and restrictions presented by the prevailing social conditions of peasant farming.

The researchers can introduce some instruments to systematise this experience. For example, FUNDAEC uses what is called 'characterisation of households': listing and describing the human and physical resources and their limitations. In addition, the researchers depict the long- and short-term aspirations and goals of the individual family members and the family as a unit, recognising this as the key institution in the rural community. Later, in order to focus on specific areas and to gather more concrete, quantifiable data such as about soil management, formal interviews are employed.

In the case of North Cauca, this interaction and continual analysis have gradually unearthed a multitude of complex conditions. The most important initial result is a list of proposals to guide the search for alternative production systems:

 to improve food production at the farm level in order to secure a more balanced diet for the family;

- to make more efficient use of available agricultural resources (labour, land, agricultural byproducts);
- to encourage diversification in crop and animal species in order to minimise risks;
- to regulate the labour inputs of the family as a whole, thereby smoothing out fluctuations in their availability;
- to reduce the use of expensive external inputs and increase returns using more appropriate technologies;
- to regulate the flow of money and food, ensuring a more even distribution of harvests over the years;
- to ensure that alternative systems of production benefit not only a few families, but work to the advantage of the whole community.

#### **Developing subsystems**

As pointed out above, the depiction of production conditions and peasant rationality ought to become increasingly substantial over time. Furthermore, attention should be paid to the often rapid changes experienced in rural areas which could damage the integrity of the community. Nevertheless, the proposals listed above are sufficient to initiate a combination of the activities which FUNDAEC has termed 'developing subsystems'.

FUNDAEC initially tried with a number of families to design complete production systems following the above proposals. However, the complexity of the North Caucan peasants' lives, which did not allow them to spend their whole time on their small farms, was soon appreciated. They had developed a balance between on- and off-farm activities which did not permit them to experiment with a new production system, even if it was patently superior to what their existing conditions had forced them to adopt. In addition, the new systems implied much more infrastructure and tighter management, which could be achieved only if the pace of change were slowed down.

In agricultural literature, the term subsystem is often used to refer to the different component parts of a total system. In this view, the household and the soil are both subsystems of an overall agricultural system. FUNDAEC uses the term subsystem differently to refer to a physical space within a smallholding (a unified space or the sum of distinct spaces) complete with a set of crops (or animal breeds) and a plan for the management of time and space. In the case of North Cauca, the size of the subsystems in this stage of development varies between 500 and 2000 m<sup>2</sup>, depending on the particular circumstances.

The intention of this second group of activities is to develop, together with selected peasant households, subsystems that may be workable in the wider region. A given household, according to its particular physical and human resources, can chose and gradually establish four or five subsystems which finally comprise an overall system of production on the smallholding.

In order to illustrate the concept of subsystems, a few examples of subsystems are:

 Maize combined with a short-cycle leguminous vegetable, together with kidney beans and pumpkin: For North Caucan conditions, on an area of 500-1000 m<sup>2</sup>, maize is sown simultaneously with a leguminous vegetable such as bean, soybean, cowpea or mungbean, depending on soil fertility. Kidney bean is sown at the same time as the maize, and pumpkin when this legume reaches maturity. This subsystem lasts 6 months.

- Cassava with a leguminous vegetable, together with a short cycle of maize with pumpkin: On an area of 500-2000 m<sup>2</sup>, the cassava, the legume and the maize are sown simultaneously; the pumpkin is sown when the legume reaches maturity. Two crops in this subsystem (cassava and soybean) can be cooked and mixed for pig feed.
- Fodder with pigeon pea and tropical kudzu (*Pueraria phaseoloides*): On an area sufficient to produce forage for one dairy cow, the forage crop and the kudzu are sown very close together so that they become entangled with each other. Pigeon pea is sown as a third component. While this subsystem grows, a short-cycle legume like soybean or mungbean can be harvested.
- Bananas with leguminous vegetable, together with short-cycle maize and Xanthosoma sp.: On an area of 2000-4000 m<sup>2</sup>, maize and a short-cycle leguminous vegetable are sown at the beginning of the cycle with the banana. After the latter's harvest, another short-cycle legume can be sown.
- Pineapple with cassava, cowpea and pigeon pea: On an area of 2000-4000 m<sup>2</sup>, pineapple is planted at the same time as cassava and, after these two have been harvested, pigeon pea is planted. If well managed, this subsystem can last some five years.

Developing subsystems is very complex and consists of a series of simultaneous activities in collaboration with the farmer: observation, field trials and measurements, which at times can yield precise results, but sometimes allow only general conclusions to be drawn.

Without being very precise about what actually happens in the field, the following categories indicate the nature of these activities:

Designing the subsystems. Analysis of our experience thus far reveals the absence of a specific method for designing subsystems. The subsystems designed for North Cauca were simply the outcome of the research team's linking the general propositions already summarised with peasant farming practice. An attempt was made to tackle the more obvious limitations of existing production systems or to circumvent them. A more fruitful approach would involve a more systematic classification of farming practices and the combined efforts of farmer and extensionist in making a preliminary design of each subsystem.

Two paths could be followed in designing the subsystems. The first would start with extensionist and some farmers choosing a crop well known to the region. Then, in consultation with each other, they would begin to consider others which could be combined with the first to constitute a viable subsystem. When contemplating the feasibility of the subsystem, consideration would have to be given to all the variables pertinent to the vegetative cycle of each crop, the possibilities of competition or

symbiosis between the plants, the quality of the topsoil and the potential for reducing labour inputs.

The other route could be to design the subsystem gradually, starting with a crop already existing on some farms, and then move ahead, adding other crops, thereby arriving empirically at a subsystem similar to those described above.

FUNDAEC presently tends to operate according to the first method, given the importance, at this early stage, of experimentation and subsequent frequent revision of each subsystem. The result of this experimentation is not a timeless, unchanging alternative, but one which, precisely as a result of experimentation, can survive and even direct the changes which the society and agriculture will surely experience.

Conducting trials. Once a subsystem has been designed with maximum local participation, the core group conducts a series of trials to determine the agricultural, economic and social feasibility of each subsystem. Further trials are done on the plots of the farmers, who are effectively the researchers at this stage. The costs of the inputs are borne by FUNDAEC, while the produce is for the use of the farmers' households.

These trials are simple, based on three variables: planting density and configurations; times of sowing and other farmwork; and choice of combinable crop varieties.

In later stages of experimentation, trials are run to determine the influence of particular technological variables of the subsystem, such as levels of fertilisation, management of phytosanitary problems, tilling and soil improvement.

Selection of better alternatives. At this point, the research encounters various economic and social difficulties that hinder this kind of work in countries where agricultural policy does not favour peasant production. The basic problem lies in how to establish the criteria to decide whether a subsystem is suited to the region in question, and which subsystems the peasant could adopt as part of his or her farm. For this purpose, the University has focused on three out of the long list of important indicators and has now added a fourth.

The first indicator is the land equivalent ratio (LER), i.e. the area needed to produce in the same timespan the combination of crops to be included in the subsystem, in relation to the area needed to grow the same amount of yield under sole cropping. Obviously, LER must be greater than 1. In fact, the most viable subsystems have shown ratios that vary between 1.5 and 2.5.

The second type of indicator is economic. In general, we have used two indicators, both fraught with practical and theoretical problems. The first figure is the total profit of the subsystem in pesos, divided by the working days expended. The second figure must show somehow the risk factor and it could be calculated thus: assume that we have a yield reduction of the major crop of 50% (in the multiple cropping subsystem) and we quantify the total profit written off; we then compare this quantity with the profit forfeited if 50% of the sole crop had been lost.

However, unfavorable market fluctuations make this calculation very difficult. The

subsystem's acceptability would certainly increase if the profit per working day increased. But the merit of the system does not depend on just that eventuality and it would be unfair to compare two subsystems based just on this indicator. For example, on one occasion, the regional cassava price reached an all-time high, pushing up both profit per working day and yield per land unit, i.e. any other combination would have yielded a lower profit than sole cropping of cassava. A few months later, the cassava price plummeted, making a cassava subsystem which combined two or more crops much more desirable than sole cassava. What is more, the farmers themselves do not consider this economic indicator as the only criterion for decision-making.

The third indicator is social, which the University has not felt the need to quantify. Rather, through trial and error, the research has shown which subsystems are socially acceptable. There is considerable variation in the factors that impinge on the producers' decision-making. For example, it appeals to him/her to have food available throughout the year (and the greatest variety possible); but the fact that a subsystem demands more labour per unit of land, which is compensated for by a higher yield, makes such a subsystem relevant because it reduces the need to look for work under conditions of scarce employment.

An argument against a subsystem could be that its complexity diminishes its social acceptability. Many of the FUNDAEC subsystems are difficult to operate and only very skillful farmers manage to handle them properly. However, the complexity does not constitute sufficient reason to reject them; on the contrary, the participating farmers and their friends tend to accept a subsystem at least 'theoretically'. The farmers understand its logic and presuppositions within their own frame of reference. But not all the farmers face the same complexity from the beginning. For example, in the first subsystem presented above, it is possible that, in the first two or three attempts, some farmers do not manage to plant the kidney beans as they cannot organise their time because of the rains. In the design of the subsystems, we considered those possibilities and made sure that the criteria of agricultural, economic and social acceptability were fulfilled.

A fourth indicator that FUNDAEC has been obliged to include in its analysis of subsystems has to do with regeneration of the soil. There is no doubt that, next to social factors such as inequitable land distribution, the waning fertility of the land available to the peasants is a major problem. So we should design subsystems which include not only rotations with leguminous crops that produce edible grains, but also bushes and manure etc. which would improve soil quality. There is a snag. This improvement can be measured only in the long term. Furthermore, it is very difficult to find clear indicators of value to the search for alternatives under peasant conditions. Finding such indicators is a challenge which must be faced head on.

#### 3.3 Community learning structures

In the methodology of FUNDAEC's search for alternative systems, the concept of extension has acquired a highly specific meaning. In practice, we find two situations:

each time that a subsystem works, the Rural University spreads its knowledge through its workers and collaborators in the field. To do this, supporting materials for community education are produced. There is a second site of learning, with a strong research element: learning plots. These are not demonstration plots in the traditional sense; rather, as the name suggests, they serve the community as a learning medium. To set up a learning plot, the farmer makes an agreement with the University to establish, according to his/her needs and possibilities, a total system that includes a certain number of the subsystems that have been tried in the region. The University agrees to provide the inputs with the understanding that the farmer open his/her plot to the community to hold regular meetings with other farmers to discuss the progress of the plot.

In mid-1985 in North Cauca, ten farmers agreed to set up such learning plots. These had a great impact in the community, and the demand to establish such plots grew to 100 by 1990. In this endeavour, it is important to note that, in spite of the peasants' enthusiasm, the selection of subsystems presents serious problems that cannot be easily overcome. When a farmer, taking his/her circumstances into account, choses four or five subsystems, it is necessary to ensure that all relevant seasonal factors, e.g. distribution of labour and rainfall pattern, have been taken into account. The subsystems generally have to be modified accordingly. In addition, the increase in production implies that other FUNDAEC activities, especially those related to setting up communal warehouses, small businesses, cash flow etc., are coordinated with the search for production alternatives. Thus, although the learning plots belong to individual farmers, the emphasis shifts toward communal structures such as communal funds, technical and financial committees, and even communal plots devoted to the permanent search for improving alternative systems.

#### 4. CONCLUSIONS

The achievements of this programme are not so much new or more appropriate technologies, but the understanding gained by the FUNDAEC researchers about the need to engage in the everyday lives of the people of the region. It was strongly felt that the usual large-scale survey-type studies do not present opportunities for participant development conducive to closer identification and friendship of the researchers and local people, drawing them into a creative partnership in the search for immediate solutions to rural problems.

The knowledge that has been generated and taken up by the community is not all new but has helped to understand better the traditional small-scale farming in the region. Although the Rural University aims to develop, where necessary, new production systems, the desirability of this approach lies also in its preserving and even strengthening some elements of peasant rationality.

In the decade after this project was initiated, the University researchers, together with an increasing number of farmers in North Cauca, spent much effort developing appropriate subsystems for three zones in the region with distinct climates and soil

types. As a result of this research, there are now 15 well-tried subsystems which are superior to traditional ones and to the sole cropping systems which, unfortunately, are still promoted by many development programmes.

With this success assured, the Rural University has focused its attention on two main sets of tasks. First, it has moved into two other ecological regions to systematise its achievements, adjust its methodology and learn to share it. The second set of activities revolves around the search for formal structures at local and regional level: small communal experimentation plots, communal educational plots, technical committees in the village to handle experiments, communal funds administered by a special committee, and possibly a regional fund which will command larger sums of money earmarked for investment and credit among individuals, groups and communities. These two sets of activities are already underway, but it is too soon to evaluate their results and make final conclusions about established structures and ultimate achievements. However, the success of these endeavours is indispensible if we want the Rural University to create the basis of a participatory approach to the search for technological alternatives.

These learning activities could be grouped into three programmes of human resource development:

- The first one is aimed at the farmers and is geared to enhancing their skills within the new and more appropriate systems of farming. This also includes farmers' involvement in research and in diffusion of knowledge generated in the overall programme.
- The second is aimed at the extension workers in official and private development agencies, in order to enhance their abilities to give technical advice.
- The third includes a series of postgraduate courses which CELATER provides for professionals working in rural areas who, rather than acting as mere propagators of technological know-how, see themselves as facilitators of participatory change and knowledge generation. Alongside these educational activities, the Rural University continues to do the necessary research to create new subsystems that include new crop species and better ways of handling the natural resources of each subsystem, especially the varied soil conditions.

#### 5. FINAL COMMENTS ABOUT PARTICIPATION

Concern with community participation is not new, and many development programmes have incorporated it into their activities. The feedback, the contribution of human and physical resources, and the collaboration to define needs and to formulate plans are examples of community participation. However, FUNDAEC tried to analyse participation more within the institutional context of the community and its organisation of community education than within specific segments of the population.

The group acknowledges that the diverse conditions of Colombian society go beyond mere differentiation of economic capabilities. The modern sector embraces numerous institutions that facilitate access to political power, information, capital, credit and the appropriate use of technology and technical assistance. In the rural areas, by contrast, administrative structures are sparse. Channels for the flow of resources and information evaporate as they approach the threshold of the urban and rural poor. Even in the most successful projects, the institutions of development have had to accommodate their activities to organisations which have experience only in working with large landowners. The cultural heterogeneity among different sectors of the rural population has only slowly and painfully been acknowledged by these institutions. With very few exceptions, the extension programmes have been catering to the large farmers who could progress independently of their neighbours. They tend to have better education and better access to information, and their living conditions (such as schooling and health services for their families) do not totally depend on the outcome of a harvest. These large farmers have access to diverse sources of credit, they do not depend on just one buyer to sell their product, and they often invest in the marketing system. In general, they participate directly and indirectly in a series of institutions among which they could chose a variety of services

Conditions of the peasant population of Colombia and other Latin American countries are diverse. They need basic education as much as technical advice. Their only capital is their small plot, which does not attract credit. The hope of obtaining credit lies in the whims of officials who show up only occasionally. Their plots have little or no infrastructure, and the technological advancements that they come across are beyond their means. The fact that they have no choice in technical assistence, credit and marketing of their products means that they have to buy and sell at prices beyond their control. Their fate is intimately linked to their neighbours. The village should progress, be educated, have access to credit and technical advice as well as developing its own viable organisation.

The key concepts which emerge from FUNDAEC's discussions are based on the conviction that real participation necessarily implies the existence of institutional structures that truly belong to the people, who have designed their own route to development. However, the creation of new institutions and the strengthening of existing ones, in itself, does not guarantee participation.

A second essential element, almost as important as organisation, is knowledge. People can only be said to have taken charge of their own development when they systematically learn about changes in society, consciously incorporating elements of their own milieu into this lifelong education. The original FUNDAEC group felt that only when those two elements, i.e. appropriate structures and a systematic, continuing education which includes access to world scientific knowledge, had been completely developed, could the rural population interact on an equal basis with, instead of being the object of, programmes designed by other individuals or institutions.

## PARTICIPATORY RESEARCH WITH COMMUNITY-BASED FARMERS

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The experience on which this article is based was gained within the Project for the Validation of Technologies for Highland Communities, implemented by the Small Ruminant Collaborative Research Support Program (SR-CRSP) in conjunction with the National Institute for Agricultural Research (INIAA) of Peru. Additional support was provided by the University of Missouri, Columbia and Grupo Yanapai, Huancayo. The comuneros - men and women of the region of Sincos - and the interdisciplinary field team did the actual work of searching for solutions to production problems defined by the peasant farmers.

## 1. THE PROJECT APPROACH

The Project for the Validation of Technology for Highland Communities was initiated in 1983 in communities on the southern side of the Mantaro Valley at an altitude of 3500 m. From the outset, it was decided that activities would be carried out on a community basis and with individual farmers only upon community approval. This decision resulted in a shift in the definition of the farm unit generally used in Farming Systems Research. The limits of the system were defined as the community, and the household was considered as a sub-unit of this.

#### Setting a research agenda with farmers' committees

After initial visits by the field team to the communities' elected leaders, they suggested that the following proposal be placed before the community assembly:

 implementation of agronomic experiments, with the community, on production problems which the community identified as priorities;

- technical support in discussing and evaluating these problems, together with provision of information and methods which would lead to the selection of useful alternatives;
- 3) appointment of a collaborating committee by the assembly which would be responsible, together with the field team, for planning, implementing and evaluating the experiments previously approved by the community assembly.

The decision to accept the proposal was slow in coming on the part of all communities involved. Not only did they find the approach strange in comparison to that of other projects and institutions, but they carefully considered the capability of the project to carry out a sustained effort.

Farmers who were appointed to the collaborating committees were on the whole not resource-poor in the micro-situation of the community, although they may be considered so in the context of national income. They shared common techno-productive interests and experience and a motivation to work together to overcome specific production-related problems. The committees prioritised the production problems they wished to solve. It was a challenge to the research team to balance research activities so as to include those which would show short-term results with those which required longer-term implementation periods.

Setting the research agenda was a joint effort of community farmers and project researchers. All problems to be researched were explicitly defined by the participating farmers or were directly complementary to these. For example, if a farmer group had defined external parasite control in sheep as a problem, treatments used locally (e.g. plants) as well as alternatives produced by chemical firms or generated on experiment stations were tested. Information was gathered with the farmers as to parasite control methods in use, and possibilities of selecting animals to build up flocks with greater natural resistance to the parasites were discussed. The three research areas were thus opened up by a collaborative search for solutions to the problem of external parasites in sheep.

After the research needs had been defined by the farmers in a joint effort with researchers, appropriate methods for evaluating a given technological alternative were agreed upon. During the five-year period, the research team was limited in its ability to discuss research designs with the farmer groups. The tendency was to chose a design, attempt to implement it and, if it did not work, modify it to fit the conditions under which the experiment was taking place.

All trials were implemented by community farmers. This part of the trial phase was the most successful in terms of participation. The problem which arose here was whether the participating farmer was more of a labourer than an agent in the research process as a whole. When his or her participation in the implementation phase was more that of a labourer, the understanding of the results and, therefore, the possibilities of evaluation and future selection were hindered.

#### Roles of the researchers

The interdisciplinary field team was made up, over the five-year period, of different combinations of researchers in the areas of crop, livestock and veterinary science, agricultural economy, anthropology, rural sociology, forestry and communication. The minimum size of the field team was three and the maximum six. The disciplines represented in the team were modified over time and responded to community research needs as well as to funding capacity.

All activities carried out by the team were considered to be interactive and complementary. Within a context of high levels of disciplinary specialisation along academic and/or technical lines, the degree of interdisciplinary interaction required by the organisation of the project often put great stress on field team members.

None of the total of 23 field team members had previous experience with interdisciplinary work and only one in five had experience with multidisciplinary biological research. Since new team members were incorporated in small numbers (one or two at a time), initial team-training activities were not possible. Orientation sessions were organised, however, where current team members shared experiences with new members, and methods of organisation and task implementation were discussed. Consciousness gradually increased among the team members that interdisciplinary collaboration and a capacity for organisation and effective communication were essential for working within the team and with the farmers.

During weekly group sessions, team members planned and evaluated their work with the farmers in identifying and prioritising problems and planning activities. Each consideration being discussed was looked at from ecological, economic, organisational and crop and animal production perspectives. Problems encountered in team interaction and organisation of tasks were also discussed. These meetings served as a kind of on-going training in both farming systems perspectives and interdisciplinary research.

The project aimed to involve farmers in all phases of the research process, including problem definition, trial design and implementation, recording and analysis of results and readjustments for future research agendas. The team was most successful in involving farmers in problem definition, trial implementation and analysis of results. Working with farmers on trial design and evaluation was found to require fundamental changes in the attitudes of researchers as well as in the methods used.

The performance of researchers in this context can be observed from two points of view: firstly, how the project conceived of our role and, secondly, what each researcher was able to do on a day-to-day basis. The methodological framework of the project defined the role of the researcher as fourfold:

- stimulater and catalyser in identifying farmers' ideas and needs;
- provider of complementary biological and methodological knowledge;
- adviser in analysing and selecting alternatives and designing trials;
- facilitater in explaining and analysing research results.

A researcher's ability to stimulate farmers' ideas is directly related to the degree s/he recognises the farmer as a capable and innovative agent operating within a specific agroecological and socioeconomic context. In Peru, this ability is influenced by historical processes which have led to community-based peasants' being viewed as the most backward group within national society.

The field team was more successful as advisers and catalysers. Experienced researchers were more capable of providing farmers with the biological knowledge not available to them through simple observation. The main problem that arose was a tendency to confuse complementary biological knowledge with technical prescriptions which were not necessarily adequate for high-altitude, rainfed, small-scale farming.

It was difficult to overcome the temptation to keep trial results in office files. Even where the team realised the importance of farmers' having access to detailed experimental results, the form that the reports took often resulted in their being filed away by the collaborating committee or the community. The team therefore saw the need to work on methods of communicating information in ways which could be better used by the farmers. This problem became more specific in communicating the results of the economic analysis of trials. Some of the team members then began designing graphs, posters and other ways of making information more easily comprehended by the farmers.

One of the most stimulating results of our research in communities was the adoption of useful technologies defined by farmers, despite our inadequacies in communicating research results. For example, 50 kg of a native variety of potato seed tested with five farmers was found to have been multiplied and distributed informally among 100 farmers over a two-year period. Farmers who obtained portions of the original yields multiplied the tubers for seed so that they could plant the variety on a larger scale.

The project team recognised that, in taking on the challenge of research with community-based farmers, it had assumed a difficult task. Few of the team members had experience working with Andean community groups. The specialised knowledge of each researcher had to be applied within the context of a production system which differed in ecological, economic and organisation terms from the systems with which most of the researchers had direct experience. It was the comuneros who had direct production experience under these conditions. Participation then became a necessity to the project. In addition, most team members had been used to looking at research problems from a disciplinary point of view and making results available to specialists rather than to small-scale farmers.

#### 2. THE PROCESS OF DESIGNING PARTICIPATORY ACTIVITIES

## Accommodating the dynamics of production systems

The project goal was adaptive research and technology validation within the context of the production process. The focus was thus on *people* involved in organised production systems. Biological research is based on an assumption that variables under study can be isolated and maintained in stable states at least over the experimental period and that external conditions can be regulated at least to the extent that they can be described and repeated for all replications. These methods

can be easily applied to work with plants and animals, since they can be controlled and manipulated by humans.

As community-based farmer organisations and their agricultural production processes are in a state of constant change, social variables cannot be controlled like biological ones. A proposition made to a farmer not to treat his animals against parasites for two years in order to measure the cumulative effect of parasites on production would be immediately refused. The farmer's objective is the most efficient production possible, using the skills, knowledge and inputs available to him or her, and it makes no sense to leave animals untreated. Furthermore, it is unacceptable to a farmer to maintain production practices static for sake of comparison with another farmer who is implementing technical modifications which raise levels of productivity. Over a period of, say, three years it is probable that the farmers themselves (individually or as groups) will modify some elements of their farming system independently of project influences.

The initial challenge to the team was to carry out research within the social process of production, defining relevant problems yet controlling enough variables to measure results. Attaining this goal required modifications in the criteria according to which biological results of experiments are measured as well as in the parameters used to measure the effect of modifications on the system as a whole.

## Reaching agreements about implementing experiments

When it came time to implement the experiments planned with the collaborating group, discussions centred on three points:

- · which land would be used,
- · who would commit the necessary labour, and
- who would provide the inputs.

The farmers' apparent unwillingness to carry out activities at this point indicated the high risk of experimentation for the community. Allocating prepared cropping areas to experiments could waste resources, especially if the yield was not satisfactory.

Furthermore, the community had little confidence in the researchers' ability to produce in the first place. If the experiments were to be carried out on communal lands, a communal 'faena' would have to be organised. This meant that farmers would have to take time and inputs away from their family production efforts. The high level of risk for the community and its individual members made it difficult to maintain group commitment to the experiments. In more than one case, the experiments were left unattended between planting and harvest, or the crop was harvested before yield could be measured.

At this point, the team decided to make two changes during the second season:

- work would be done with individual farmers on experiments requested and approved by the communal assembly, and
- the project would enter into sharecropping arrangements (al partir) common to
  the region: one farmer provides land and labour or seed while the other provides
  chemical inputs and labour or seed, and the harvest is divided according to each
  collaborator's investment.

These modifications in the adaptive research programme solved many of the problems encountered previously. On the one hand, the number of people involved in day-to-day decision making was reduced and, on the other, the investment risks were distributed. The *al partir* arrangement also permitted the project to generate its own genetic resources which, in the following season, served as a basis for the validation trials carried out at the community level.

Community-level trials ended up having two purposes for community members. Since all production on communal land is done by the community as a whole, all farmers participated in all cultivation phases. This meant that all took part in the fertiliser and pesticide management activities, which served as a group training effort. When the harvesting was done, the communities decided that the product should not be sold, but rather used as a basis for seed production which would, in subsequent seasons, be distributed among the individual farmers to improve the quality of seed on their own farms.

This alternative, developed by the farmers themselves, guaranteed a horizontal interaction between individual and group interests, on the one hand, and between research and action, on the other. As a result, organisation and technology were integrated so that community and individual as well as research and application processes complemented each other.

Although the collaborating committees had been rather shaky organisational structures when their only purposes were problem definition and experimentation, they gained strength as the resource management role was incorporated into their activities. It became apparent that adaptive research and validation lead increasingly to a need for group decision-making concerning technology use. The committees became active not only in defining problems for research, but also in decisions as to how the technologies considered adequate could be put at the disposal of other community members.

#### Incorporating the livestock component into the research

Because of the way the community assembly was organised, the field team assumed that the male farmers were not only the household heads but also in charge of all agricultural activities in the community. It was puzzling, however, that - in a farming system where half the land resources were allocated for grazing and where each family possessed an average of 30 head of livestock - knowledge about animals could be so limited.

Men knew little of grazing patterns and of health and breeding practices. If the men were responsible for the production unit as a whole, they should have access to the technological knowledge related to all areas so that they can make decisions and distribute tasks adequately. If they did not have this knowledge, someone else must. This deduction led to a redefinition of the idea that women were merely the herders. At an early stage, we began to look at what the women were doing with the animals and observed that they were castrating, treating, giving supplementary feed, culling and herding. It became clear that the women were responsible for managing animal production and not only for carrying out herding tasks.

The team made a proposal to the community assemblies that women be included in the collaborating committees. It was unanimously accepted. Women were appointed on a volunteer basis and invited to the meetings. Some of the women came a couple of times but sat silently at the edge of the group while the discussion centred around problems related to crop production. Soon they stopped coming, stating that they had no time. We initially took this motive at face value and continued work on crop production priorities defined by the men.

After 18 months, the project was still unable to work systematically on the livestock component. The women were then invited to informal gatherings to discuss production problems of importance to them. Within a month, about one third of the women in each community were coming to the weekly meetings. They defined their problems in the following order of priority:

- 1) parasite control
- 2) providing supplementary fodder
- 3) improving natural pasture quality
- 4) seed selection and storage
- 5) adequate planting densities.

Before the first month of meetings had ended, the women's groups had requested and obtained recognition by the communal assembly. The contrast between the organisational functioning of the collaborating groups appointed by the communal assembly and the Women's Agricultural Production Committees was notable. However, these groups were formed in the second year of the project's activities, when the first hurdles of team credibility and experimental risk had been overcome. In addition, as women are the main animal-keepers and as the nutritional base for production is communal land where animals from all family herds are grazed, it is likely that group interaction is more important for experimentation and innovation adoption in livestock production than in the case of crops, where land is managed by the household.

Work was begun with the women's agricultural committees on their first priority. In group meetings, the women's knowledge about parasites and ways of controlling them was elicited and systematised. This effort permitted not only identification of technological and economic constraints but also the socialisation of available information among the participating women. Subsequently, the team parasitologist talked with the groups about the habitats and life cycles of the different parasites found in the area. Then the team went on to determine, together with the women, which available (traditional and introduced) control alternatives might prove viable in ecological, economical and organisational terms. Having screened all possible alternatives on the basis of these criteria, adaptive experiments were designed with the women, to be carried out in their herds.

To overcome the problem of maintaining control groups, experiments were carried out with farmers who were willing and able to take risks, and the nonparticipants served as control groups. Within the concept of the scientific method, this alternative is questionable, as the fact that one farmer is willing to participate and others are not may reflect differences in management conditions. To

overcome this, experimental and control farmers with similar characteristics in relation to access to land and animals and family size were chosen. The control and treatment farmers could be matched rather easily in the initial agricultural season of the experiment. When the two were well matched, it was found that the control farmers soon wanted to participate in the treatment stages of the experiment.

The alternative then was to incorporate these farmers into the experimental group and incorporate other nonparticipants of the same community or of another as controls. Those of the initial experimental group and the last control group would become less similar at any given moment, and those in the experimental group would become more similar.

It became necessary to make a detailed description of the criteria used to select the matched groups over time so that, in the long run, not only the biological results but also the social conditions under which each experiment was carried out could be compared.

Farmer participation from the problem definition stage through to evaluation permitted the team to overcome some of the limitations presented by carrying out biological research within the socioeconomic situation of small-scale farming. Continued redefinition of production problems with the farmers made it possible to take changing production goals into account. By doing this, it was not necessary to understand the subtleties of these changes and, at the same time, changes in problem definition indicated the direction the new goals were taking.

#### 3. ASSESSING THE VIABILITY OF NEW TECHNIQUES

The next challenge was to measure the viability of the new techniques and their possible effects upon the system as a whole. Criteria for assessing techniques which account for the interactions of resource (labour, land, capital) management over time and for the various production goals (cash, exchange, renewing resources, and family and community well-being) were nonexistent. In the initial phases, it was decided that the evaluation would be left up to the farmers and the team would content itself with noting the type of technique incorporated and the rate of incorporation by individuals and groups in and outside of the community. This method assumed that the farmers have the most complete knowledge of how their farming systems function and will integrate only those alternatives which complement resource management and production goals.

Over time, however, some of the criteria which the farmers used to select techniques could be identified:

- rusticity (climate, pests, diseases);
- · minimum requirements for external inputs;
- multiple use value (food, fodder, sale, exchange);
- · storage capacity over time;
- size of available (sale, trade) units;
- adaptability (season, space and quantity) of labour requirements.

These criteria differ substantially from those generally applied on experiment stations. In addition to yield, one of the main criteria used by on-station researchers, the farmers' criteria for evaluating potato varieties, for example, included their colour, their resistance to pests, plagues, frost and hail, their capacity for long-term storage, and their taste and texture when cooked. Grains were evaluated not only for size and colour (larger and whiter ones bring higher prices) but for the palatability of the residues as fodder.

With respect to sheep, size turned out to be important from the producer's perspective, since one animal is the smallest unit of convertible cash for momentary cash requirements. For this reason, the larger animals were not necessarily the most advantageous. Different colours and qualities of wool were used for different types of weaving, making uniformity of colour and quality less important than researchers had assumed. Resistance to parasites and infections, together with adaptability to range and fodder quality, made rustic breeds more valuable than the 'improved' ones.

#### 4. INDICATIVE EXAMPLES OF COLLABORATIVE RESEARCH EXPERIENCE

As the field team did not have first-hand knowledge of the production technology and human organisational system of the area and in view of the communities' need to solve immediate problems, the initial phase of the field team's activities was devoted to:

- 1) developing a participatory process with the comuneros;
- preliminary data collection, on the basis of which specific criteria for more systematic information gathering could be established; and
- gaining credibility within the community, while offering basic technical services to solve immediate problems.

During the first growing season, priority was given to a community information series (programmed talks and discussions to which the whole community was invited), technical assistance, and general data collection on interrelationships between social, ecological and technical aspects of the system.

The method of data collection was based on the anthropological techniques of participant observation and descriptive recording. Each team member recorded on a daily basis the observations or incidents which were considered not to be common knowledge to team members or which would help gain more insight into the system. Three copies of the 'cards' were prepared on a small portable typewriter, one for the community file, one for the writer and one for the project office.

These 'cards' included information on various subjects such as climate, soil, vegetation, crops, livestock, use of inputs, disease treatment, labour allocation, family organisation, decision making, community action; as well as notes on crop and animal yields and on the consumption, exchange and sale of products.

During this first phase, the field team consisted of two agronomists, two veterinarians, a livestock specialist and an anthropologist. The agronomists and livestock specialist resided during three weeks of the month in the central

community of the project area. The livestock specialist and the anthropologist were women.

The following short case histories indicate a few of the particular problems confronted when attempting to follow the participatory approach. It is on experiences and data such as these that the second phase of the project was planned.

### Outsiders gaining credibility among farmers

The community where this incident took place was one of the first to become involved in the collaborative research. It is the central community in a group of fourteen smaller ones. Here, the others gather for livestock markets and other activities of a district nature, and traders from the higher surrounding mountain area and from the valley centres come to exchange or buy.

From the beginning, the community authorities were wary of being 'taken' again. The previous two seasons, they had prepared agricultural plots for experiments with another project that never received the necessary funding.

Eight months after the initial contact, we took part in a community assembly meeting held at the corral of the communal sheep farm. As the meeting took place during a communal work party, the number of women present was larger than usual. (When the family head cannot participate in the work parties, another member of the family is sent in his place.) The livestock specialist described the objectives of the project, the partnership agreement that could be signed and the working method proposed. Only a few of the men showed interest - the younger ones - but two women stood up in turn to state that the dry season was unusually harsh and that many of the lambs were dying. If they agreed to the project, they asked, would there not be a chance of solving some of the animal health problems? The men remained skeptical.

In response, the livestock specialist explained the problem of increased parasite incidence when nutrition is poor. She explained that most of the sheep were infested with intestinal parasites. This was causing the wool to fall out and general physical weakness, especially in the young. When the shepherdess mentioned that a lamb had just died in the corral, it was immediately suggested to dissect the carcass to see what the cause of death had been.

While the woman went to get a knife, the whole assembly gathered to see the livestock specialist at work. In front of everyone, the abdomen and then the intestines were opened to show an enormous quantity of parasites. The point was made. Standing around the specimen, the villagers decided to take part in the project and the collaborating group was named (five male comuneros who volunteered their time) in representation of the entire community.

The most important conclusion to be drawn from this incident is that any project which enters a community has to confront the comuneros' lack of confidence in outsiders. This attitude is due to many historical factors, not the least of which is the general disillusionment with government programmes which have promised much and solved little. The comuneros in their desire to better their situation have, in many cases, tried new ideas and methods suggested by specialists. Most will say

half-jokingly that the 'engineer' doesn't know how to farm and can offer evidence to illustrate a lack of practical experience.

The fact that the community was finally persuaded when they observed the livestock specialists' competence at her job as well as her respect for their own concern and diagnosis in a practical situation speaks for itself. The fact that the women were highly influential in giving the specialist an opportunity to prove herself and also influenced the final decision of the villagers is not surprising, as the women have greater responsibility and therefore interest in the livestock component of the system than do the men.

## Rediscovering traditional technology

A group of five collaborators gathered one morning with the livestock specialist and the veterinarian to discuss the most common diseases in the community's sheep population. A list was drawn up which included liver fluke, hydatidosis, diarrhoea, 'worms' and ectoparasites.

The main contributor to the discussion was a man who had almost no cropland and had been a shepherd on a large landholding (hacienda) in the area before the agrarian reform began in 1968. After reviewing symptoms and causes as the farmers saw them, an attempt was made to evaluate which of the diseases was considered the most urgent to tackle. As the discussion took place in the dry season, when forage was scarce, it was felt that the most urgent problem was parasites, which were further weakening the animals.

Dipping and dosage with veterinary products was mentioned but the group members pointed out that, although they had used these treatments until the end of the 1970s, the products were now too expensive for all but a very few families to afford. The discussion then turned to alternatives and two suggestions were made. One was the use of a 'green salt' which was said to contain copper and had been used on the *hacienda* to control internal parasites. The other was the use of a wild tobacco, locally named *utashayli*, to control external parasites. As the 'green salt' was not to be found in the community, it was thought that possibility should be left aside until the researchers and collaborators could identify the properties and source or an economical alternative.

That left the possibility of starting a trial for the control of external parasites. The young comunero who had suggested the *utashayli* explained that he had seen his grandmother use it together with black soap on horses, cows and donkeys. The leaf itself was rubbed into the animal's hide and the parasites fell off seconds later. The possibility of using the plant on sheep was discussed. The group felt that, if it were ground and diluted in water, it could be used as a dip. A day was set for the trial. The group of collaborators were responsible for collecting the plant and preparing the mixture they considered appropriate.

The group decided that, for the first trial, as many families as possible would be encouraged to bring a few of their sheep to be dipped so that they could observe the results first-hand. Careful measurements would be made of the mixture that was prepared.

On the day of the experiment, two veterinarians joined the community in observing the effect of the dip on the animals. The villagers agreed that its action was even more immediate than that of the chemical products they had used previously. In evaluating the experience, the group decided on the next steps to be taken:

- to begin talking with all families of the community about the need for dipping all animals at the same time so that contamination could be reduced;
- 2) to give new impulse to the construction of the community dip (an oil drum had been used for the trial) which had already been planned;
- 3) to begin observing areas where utashayli could be found and estimate its supply so that provision could be made for protecting and multiplying the species, as present supply was probably insufficient.

The research team proposed that the properties of the plant be analysed in the laboratory, that successive experiments be carried out to verify the initial results and that the minimum concentration of *utashayli* needed to make the dip effective be determined.

This example shows that, in evaluating the possibilities of validating technologies dependent on external inputs within a peasant farming situation, it must be taken into consideration that the overall contraction of the national economy affects the smallest producer first. Here, a technology had been discarded not because of its lack of effectiveness, but because of its cost. It is an example of the exchange of an adequate or adaptable traditional technology for an input-dependent one. As a result, over a period of less than ten years, there was an extreme decline in animal health and management practices.

The recuperation of the traditional technology and its adaptation to present needs, on the basis of the comuneros' experience, has probably greatly reduced the amount of time required for developing appropriate technology through pure research. However, the alternative tested is not adequate for individual use, as the availability of the plant requires joint action by all community members to conserve the plant in the native habitat, as well as to distribute it.

#### Combining folk science and formal science

When the problem of internal parasites in sheep had been discussed with the community collaborators, a high incidence of liver fluke was cited. On-station researchers considered this to be endemic to the area and identified the means of control as breaking down one or more links in the life cycle of the organism.

The community members expressed the belief that the 'illness' was caused by ingestion of a small leaf found in marshy areas or along streams. They therefore kept cattle away, when possible, from areas where the leaf was found. The field team clarified that it was not the leaf itself which was responsible for the disease, but that the cysts which later developed into the parasite were to be found on vegetable-type leaves found in humid places. Being aware of the comuneros' misconception, the team included a talk on the life cycle of the liver fluke in the community information series.

The talk was prepared by a research professor, with complementary graphics, and offered consecutively in three participating communities. The three sessions were attended by mixed groups of 50-100 men, women and children. At the first meeting it became evident that, although the specialist had made great efforts to explain clearly in common Spanish vocabulary, the public had problems relating to what was expressed verbally and in the graphics. At the end of the meeting, when petri dishes were passed around with specimens of the shell in them, it became clear that people had envisioned the size of the snail to be about 10 times that of the real one. The colour terms had also been misunderstood, leading the participants to identify in their minds a benevolent snail, commonly found in the same areas, as the carrier of the liver fluke cyst.

Between the first and second session and with the aid of the community collaborators and the field team, an effort was made to identify the local vocabulary used to designate relevant plants, animals and insects in order to facilitate clearer communication of the problem. The petri dishes were passed around both before and after the second session and a size comparison was made between the real-life specimen and the graphics, to avoid the size misconception. During this second talk, the interest shown and the questions asked immediately revealed that much more was being understood.

In this example, detailed and complex knowledge of cattle anatomy and disease symptoms was exhibited by all comuneros involved in the discussion. The fact that they attributed liver fluke infestation to ingestion of a certain kind of leaf was logical, given their sources of information and observation. By taking the necessary time to understand this rationale, the team found it a simple task to make more complete information available to the comuneros.

Our attempt to explain facts and organisms not directly observable to the naked eye made us aware of the distinctness of the visual and verbal codes the comunero uses, which seriously impaired our capacity to make the information understandable. It could be inferred that in many situations, even when there is a mutual openness to exchange between researchers, extensionists and peasant farmers, this type of communication gap may be a major reason for misunderstandings or lack of confidence on both sides.

## 5. PROBLEMS AND IMPLICATIONS OF PARTICIPATORY RESEARCH METHODS

Implementing a research programme to develop technical alternatives for small-scale mixed farmers who produce first for subsistence and second for the market and who operate under highly variable agroecological conditions, confronts the conventional organisational structure of agricultural research. The experience gained with high-altitude community farming led the team away from 'commodity' research on sheep toward research which took into account the interactions of the various activities of the farming system which influence, directly or indirectly, small ruminant

production. This shift in focus was a requirement for working with community-based farmers and came with the realisation that conventional discipline-oriented research would not solve the problems of peasant farmers.

Although different researchers may be housed in the same institute, they often work on a non-integrated research agenda. If scale-specific and adapted technology is to be designed to improve community-based farming, modifications in the organisation of research institutions, as well as in the focus of research, are required.

Participatory agricultural research is often seen to have more of a flavour of extension than of research. When farmers are involved in the research process, there is a need to orient it toward action. The difference between extension and participatory research is that, in the case of the latter, the aims are to identify problems and to test and evaluate possible alternatives together with farmers.

Working with the community farming system means working with groups of farmers. The community members make joint decisions as to project activities in the areas of identifying research problems, designing forms of implementation, and community education. The possibility of making all these efforts more efficient over time depends on the community's organisational capacity not only to decide as a group, but also to work together. It is on the basis of collective action that the community as a whole will be able to improve its productivity in the shortest time possible. The project therefore gave much attention to strengthening the organisational structure of the community.

When better organisation is a goal, positive accomplishments are a corollary. The notion of positive accomplishments is a very simple one. A group which carries out actions that are successful is willing to try another group action. An action which fails raises questions whether the effort was worth it. It might even be postulated that the progressive weakening of community organisation in the Peruvian highlands is partially the result of unsuccessful efforts on a group level. While the population of a community was small enough to sustain its members, the land redistribution system and the communal management of crop rotation were successful group accomplishments. As land pressures increased, however, even the most organised communities were unable to deal with the assignation of adequate land areas to new families and with the design of rotation plans for ever more numerous and increasingly smaller plots. The failure of the community structure to deal with these problems (and to find a viable alternative to them on a community level) has resulted in the loss of the part of the community organisational structure which dealt with these areas.

The balance between positive and negative accomplishments provides the motivation for an organisation and, in the final analysis, defines its usefulness. No one would question the greater possibilities afforded by group over individual action. The problem is how to build or, in the case of Andean communities, rebuild collective action. In a strong organisation, the balance between positive and negative accomplishments may tip toward the negative more than once without destroying it. In the case of new or recovering organisations, however, it is important that the positive accomplishments of the collectivity outweigh the negative ones. The nature

of this process is a challenge to participatory research efforts. The production problems must be assessed not only for their importance within the system but also for the potential to achieve advances toward a solution within a relatively short time. Otherwise, the failure of an experiment (totally acceptable in scientific terms) may result in a loss of participation and a further weakening of the community's faith in its capability to carry out successful collective action in other areas.

It is for this reason that basic research cannot be carried out in the community situation. Furthermore, there are risks in carrying out adaptive research in communities where the research experience itself is new. Our experience shows that the most appropriate kind of initial research for communities where the organisational structure is weak is technology validation. As the organisation becomes more confident in its ability to succeed, adaptive research may then be undertaken.

In cases where adaptive research is necessary from the beginning (where appropriate technology is not available), this stage can be carried out with individual farmers with the approval of the community as a whole, as long as it remains only a step in providing the group with new information and experience. The group must become incorporated into this process as soon as possible, or there will be a tendency for the individual participators to gain an advantage over the group as a whole, resulting in further social and economic differentiation within the community. All members of an interdisciplinary team working with groups of farmers have a role in facilitating this incorporation.

In the selection of problems to be tackled, it must be kept in mind that it is easier to work in areas where the technological weight of the constraint is greater than the social one. For example, determining appropriate fertiliser levels for potato is more of a technical problem than is improving natural pasture. Applying fertiliser affects the work habits of one or two people within the household. Trials would require little more than differential application of fertiliser by these people on small areas of their plots. One growing season gives sufficient time for evaluation.

In contrast, as natural pastures are used by all households in the community and improvement requires modification in use patterns, large numbers of people (in this case, women) must be involved in the decision to carry out such an experiment. Furthermore, even if all agree to allocating land for experimental purposes, the experiment itself will require adjustment in the labour patterns of the producers who participate directly. The results of the experiment will hardly be visible over one agricultural period. This is not to say that experiments with a high social weight should be avoided, rather that group confidence in itself and commitment to solving the problem must be greater than in the case of primarily technical problems.

Doing research with community participation requires high levels of creativity and flexibility on the part of the researchers involved. It also requires a large measure of institutional flexibility, especially at the field level. Researchers must not only be willing to look at new problems, but also be able to adapt research methods to the farmers' production system and take ecological, economic and social organisational factors into account.

The researcher, as part of an interdisciplinary team, must be capable of contributing to the evaluation of dynamic social processes. Researchers must be willing to take part in a mutual learning process with the community as well as to contribute specialised information in down-to-earth language which will stimulate the process itself.

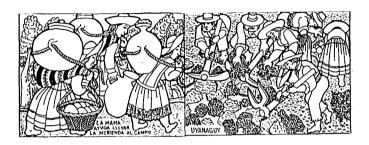
Research plans must be simple and specific enough to permit their rapid modification or adjustment to new findings as well as to unforeseen climatic and organisational factors. Research results must be analysed rapidly (before the beginning of the next farming season) and communicated in ways which are easy for the farmer to understand.

All of these requirements put new demands on the researcher as well as on the research methodology itself. The advantage, however, is the generation of information, technology and knowledge which can be quickly translated into action. In addition, in a collective effort, evaluation of and experience with methods as well as with technology permit rapid adaptation by making use of the experience and ability of whole groups of farmers. Although the educational and organisational processes of the participatory method appears time consuming, this investment pays off in more efficient technology generation. The end result is an increase in the number of farmers who gain more control over the processes required for improving their own production system and, consequently, in a reduction in their dependence on outside agencies to solve their problems.

# AGRICULTURE AND PEASANT KNOWLEDGE: REVITALISING ANDEAN TECHNOLOGIES IN PERU

#### PRATEC

Proyecto Andino de Technologias Campesinas (PRATEC), Pumacahua 1364, Lima 11. Peru.



#### 1. INTRODUCTION

## PRATEC (Andean Project of Peasant Technology)

PRATEC is a publicly registered, Peruvian, nongovernmental organisation (NGO) of professionals with field experience and research expertise in the Andean region of the country. It was set up in June 1988 and has its central office in the capital, Lima.

PRATEC's purposes are to contribute to improving the quality of life of the Andean peoples and, in so doing, to reaffirm their cultural identity. Andean culture, one of the few remaining original cultures known to history, continues to be the life style of the original inhabitants of the Peruvian Andes. However, it has been diffused through the pan-Andean region, taking on a diversity of particular forms. It contains, as parts of an indissoluble whole, technical achievements, social organisation and pantheistic religion - the combination of which is fundamental for both the benefits of its members and the harmonious symbiosis of society with nature.

Its great practical relevance for the present, when hunger and violence are rife, is that it has a proven record of having been able to provide for a population as large as the present one. In spite of colonisation and the current disorganisation of Andean societies, there still exist the knowledge and skills to reconstruct, on the basis of Andean values, a society distinct from what currently exists.

The task of recovering the well-being of the Andeans, lost over nearly five centuries of a colonisation which continues to the present day, is to enable the people to cease being marginal, on the edge of Western society. We are not against all things non-Andean, nor do we propose an Andean autarchy. On the contrary, we are in favour of symbioses between cultures in order that each enrich the other.

Our main goal is a world in which all cultures blossom equally, each one glorying in its originality. This world of unabashed diversity is possible only to the degree in

which each people affirms the values of its own culture, thereby rejecting all forms of imperialism.

## The way PRATEC works

The point of departure from which PRATEC approaches its support for Andean culture is agriculture. This perspective corresponds to the centrality of agriculture in the Andean way of life, the archetypical expression of the dialogue between multi-ethnic society and the multi-ecological natural environment of the Andes.

Our affirmation of Andean culture implies for us a triple task:

- 1) to assist and support the work of retrieving knowledge and cultural identity,
- to contribute to recreating and revitalising the culture and agriculture of the Andes, and
- 3) to convey ideas on Andean culture to official organisations of research, education and extension.

Helping to retrieve knowledge and cultural identity. The main issue here is to help rescue the technical knowledge which, as a result of prolonged colonisation, has been deeply eroded and widely scattered. This technological erosion has occurred to differing extents and in different ways in each location. But this makes it possible to bring from one area what has been lost in another.

The 'revaluation' or revitalisation is accomplished concretely by means of brochures which publicise Andean farmers' technologies, and by means of studies of paradigmatic communities. The brochures are small pamphlets containing many illustrations and very little text, in which aspects of a particular technology which can stimulate their revitalisation by other farmers are depicted. The studies describe living Andean examples of peasant societies which retain an active social life in balance with nature in the manner of the indigenous culture.

The principal aim of these activities is to facilitate a horizontal interchange between peasant communities so that they can enrich each other, sharing the scattered cultural elements of a once unified entity. With this in mind, PRATEC supports meetings among peasants as well as between ethnic groups. We judge that this is a useful way to contribute to preventing the erosion and dispersion of Andean culture.

Recreating and revitalising Andean culture and agriculture. Andean knowledge offers elements of a solution to social and natural health problems and presents autonomous development alternatives. We therefore propose to contribute not only to recovering items of knowledge, but also to increasing rural development potential.

To this end, PRATEC does not limit itself to its own efforts, but establishes networks of cooperation at different levels: with institutions concerned with research, education, promoting the developments in question and revitalising Andean culture. Relations are formed between NGOs, state projects, international technical cooperation projects, peasant associations and universities.

Conveying ideas on Andean culture to official organisations. Without falling into the error of considering ourselves as mouthpieces of Andean society, PRATEC seeks to stimulate debate on the Andes and its potential in various spheres of national official society.

We try to convey our viewpoint in those very arenas in which Western culture has penetrated most strongly - to the point of negating the possibility of developing local cultures. Our activities in this regard are of three types:

- developing a theoretical framework on Andean culture starting from agriculture, which we have named 'the New Andean Agronomy';
- 2) demonstrating the possibilities presented by the diffusion of Andean technologies and knowledge; and
- training local extensionists in the Andean countryside; this involves seminars and workshops in which diverse themes associated with Andean agriculture, farmers' education and research etc. are debated.

Relations with universities deserve particular comment. For ten years now, the universities have attempted to modify their curricula to conform to the productive cycles of the region, but without success. One of the problems is that there are not enough lecturers who are Andean specialists to cope with this task. Neither is there the expertise to prepare texts on the Andes from the viewpoint of Andean culture. For this reason, PRATEC devotes some of its resources to a) training and assessing teams of university faculty staff who have taken a stance on the importance of the Andean question and have committed themselves to preparing texts, and b) assessing the curriculum modifications of the agricultural faculties of the universities which have asked for this assistance.

#### 2. AGRICULTURE AND CULTURE IN PERU

Recovering the indigenous culture and agriculture of Peru is fundamental to improving the lives of the majority of the people. This cultural retrieval involves rescuing the indigenous world view as the basis of daily life.

We are opposed to agricultural modernisation along the lines of conventional extension which, combined with the provision of farm credit, promotes and increases the sale of inputs. This enriches the multinational companies selling them, while it increases our dependency cythereby distorting our own national development and threatening indigenous culture. The importance of the recovery of this culture lies in its contribution to autonomy and self-sufficiency in Peru, thereby guaranteeing a better life for the majority.

## Agriculture as an expression of Andean culture

The Andes has a unique indigenous culture in which agriculture plays a central role, in contrast to its subordination to industry in capitalist countries. Figure 1 indicates the importance of agriculture in Andean culture.

Culture, nature and agriculture in Andean society. In a relatively small area, Peru contains most of the world's ecosystems (84 out of a world total of 103) from the extreme mountainous heights of the Andes through deserts to the equatorial forests of the Amazon region. The population began to arrive in what is now Peru about 20,000 years ago. On the basis of agriculture, the ethnic groups consolidated a unique form of social organisation which included plant breeding, animal breeding and husbandry, and conserving and storing agricultural products. These activities, designed to make the most productive use of resources, gave rise to an economic system which was more or less self-sufficient, regulated by the needs of its constituent populations. Each ethnic group used its resources in an integrated, intensive and sustained manner.

Indigenous Peruvian culture has a holistic world view or rather cosmology, as it takes into its integrated perspective not just the world but the totality of the cosmos. In this perspective, the whole of nature is conceived as a living being like an animal in which all its parts are interrelated, man being one of them. In this scheme of things, nature does not belong to man, but man to nature. Thus, human society does not stand in opposition to nature, as in the Western view of man, the conqueror of natural forces; rather, man works with and communicates with nature.

This is no static conception of the world but a dynamic one in which there is a continuous transformation and domestication of the environment. The ancient Peruvian cosmology holds agriculture at the centre because of the primary concern of society to ensure adequate nourishment for the population and for the development of arts and crafts. The arts, sciences, philosophy, religion, systems of perception and classification, language and technology are all organised around agricultural activities. For example, the language is extraordinarily rich in expressions related to crop and animal characteristics pertinent to their breeding and husbandry. Thus, the agricultural centredness of Andean culture is linked to the integrated management of the ecosystem (see Fig. 1).

Resources. Indigenous society regulates social relations around the principles of reciprocity and redistribution, i.e., production is dictated by the necessities of social reproduction. The environment is organised and used so as to bring mutual benefits to both society and nature. Environmental management by a culture based on farming gives priority to resources which have a fundamentally social function. Thus, water becomes the source of irrigation and the flora becomes the nutrition for animals. The whole countryside appears as a cultural entity as much as it does a natural one.

The holistic culture of the Andes is best expressed in the fact that the soil, water, crops, breeds, climate and landscape are not conceivable as existing in isolation from each other; they are joined by their multiple interrelations resulting from the everyday practice of agriculture.

Indigenous agriculture has certain basic features in common such as maize and potatoes and their associated crops, and pastoralism centred on the llama and alpaca. Each of these core features is adapted to local conditions. Thus, the higher one goes,

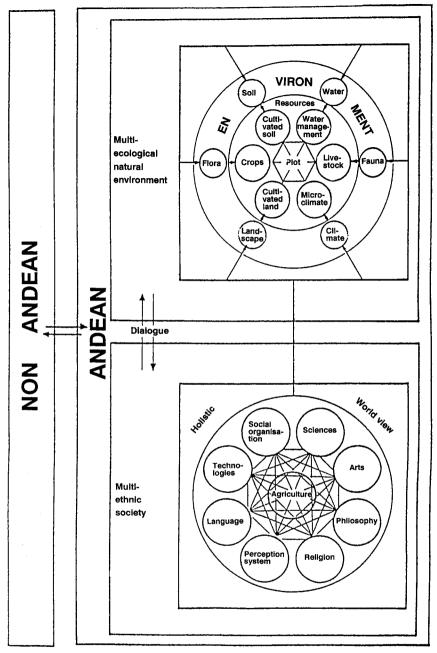


Figure 1: The Andean conception of the relation between nature and society (Grillo-Rengifo)

the less intensive is land use, rotation cropping (including fallowing) being employed to permit the soils to recover their fertility. On lower ground and its specific microclimates, in contrast, land use is more intensive to the point where, in some places, no sooner than one crop is harvested, another is sown.

We are speaking, then, of an agriculture with a diversity of forms derived from the use of favourable natural conditions and the creation of lacking conditions, always operating on a long-term basis and expanding resources with increase in population.

#### Consequences of the country's colonisation

The invasion and domination of the Andean population by the Spanish in the early 16th century marked the beginning of a colonial state which continues in essence up to the present time. Before the colonialists arrived, the indigenous peoples had developed an advanced agricultural system able to cater for the needs of a population as large as at the present time. But following the European invasion, agriculture was neglected and has remained so. The country was turned over mainly to mining and, to a lesser extent, to other commercial products of interest to foreign-based capitalist enterprises such as guano, salt, fish and rubber. This product specialisation has become so ingrained that a widespread fallacy has permeated public consciousness: that our country lacks the conditions necessary for an agriculture sufficiently productive to sustain its population.

Some recent figures appear to corroborate this view. Agricultural products as a percentage of gross national product (GNP) has fallen from 23.5% in 1950 to 10.8% in 1980. According to the National Office of Evaluation of Natural Resources (ONERN), only 5.9% of our land surface has agricultural potential, while the world average is 25%. As if this were not enough, the National Institute of Planning (INP), in a study presented as technically highly rigourous, argued that even granting a nationwide programme of investment in the rural areas and maximum use of all agricultural resources, even under optimum weather conditions, Peru would have to import 2 million metric tons of wheat in the tenth year of such a plan, the year when the most ambitious goals would have been reached.

This, then, is the current diagnosis of our agricultural situation. The environment is not just unpromising but apparently even hostile to agricultural activity. Such a biased appraisal is associated with a school of planning which treats the population's need satisfaction as subject to a) the supposedly objective estimation of existing resources, b) the responsiveness of these resources to currently available technology, and c) the business attractiveness of such technological development of available agricultural resources.

It is true that five centuries of colonialism have impaired Peru's indigenous productive forces through detrimental land tenure systems, orientation of production away from local requirements, and failure to maintain existing technology and infrastructure. All of this has resulted in a decline in the nutritional intake of the population. Also, planning has been dictated according to international agencies and has responded to international capitalist rather than national interests. Under these conditions, for developing countries such as Peru, transfer of technology has basically

meant purchasing internationally available technology, something which has aided the expansion of the markets of capitalist enterprise rather than effected a transfer of know-how required for real technological development.

For this reason, technology transfer should not be the path for developing countries to pursue. Even the undoubted advantages of agricultural research such as that carried out in the International Potato Center in Peru have been tarnished by dependence upon costly foreign-produced technology and capital.

## Toward recovery of the Andean cultural identity in agriculture

The peasant community. The basis of an autonomous Peruvian agriculture must be the peasant community, a highly developed and integrated type of social organisation. Notwithstanding the fundamental integrity of the peasant community, colonial and post-colonial intrusions have inculcated social differentiation into the peasantry. The most clear demonstration of this is the fact that 90% of farm units possess only 11% of registered land. Nevertheless, this limited area embraces over half of the land devoted to sustained agricultural activity.

Although agriculture is the basis of peasant life, the peasant population is not petrified in its traditions nor constitutionally incapable of adapting to modern life, as is often assumed. On the contrary, it has been forced by the impact of capitalist social relations to seek employment in the industrial and commercial sectors and to adapt to urban life. Meanwhile, the essential characteristics of peasant society remain: family labour, reciprocity, redistribution, the characteristics of a society based on satisfying the needs of its members.

Systems of land use. Of the four key elements of ancient Peruvian agriculture - animal and plant husbandry, land use, infrastructural development and conservation, storage and transport - this section focuses on the second element. This is because land use is the cornerstone of Andean agriculture. Land utilisation can be classified according to the degree of intensiveness or extensiveness with which land is cultivated.

The first type of land use is that which includes fallow periods. One system, known as shifting cultivation, involves the land being left to reconstitute itself by the physical departure of the people and is practised in woodland areas. The other main system is rotation farming, in which the population does not leave the land but uses only a part of it at any one time. The land is divided into sections, which are put to different uses according to a strict sequence, including a fallow period. The number of sections designated to fallow varies according to the length of the fallow period which, in turn, depends on biological and climatic factors. This system is particularly associated with mountainous zones. The first stage in the sequence is bringing back into use a fallowed section, which is fertilised with manure to produce fodder. Potatoes are the first crop of the sequence, followed by oca, olluco or mashua, and, since colonisation, onions.

Another non-irrigated system, which also reconstitutes the soil, is found on lower-lying but hilly lands which favour maize and sweet potatoes. This system uses

terraces to prevent soil erosion and to make full use of the soil potential and rainfall. The terraces are generally intensely cultivated, alternating with fallow periods. Strict patterns of crop rotation and crop combinations are practised.

Turning now to forms of constant or fixed land use for agriculture, the best example and one which represents one of the pinnacles of world agricultural architecture is the Andes system involving monumental irrigated terraces. Besides constituting a complete cultural phenomenon, this system is an archetypical solution to steep slope cultivation.

Llama and alpaca pastoralism was marginalised by the introduction of exotic species like the ovine following European colonisation. Traditional pastoralism has remained peripheral until the present day.

Research and technology development with and for peasant farmers. In the holistic world view of Andean culture, technology is treated as the intermediate link between the scientific knowledge that the farmers themselves have of their resources, and the material quality of life measured by at least being able to count on enough food and reasonable health. The colonial intrusion into indigenous agriculture over the past 500 years is visible in the genetic deterioration of local crop varieties and the soil erosion. But, in spite of everything, Andean culture has retained its traditions of research, basically for three reasons:

- in view of the ecological constraints, cropping and animal husbandry practices must be adapted to the specific conditions of each farm, soil type, topological form etc.;
- the resources need to be managed according to variations in the kinds of family labour available as a consequence of variations in household composition according to size, age and sex;
- the variations in climate and weather conditions necessitate experimentation and research on, e.g. sowing dates, crop combinations.

In these circumstances, it is obvious that scientific research really capable of serving the farmer ought to start from the farmers' own knowledge, taking it further critically, grasping the farmers' objectives but seeking more effective solutions with the help of means not available locally. The professional researcher would need to participate actively in order to define the problems accurately and spell out the consequences of solutions proposed for different social and geographical circumstances. An excellent example of this kind of involvement is that of Valladolid Rivera and Nuñez Aguilar (1986), who made highly detailed studies of Andean tubers and grains.

Only by understanding the integrated nature of the peasants' problems can agricultural research really contribute to unleashing the full potential of Peruvian agricultural resources. In this way, one of the foundations for national autonomy will have been laid.

In 1983, under the auspices of the Interamerican Institute of Agricultural Sciences (IICA) and the Coordinating Commission of Andean Technologies (CCTA), a roundtable was held at the International Potato Center (CIP) on 'Methodological

Advances in Agricultural Research in the Andes of Peru'. The explicit aim of almost all the research was to help facilitate the transfer of modern technology to the farmers. The predominant conceptual framework was one which reduced technology to a production function, thereby missing the real-life conditions of the peasantry. Methods developed by Hart (1980) to systematise very succinctly the behaviour of production units and, using the concept of 'agroecosystem determinants', to link technology transfer and technology generation to form a farming system research and extension process are particularly inadequate in this respect, for the following reasons:

- 1) the subdivided constellation of agricultural entities making up peasant farms loses its substance by being reduced to a 'farm unit';
- 2) only one moment rather than the process of the farm's organisation is captured;
- the overall model of farming is inadequately revealed, since preference is given to the individual case, which can only make a partial representation of the whole model.

We do not criticise the method of conceiving farm processes as systems, only Hart's 'practical reductionism'. Indeed, working with systems can enormously enrich the conceptualisation and description of indigenous agriculture including, e.g., the role weeds play in them. It is important not to forget that Peruvian agriculture contrasts with US agriculture in its being a mini-agriculture in its filigree-like fine-tuning of techniques adapted to tiny spaces and small-scale technology.

The recovery of cultural identity in agriculture means, in the present context, that we are making explicit the achievements of the pre-colonial Andean peoples in order to create a paradigm for the future. The future is strongly linked to the past. While paradoxical in Western Christian thinking, this is completely consistent with the cyclical view of time in Andean culture.

### 3. GUIDELINES FOR RECORDING ANDEAN FARMERS' TECHNOLOGIES

PRATEC presents these notes by way of reply to the requests from extensionists from diverse organisations for guidance in collecting and recording Andean farmers' technologies. We stress, however, the prime importance of not treating this exercise as a routine application of a formula, but as more of a stimulating creative process in which the extensionist stimulates the farmer-as-author to elaborate his/her expertise freely.

In addition, in preparing the catalogue of techniques, the extensionist must take a back seat - beginning with the selection of techniques, a task to remain in the hands of the farming community itself. This methodological proviso represents a considerable advance in the representation of farmer knowledge and skills.

Aims. There are at least four aims behind gathering Andean farmers' technologies:

1) to contribute to recovering a technology which, for whatever reason, has been lost in one area, by registering its use in another; by thus acting as an

- intermediary between two farming communities, one can facilitate revival of the lost technology;
- to contribute to training field-level extensionists in the technological repertoire
  of the farmer, something which would not have been covered in their previous
  training, oriented as it would have been to the transfer of modern, Western
  technology;
- 3) to contribute to the inventory of farmer technologies which, for the past five centuries, have been continually and substantially undermined and dispersed and, in so doing, to highlight the richness of peasant knowledge and skills in managing their own resources; there is intrinsic value in making known a wisdom which has consistently been depreciated or remained unacknowledged in colonial and post-colonial society;
- 4) to contribute to the farmers' own appreciation of the richness of their knowledge to meet their own needs, having recourse to just those elements available locally, thereby achieving solutions quite adequate to the problems presented. This implies strengthening the farmers' awareness that they possess the means to solve their own problems, making it unnecessary to seek outside assistance for their resolution.

It is vital to have these aims in mind when compiling technology brochures or pamphlets (see below) which explain the indigenous technologies.

Requirements of the inventory. On the occasions when local experts-authors (a provisional term to denote the farmers as authors of the inventory) have met, they have asked highly detailed questions about the technology being presented, in order to define as precisely as possible the similarities and differences between it and that practised by the host community or to introduce it where it is not known. This desire for detailed knowledge springs from the fact that the farmer realises that the technology demonstrated corresponds to the characteristics of a highly specific situation in terms of its setting in time and place. It is understood that, in order to transfer the technology, it will be necessary to adjust it to the circumstances of the adopter's farm environment. Bearing this in mind, each item about a technology described in a pamphlet must be entered as clearly and explicitly as possible, paradoxically not to copy it but to permit its recreation. As Andean culture is less discursive than practical, the texts should be brief, easy to read and preferably in the Quechua and Aymara languages. There should be abundant, well-designed illustrations indicating precisely the details of each operation.

As to the use of these pamphlets by extensionists, initially the process will be the reverse of that just outlined for the farmers: the extensionists will begin by learning the technology within a formal model of the type taught in university, leaving aside at this point the specific details of the particular technology presented. Nevertheless, as in the preparation of the pamphlets, the variations of a single technology will be presented, whether they be regional variations or differences stemming from distinct conditions within a region. This will sensitise the trainees to appreciate the variations on core technologies operating in different circumstances. To complement this

awareness, the extensionists will participate as observers in the meetings of local experts, which will arrest the tendency toward generalisation endemic to professional training.

Referring back to the third aim about the intrinsic value of cataloguing indigenous technologies, information regarding all aspects of peasant life gained from its most prominent practitioners is of relevance. This includes not only cultivation and animal husbandry, but also crafts and human health practices. It would be ideal, for example, if in each farming community a calender were made of farming activities over a whole year, identifying the sowing seasons, the farm work carried out during growth, and the harvesting of each crop. The same detail should be made in the process of animal husbandry. In this way, each technology registered remains embedded in its local context and in the annual cycle of the community.

By so doing, the farmers' knowledge of their own technological repertoire, not only in their own setting but enriched by knowledge of their operation in other communities across the length and breadth of the Andes, would help the farmers combat the pernicious influence of inappropriate technologies and ideologically loaded propositions about development. Strengthened by their conviction about their own identity, the farmers do not have to resort to 'resistance' to defend their culture, but can demonstrate the superiority of their own technology in the Andean context against other impositions.

Procedure for designing the inventory. Until the community can assume for itself the whole process of selecting the technologies to be catalogued and identifying the local experts together with the other members who will assist in the writing and drawing, the extensionist will act as the compiler of information. At a later stage, s/he will take a back seat, remaining only to accompany and support the work in whatever ways are deemed necessary.

In the first stage, it is important that the extensionists' description of a particular technology for the pamphlets be treated as a process rather than a 'one-off' activity. Part of this process should be consulting those local experts with special familiarity with and expertise in a particular technology for their suggestions about selecting the technologies. Then there should be various interviews with these local authors to learn more about the choices made, in order to arrive at a first version for the pamphlet. This should then be returned to the local authors for criticisms, so that the necessary corrections can be made. At this point, further comments should be solicited from other farmers who use the technology, in order to make further refinements. Only after all this has been done should one proceed to the final version for publication. This does not necessarily end the process; if it becomes apparent with time that the description has shortcomings, revisions of the pamphlet could and should be made - as many times as necessary. It is thus clear that the final work is the result not of just one person but of all those who participate in it.

A little more detail on converting local farmer knowledge into the visual presentation in the pamphlet might be useful. The agronomist must first learn to dialogue with the farmers without betraying any impatience about achieving

immediate results - a typical fault of those accustomed to urban and university environments. It is much better to proceed slowly, familiarising oneself with the local experts and their technologies which are to be catalogued. Beware of that occurrence typical of classical interviews in which the farmer acts simply as an informant. If it is borne in mind that it is the farmers who are the authors of the pamphlet, then it is correspondingly their rhythm and styles of working which should be followed.

Secondly, given the interconnectedness of the Andean world view and the embeddedness of technology in nature, essential details for the functioning of a technology might easily be missed if the farmer is not allowed to speak freely. Yet, if asked specific questions, the farmer may reply with short no-nonsense answers which do scant justice to the extent of farmer knowledge in defining and characterising a technology. Conversion of the peasants' holistic grasp of technologies to their representation in pamphlets is complex, each case being different, therefore demanding considerable creativity and pure hard slog. Certain media and visual aids such as photos, maps and drawings can be of great help in this endeavour. The effort made by the farmer to make the transition from his/her practical grasp of technologies to the demands of the inventory and pamphlet should not be underestimated. It should neither be forgotten that the farmer will use the pamphlet only as a reference point to activate its contents in daily farming practice. At any rate, it plays a didactic role in the re-acculturation of Andean peasants on the basis of their own experience.

## Practical guide for designing the inventory

Preliminary tips. In presenting the inventory guidelines, the following observation was made: 'This guide is not a list of questions which has to be followed rigidly. It only indicates the main points of reference for a dialogue with the farmers.'

Basically, if we refer to the ten technologies that were recorded during the workshop, as well as the 300 that made up the next batch of the inventory (up to June 1990), the outline which was generally adopted is the following one. As will be seen, it comprises three parts. The first is introductory and refers to the geographical and social context in which the technology occurs. The second part is where the details about the technology itself are entered. The third part contains the observations and conclusions of the extensionist.

Transition from ideas to words and illustrations. One of the greatest difficulties of verbal expression is that the meaning of the original discourse can easily get lost. In the case of the farmer, this transition is doubly difficult. Firstly, his/her vision of the world is holistic and, secondly, this understanding is communicated through an indigenous language (usually Quechua or Aymara) whose words have no visual representational equivalent for the speaker, the more so because this language has not been substituted by Spanish.

Inquiry into everyday peasant life by nonpeasant people and 'translating' it inevitably results in a certain amount of distortion. This can be minimised and the original meaning retained if the farmers themselves monitor the process of

representing and recording their world. But the 'validity' of this task must always be judged by the social group about whom and for whom the inquiry is being made. Representations are always cultural and, in this sense, they always remain 'subjective', but that is the nature of human cultural products.

For other sociocultural groups, the descriptions and characterisations in the pamphlet will serve to fill a gap or need, and what they lose in translation, as it were, will not matter too much since they will not be simply copied but rather adapted for the new setting. Indeed, we have tried to avoid making 'primers' of cultural revival since these always end up as reductions of a much more complex reality.

It is extremely difficult to put in the pamphlet all that the farmer says about this or that aspect of a technology. One way of ordering (or disordering!) what s/he says is to make a preliminary list of items, as a basis to decide later which ones should be expressed verbally, and which ones visually.

For practical reasons, it is suggested that the extensionist, during the many meetings and talks with the farmer, compiles all details of the farmer's explanations and employment of the technology. S/he should not try to capture a farmer's discourse in some pre-set classificatory scheme. As has been said, the pace of the farmer should be respected, which is not just a question of time but a whole way of life. One of the objectives of this activity is the training and sensitising of the extensionists by the Andean people. The communities must be encouraged to express their cultural repertoire in their own way.

Later, the information must be organised. For this, the following guide may be helpful. Once filled in, it will be the extensionist's script. By way of an example, we also present a questionnaire completed by the participants of the workshop.

Guide for registering Andean farming technologies. This guide is not a list of questions to be rigidly adhered to. It is only intended to indicate the main points of reference for a dialogue with the farmers. The nature of the technology, as indeed the relation between the local expert and the extensionist, determine the questions to be asked and the style of the dialogue. The objective is to begin formalising farmers' knowledge. The idea is to use the following as a means, not a strait-jacket.

## Question guide

I. INTRODUCTION (contextu	al information)	):
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- 1. Sociocultural
- 2. Socioeconomic
- 3. Conditions under which the technology was developed

### II. GENERAL INFORMATION:

1.	Name of	the	local ex	pert:		

2.	Level of instruction:Age:			
3.	Number of members in the family:			
4.	Name of the technology:	to		<u> </u>
5.	Geographical location:		18/	
6.	Name of community:			
7.	Ecology of the community: Number of ecological levels/zones	Altitude	Crops	
8.	Distance from the nearest town/city:			km
III.	INFORMATION ON THE TECHNOLOG			
1.	Uses of the technology:			<del></del> -
2.	Where was it learned?			
3.	Who was the instructor?			
4.	How many years have you used it?			
5.	Why do you use it?			
6.	What is its relationship with other farmin	_		
7.	How do you operate it? Describe the stag	ges of the operation	on:	
8.	With whom do you use it?			

9.	Locations where it is employed:
10.	Materials which it uses (inputs):
11.	How does one obtain these inputs?
12.	Tools that it requires and the way these are employed:
13.	Periods in which you use the technology:
14.	Results you obtain:
15.	Problems in using the technology:
16.	Suggestions for improving the technology:
17.	How many times have you used this technology?
18.	Do you teach its use to others?
19.	Who knows and uses this technology?
20.	Rituals/ceremonies linked with this technology:

# IV. OBSERVATIONS OF THE EXTENSIONIST:

# V. MAP

### Example of an item for the pamphlet derived from the guide: a granary

### I. INTRODUCTION

Chamis is an agrarian cooperative situated in the northwest of the Cajamarca District of the Province and Department of the same name. Chamis consists of about 100 families, engaged in cropping, cattle-keeping and crafts. Its main products are: cereals such as wheat, barley and rye; root crops such as potato, olluco, oca and mashua; and the products of cattle, sheep, fowl and guinea pigs. In addition, crafts including weaving, sewing and making straw hats are practised.

### II. GENERAL INFORMATION

- 1. Juan Lopez Ramos
- 2. 4th year of primary school; 30 years old
- 3. 6 members
- 4. 'granary'
- 5. Chamis, situated 3300-3500 m above sea level
- 6. Chamis belongs to the District, Province and Department of Cajamarca
- 7. Agroecological zones II and III

Altitude: 3300-3500 m

Crops: cereals (as listed above)

8. Chamis is 10 km from the city of Cajamarca.

### III. INFORMATION ON THE TECHNOLOGY ITSELF

- 1. A granary for storing seeds and tools as well as firewood.
- 2. Learned in Chamis.
- 3. The grandparents were the teachers.
- 4. He has been using the granary for 4 years.
- 5. Because this conserves the seeds better in whatever setting. The seeds can be stored safely for up to 3 years.
- Used primarily for agricultural purposes and secondarily to store tools, firewood and tiles.
- 7. Stages of constructing the granary:
  - a. A trench of 2 square yards and up to 1/2 yard deep is dug.
  - b. A stone foundation is laid which protrudes up to 1/2 yard above the ground.
  - c. This base is covered with a platform of wood and clay.
  - d. This platform is itself covered with either another layer of clay or with 5 cm adobe bricks and with a deep bed of straw.
  - e. On this covering, the walls are constructed, either of thin adobe bricks or of a mixture of adobe and reeds. The space is divided in half by one main partition and in quarters by partitions reaching half the height of the main walls.
  - f. A platform ceiling is constructed out of beams, reeds and adobe, or pure adobe bricks, leaving space to insert the goods into the storage spaces.

- g. Again the walls are built in the same way as above (e), leaving space for entry as with the openings to the storage rooms.
- h. The roof is made of straw and rye stalks.
- i. The entire construction is burnished with clay and straw.
- 8. The granary is made in the manner of Minga, where all the family lends a hand.
- 9. The places where this granary is made are in the Chamis area.
- 10. The materials used are described in 7, above.
- 11. The inputs are all gathered from Chamis, except for the wood.
- 12. The tools used include a pickax, a brickmaker and a hammer.
- 13. The granary is built in the rainy season (especially October).
- 14. It is used for the sound conservation of seeds.
- 15. No special problem exists in its use.
- 16. No suggestion is made for its improvement.
- 17. Any deterioration of the construction requires following the same steps as already outlined in 7. above.
- 18. Yes, the technology is taught to others.
- 19. Few beyond this area know of it, and those who do have normally originated from here.
- 20. There are no rituals linked to this technology.

### IV. OBSERVATIONS OF THE EXTENSIONIST

This practice is confined to the high Andes mountains. For this reason, it should be encouraged to spread to other areas of the country.

### V. MAP

### Example of topics on which pamphlets have been made

The following are samples of the 300 technologies which have been registered so far: Agricultural architecture:

- Terracing
- · Periodic recovery of disused terraces
- · Dry-stone walls

Agricultural and forestry techniques:

- · Various types of maize cultivation on ecological levels and niches
- · Potato improvement using botanical seeds
- · Various forms of crop rotation
- · Cultivation in areas where ruminants have been
- · Use of Andean foot plough
- Intercropping

- Use of native tree varieties for reforestation
- Animal husbandry:
- Use of Andean swamp grass for fattening cattle
- Treatment of bone fractures in sheep, using medicinal plants
- Pasture rotation (as distinct from, but equivalent to crop rotation)
- · Rationing feed for ox-teams
- · Curing bloat in cattle
- · Treating ticks in cattle

### Crafts:

- · Making Panama hats
- Making ropes
- · Making ceramic pots
- · Making mats from local plants
- · Stone carving

Conservation, food processing and storage:

- Removing tannin from tarhui (Andean high-protein legume)
- · Freeze-drying potatoes
- · Underground seed storage
- Conserving crop residues on elevated surfaces
- · Protecting springs from contamination.

### **Expectations and propositions**

We have already referred to the diverse ways the Andean technologies may appear in the inventories. This diversity helps preserve the flavour of its place of origin. There is absolutely no need for standardisation.

This is not to deny the desirability of improving the presentation of technologies, so that the farmer, with only the pamphlet to go by, can easily recreate the described item in his/her locality. This is the real challenge that the local expert, as author, faces: to be able to make perfectly clear to other farmers a technology with which s/he is familiar. This involves providing enough information of such a quality and presented in such a way that the practical value of the technology and its operation is conveyed straightforwardly. In this sense, once again the regional meetings of local experts come into their own as corrective mechanisms par excellence. They are the ideal means for this critical regulatory function. No-one can understand the complexities and implications of peasant life and activities better than the peasants themselves.

We also recommend that the peasant organisations themselves be the ones to prioritise the technologies to be revived, and to designate the person to draw up the pamphlet, together with those assistants particularly capable of preparing the text and illustrations. In this way, one can ensure that the representation is realistic and designed 'in peasant style' without the interference of extensionists with their tendency toward simplification and generalisation. The pamphlet is, after all, intended to serve the needs of the peasant farmers. To this end, case studies of local communities recommend themselves. Here the expertise of the extensionists is

important both to understand the technology and to demonstrate to the peasants the contribution of technology to their culture.

Proposals for working with the peasant farmers. To encourage farmer-to-farmer communication, the following activities are proposed:

- Meetings of peasant farmers: In the first instance, these would be for the local farming experts. For the present, the idea would be to encourage a kind of panel, in which representatives from the various corners of the Andes could present, debate and share their knowledge. There would then be a chance to extend this type of event to local authorities and beyond, to include peasant associations, in order to facilitate the exchange of Andean indigenous knowledge. It would be important to bring in those with the greatest knowledge, the ancient high office holders (Pacos, yatiris etc).
- Transzonal exchanges between farmers: When a community faces a particular problem and needs assistance, rather than going to the modern Western extensionist who can only offer solutions from outside, why not approach a local peasant farmer known to be an expert in addressing that particular problem? Institutions could be persuaded to draw up a list of themes for which there are peasant specialists and then, when an inquiry touching on one such theme is made, the inquirer would be put in contact with the appropriate specialist.
- Circulating pamphlets of technologies: With the extensionist's help, the peasant technical expert has now drawn up a simple pamphlet of a technology which has been recovered and revived. It is important that it be spread as widely as possible. This would be particularly useful in informing farmers from one area about solutions of relevance in another. If possible, the solution can be applied simply by following the information in the pamphlet. If not, then, its author could be invited to explain the solution more thoroughly.
- Work with farmers' unions: Modern representative peasant unions in the Andes, both local and national, constitute an important means of mediation between peasants of different zones. Until now, such unions have normally been placed at the service of 'modernisation'. But the potential for strengthening the bases of Andean culture offered by working with these organisations should not be ignored; it could certainly help in the recovery of indigenous Andean knowledge.

Tasks to be accomplished. In order to achieve our aims, the following tasks must still be accomplished:

- Publication of the theoretical bases of the work discussed above and the pamphlets of technologies.
- · Completion of the guide to inventorising technologies.
- Diffusion of the pamphlets.
- Copying bibliographical material on the overall theme discussed here, and making it available to extensionists.
- Getting the regional committee to strengthen itself and to become an organising body and research group on Andean technologies.

- Committing institutions to buy the published books.
- Taking the potential readership of children into account in drawing up the pamphlets.
- Teaching Andean technologies in the universities.
- Making the peasants (not the institutions) the authors of the pamphlets.
- Inviting the most committed of the peasant authors, each of whom would bring with them revitalised technologies.
- Making the work more than just an institutional commitment but a personal one to the Andean world.
- In forthcoming events, deepening the coverage of agricultural and Andean cultural themes, without leaving aside the revitalisation of the technologies.

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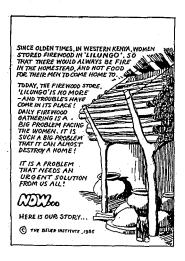
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# TREE PLANTING FOR INCREASED FUELWOOD SUPPLY FOR RURAL HOUSEHOLDS IN KENYA

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### 1. INTRODUCTION

In the high-potential, smallholder farming areas of Kenya, tree planting is an individual activity. This has resulted in wide variations in the types of trees raised and in the tree configurations found on the farms. Farmers in these areas have built up a large body of knowledge of agroforestry practices applicable to their particular farms. Any intervention project should therefore put this indigenous knowledge to full use, adding technical inputs and improvements where appropriate and acceptable in order to achieve the desired objective.

A woodfuel supply strategy outlined in Kenya's current development plan stresses the need for agroforestry programmes, peri-urban plantations, industrial plantations and active participation of the Ministry of Energy and Regional Development (MOERD) in ongoing Rural Afforestation and Soil Conservation Programmes. The Kenya Woodfuel Development Programme (KWDP), a project of MOERD, aims at developing a self-sustaining system of tree planting by rural households as a means of alleviating the woodfuel shortage.

During the work of KWDP in Kakamega and Kisii, some useful experience was gained in the process of 'learning from and with the farmer' in efforts to develop

viable agroforestry practices. An outline of the approach is given in this paper, with special emphasis on the research activities for developing technical and extension options.

In an initial phase, the natural and human resources is thoroughly studied and analysed. District-level information derived from aerial photographs is combined with documentary information on population, soils, rainfall, land tenure etc. Analysis of this data permits classification of the district into various zones with characteristic land-use patterns. This provides the basis for selecting specific households for the field-based investigations aimed at defining the woodfuel problem and designing intervention approaches. The strength of this approach emanates from the development research concept of involving the local communities in project design.

In a second phase, the agroforestry and cultural background of the people is identified and a feel for the factors which cause woodfuel problems is obtained. This information contributes toward the design of intervention approaches that accommodate 'indigenous expertise' and traditional practices. KWDP strives from the outset to determine what the target group is, what it needs and how the people themselves perceive the potentials of and constraints to achieving a desirable solution that is acceptable and appropriate to their cultural setting.

### 2. EXPERIENCE WITH FARMER-BASED TREE-PLANTING ACTIVITIES

KWDP made surveys of woody biomass cover and agroforestry practices in Kakamega (1984), Kisii and Murang'a (1985) Districts. These represent Kenya's main high-potential farming areas in Western, Nyanza and Central Provinces, with high population densities (300-700 people/km²) and small average farm sizes (1.0-3.4 ha). A summary of the major observations is given here.

### Relationship between population density and woody biomass cover

The farm area covered by trees and shrubs increases as the population density increases and average farm size decreases. In Kakamega, 20-25% of the farm area is covered by trees and shrubs, of which about 75% have been deliberately planted. The subregions with the highest population density - an average of 700 people/km², reaching 1000 people/km² in some areas with very small farms (less than 1 ha) - are those with the highest percentage of planted woody biomass and total woody biomass cover.

As population density increases and average farm size decreases, the proportion of on-farm woody biomass deliberately planted and managed (as against natural woody biomass) also increases. The areas with the highest number of rural households per square kilometre (over 150) also reflect the highest total woody biomass cover, the highest percentage of individual planted trees (trees in cropland, hedges, home compound etc.) and the highest percentage of planted tree stands (woodlots, windrows etc.) but the lowest percentage of natural woody biomass (remnants of natural vegetation, bush etc.).

### Farmers' tree-planting activities

In each subregion, a locally preferred mix of elements (e.g. woodlots, hedges, trees in cropland) and tree-raising activities is found, depending on local perceptions and practices regarding the farming system. Some types of tree-planting configurations are found virtually on all farms in the three districts: i.e. trees in cropland, trees in compounds, and hedges. The presence of natural vegetation is varied, but its disappearance is an indicator of extreme population pressure on the land. The replacement of natural vegetation (bush) by planted stands such as woodlots is evident in the densely-populated parts of the districts. Woodlots are found in the tea-growing areas (reflecting some compatibility of trees and tea growing) but, in the coffee zone further down the Aberdare foothills, the pressure on land is so great that woodlots have become increasingly expendable with continued expansion of coffee production. As a result, the coffee zone has pockets of *Acacia mearnsii* woodlots only in areas with larger that average land parcels. The cash from coffee farming can be used to purchase tree products.

Across the 26 subregions studied in the three districts, it was only in the coffee and coffee/subsistence zones of Murang'a District where a cash economy based on imported fuelwood was noted. However, in the most densely populated subregions of the three districts, e.g. in Southern Kakamega with population densities exceeding 700/km², a mixture of trees are still planted within the essentially subsistence farming economy. In contrast is the strongly cash-oriented economy of the Murang'a coffee zone, where tree planting for subsistence purposes has virtually disappeared and has been replaced by pockets of commercial woodlots in some areas.

# On-farm agroforestry practices

Investigations into the current practices of establishing on-farm woody biomass revealed the importance of planting 'fresh' material. It was estimated that over 292,000 farmers in the three districts planted trees on their farms during the previous year. Most of these newly-planted trees came not from official nurseries, but from the farmers' own or the neighbours' on-farm nurseries. (Seedlings are shared freely between neighbours.) Direct sowing of tree seed and collection of wildlings are also widespread practices in farmers' tree regeneration efforts.

### Species preferences

The seedlings most commonly planted are exotic species. In Kakamega District, 85% of the seedlings raised, bought or obtained for free were exotics (mainly Eucalyptus saligna and, to a lesser extent, Cupressus lusitanica), whereas 52% of the wildlings collected were indigenous species and 39% were fruit trees. About half of the trees sown directly were exotic species: Acacia mearnsii (black wattle), Eucalyptus saligna, Cassia siamea and some indigenous species, mainly Sesbania sesban and Croton microstachys in some parts of the district.

In Kisii, the preferred species planted varied with planting sites, but preference for

exotics was also widespread. Eucalyptus saligna, Acacia mearnsii and Cupressus lusitanica were the most common species.

In Murang'a, the main exotics planted on the farms were *Grevillea robusta*, *Acacia mearnsii* and, to a lesser extent, *Cupressus lusitanica*. A variety of indigenous species are also planted on the farm, e.g. crotons and *Markhamia plactatylax*.

### Tree ownership and uses

Trees are planted for various reasons across the three districts, but mainly for construction poles and timber and as a form of investment, to be sold for cash. These activities are under the control of men. Trees are also planted as a legal requirement to demarcate land, hence the presence of hedges (as boundary features) on virtually all farms in the three districts. In both Kisii and Kakamega Districts and, to a much lesser extent, in Murang'a, tree planting is normally done by the men. Trees are generally viewed as men's property and, therefore, men decide what to plant, where to plant and when to harvest. This is seen to be in line with the fact that, in most societies, men are the legal owners of the land and, therefore, have control over most of the farm resources. In Murang'a District, women were observed to be much more active in tree planting and management.

In general, men and women have differential access to resources at the household level. In their capacity as traditional heads of households, the men generally control the major household resources of economic importance. This control spreads to trees and, hence, men are generally regarded as managers of the trees on the farm, especially in the communities where traditions are observed to be relatively strong.

The current trend in farm forestry activities focuses mainly on trees as a form of family investment (cash crop concept) and tends to overlook the need for a rational approach to total household needs for trees and tree products. Low priority is given to women's needs for tree-related resources (firewood, fodder, raw materials for crafts, medicinal herbs etc.). The 'service roles' of trees in agroforestry systems enhancing organic matter production, maintaining soil fertility, improving soil structure and thus reducing soil erosion - which are factors of major importance in subsistence agriculture (mainly done by women), are also overlooked. To achieve a balance in providing for the total household requirements for woody biomass, these issues have to be considered and tackled at the household level. It is necessary to foster increased involvement of women in tree-planting activities at the household level, in an effort to provide for women's specific needs and enhance their status, thus increasing their self-confidence and pride.

# 3. FARM-BASED RESEARCH AND DEVELOPMENT ACTIVITIES IN KAKAMEGA AND KISII

As the farmers in Kakamega had built up a large body of knowledge of agroforestry practices applicable to their particular farms, it was decided to start on-farm trials with quick-growing fuelwood tree/shrub species on a limited number of farms. This

decision was greatly influenced by the observation that Sesbania sesban had been accepted as a fuelwood species in one ethnic group.

The objectives of the on-farm trials were as follows:

- to test the acceptability of deliberately planted fuelwood species and to gain an indication of the most important factors affecting the production of tree planting material under existing farm conditions:
- to create an environment for interacting with a number of farmers with the ultimate aim of building a relationship of mutual trust in order to learn as much as possible of their knowledge on tree growing and management;
- to observe the performance of the new species in the different zones of Kakamega and within the existing farming systems;
- to gain better understanding of the social life within the communities and the existing communication channels as a basis for exploring possible extension strategies;
- to expose the KWDP extensionists to the concept of learning from and with the farmer.

### Monitoring issues

With this basic approach of using indigenous knowledge of agroforestry to test the fast-maturing species at the farm level, a need was felt to incorporate a sound monitoring strategy during the test phases. It was envisaged that the monitoring strategy could succeed only if placed in the context of research and development, since the basic idea was to learn from and with the farmer, and to try to develop viable options that could be replicated on a wider scale.

Thus, monitoring is seen as a continuation of the learning process. By means of the resource analyses and cultural surveys, problems are defined for different farming groups and farm types. This leads to clarification of major social and cultural issues, which are taken into consideration during development of extension and technical options. The selected options are then tested to identify the best possible solutions. This testing is not viewed as an end in itself; it forms the basis of a long-term interaction with a sample of farms to monitor the impact of the tested options, and to keep the avenues of information exchange open.

Underlying this type of testing is a strong commitment to continued discussions with farmers as part of a reciprocal learning process; the programme also has the ultimate aim of fostering technology transfer at both national and international levels. The exchange of information between the farmers and KWDP and between KWDP and other agencies has to be based on sound and current knowledge of the communities with which KWDP is working. Thus, monitoring does not take the form of a one-sided data collection and analysis process.

The monitoring process on the whole is based on a multidimensional approach that has also necessited development of a variety of monitoring methodologies suitable for specific purposes. The salient features of these methodological variations are:

- periodic questionnaires aimed at gathering specific extension and technical information, e.g. on-farm nursery establishment following intervention, nursery care, root pruning, transplanting sites, planting configuration;
- structured discussions based on common guidelines to ensure consistency of information gathered; these are mainly aimed at keeping pace with changing cultural and socioeconomic attitudes, cultural perceptions, acceptance and diffusion of tested tree species, and discussions on fuelwood issues;
- continuous discussions aimed at keeping the avenues of information exchange open, and tracing assimilation of the tested species within the communities;
- on-spot field visits to assess the general impact of tested options and to ensure that the information gathering process is up to date;
- specific explanatory research into various issues such as fuelwood consumption in a selected sample of households;
- miscellaneous monitoring such as on-spot monitoring in drama and film extension, data sheets for technical monitoring of agroforestry trials (on-station trials) etc.

In all its intervention and monitoring activities, KWDP views the individual farm as the key to a realistic approach to the rural energy problem. In the final analysis, it is the individual households' approach to decision-making, and its social and economic status, that determines how the communities handle their energy problems. A crucial issue in the decision-making process, as discussed above, is who has access to and control over the resources of the individual household.

Since the decision-making process is complex and depends on several cultural, economic and social factors, everything that happens on the farm is part of a whole mechanism that encompasses all family needs. This interrelationship demonstrates the crucial need for a holistic approach to planning for rural development.

In its monitoring activities, KWDP has attempted to follow this approach. Part of the monitoring activities have thus concentrated on following a sample of households (for each test phase) from initial contact with an extension innovation to harvesting of trees and subsequent regeneration activities on the individual farm. Two examples from KWDP's earliest interventions are given here. The first involves 28 farmers in Kakamega with whom a 'no-message approach' was tested. The second refers to 25 farming groups in Kakamega with whom the group discussion and seedling distribution approach was tested.

### 'No-message' farm trials in Kakamega District

A total of 28 farms were selected on the basis of farm size and gender of the farm manager. The farmers were provided with a few seedlings of quick-growing fuelwood species and small amounts of seed. Each farmer received a total of 15-20 seedlings of three species and 50 seeds of one of the species. Once the seedlings and seed were distributed, the extensionists started collecting detailed additional information from the farm and monitored the performance of the seedlings. As part of the approach, the extensionists did not inform the farmers what they should do with the seedlings and seed, saying only that they are quick-growing fuelwood species like *Sesbania sesban*, a species already known in the District, KWDP wanted to see what the

farmers would do with the new materials on the basis of their existing knowledge of tree growing.

Four species were used: Calliandra calothyrsus, Leucaena leucocephala, Mimosa scabrella and Gliricidia sepium. Of these, only Mimosa and Sesbania have no coppicing qualities.

The farmers had limited interaction with KWDP after the initial discussions and issuing of seed and seedlings. The only contact was during monitoring activities, and the occasional visit for more in-depth discussion. However, a few of the farmers later became members of the 25 groups discussed below.

Tree-planting configurations and sites. The farm trials were based on the premise that the farmers had been planting trees for decades and did not need to be told where and how to plant the trees. It was interesting to observe what the farmers did with the seedlings and seed. For a start, all the seedlings were planted and nurseries were established using the seed. The seedlings from these nurseries were later transplanted on the farm, without any external instructions.

A range of tree-planting configurations and sites were observed: the trees were planted in hedges, on cropland, near homesteads, on terraces, in tiny woodlots and as scattered trees all over the farms. Sometimes they were planted in pastures, which led to their destruction by animals if the trees were not protected. This problem is an offshoot of the fact that three of the species tested are palatable to animals. Survival of planted seedlings was very impressive, and their performance encouraging. Only Gliricidia sepium did not do very well.

Tree ownership, management and harvesting. In structured discussions, some women claimed ownership of the trees but, in most of the 28 farms, the husband reportedly owned the trees. In a few cases, they were owned by 'the family'. A few women considered the trees to belong to their husbands, even though the husbands did not live on the farm and had not participated in raising the trees.

There was no distinct difference between farms in terms of who cared for the trees. In most farms, either the husband and the wife or son cared for the trees jointly. In other cases, the whole family reportedly looked after the trees. In a few cases, a woman had been caring for the trees alone.

Perception of and attitude to the fuelwood species. It is difficult to gauge attitudes from brief interviews and, in any case, an individual's attitude may change from time to time or even from place to place, depending on the surroundings and context of a discussion. Long-term interaction with individuals can lead to an understanding of their attitudes, whether changing or otherwise. In the case of these trials, it was possible to gain a general view of what the farmers really thought of the trial species and how they perceived them in terms of their possible contribution to the household energy budget and other farm needs.

Generally, there appeared to be no common pattern as to how the farmers perceived the species. Some species drew many comments, while others were

mentioned only once or twice in passing. Leucaena, for example, was noted for its horizontal growth, its slowness to increase in diameter and its too prolific seeding. Calliandra was often mentioned for its ornamental characteristics, while Sesbania appeared to be easily acceptable but not particularly notable. Few comments were made about Mimosa but the farmers, especially the men, appeared to be watching it with keen interest. This may have something to do with *Mimosa scabrella*'s obvious signs of growing into a big rounded tree, in comparison to the other species, which are shrubby.

In some cases, women voiced an intention to regenerate more trees in future for fuel and other needs such as building of granaries. Where the men expressed intention to regenerate more of the species, the intended end uses were more ambivalent. They gave a list of uses such as for construction poles, railing and fencing materials, sometimes with reference to particular species such as Calliandra, Mimosa and Sesbania. Fuel was also mentioned by men, but it was difficult to ascertain the priorities they attached to the various uses. A few men indicated that they wanted to grow the trees for fuel for their wives, which in itself is a promising development.

Conclusions. Although the small number of trials dictates that the information be treated with caution, some noteworthy conclusions emerge from a critical assessment of the trials on the 28 farms:

- Barely two years after the trials began, it became apparent that some farmers had already given up on the species. In one particular case when a woman was interviewed, she indicated her husband's dissatisfaction with the species and stated that they have no intention of regenerating more trees. She was not willing to express her own opinion on the species, but claimed that her husband expected to be given Eucalyptus and Cupressus, only to be given the fuelwood species which, to the husband, are not worth growing (according to the wife!).
- Male ownership of the trees appears to be a prominent feature. In fact, in those cases where the trees had not been harvested at all, they were most commonly owned by men. Nevertheless, there are indications that some men have already left it to their wives to look after the trees and harvest them, while others do it for the women. It would appear that some men are keen on leaving the species to grow for a longer period of time in order to observe them. So far, male ownership does not appear to have adversely affected the original intention of promoting cultivation of trees for fuelwood, since the majority of harvested trees have ended up in the kitchen.
- Generally, interplanting of the trees with crops was observed to be an acceptable practice. Some women have been impressed by the fact that, having been unable to grow Eucalyptus saligna (a common species in Kakamega), they have now found some species which they can plant in cropland. Judging from the planting site preferences, it is also possible that the farmers will, in future, experiment with the trees in a variety of planting sites. However, it is recognised that, for a farmer to make meaningful decisions on the most productive planting site, s/he needs to

grow many more trees than the small number given out to the 28 farmers.

- There was some concern about the reasons why the farmers are not establishing nurseries, sowing directly and coppicing regularly at a higher level. Why do they keep seed, and where and how do they store it? Why do they prefer giving it away? While it is possible that they intend to establish nurseries in future only three said so -, KWDP also felt that further explanation is needed.
- There is need to communicate with the farmers about the coppicing qualities of Calliandra, in particular, and the possibilities of direct sowing of the other species.
   It appears that most of the farmers are not aware of the coppicing characteristics; they have also not tried planting cuttings. Direct sowing was tried in only a few cases. Collection of wildings should also be encouraged, so that it becomes widespread and intensified.
- KWDP has realised the importance of explaining to farmers about the growth characteristics of the trial species and their 'shrub-like' features. This helps avoid disappointment in poor performance of the species, in cases where farmers expected them to grow into big thick trees. Unrealised expectations could cause adverse reaction to the fuelwood species.
- No clear harvesting pattern emerged from the trials; the number of farms involved
  was too small for such a pattern to emerge. It does appear, however, that KWDP
  needs to support on-station experimental data with a wider body of data from
  farmer's experiences, a process which is already underway.
- If the incidence of giving away trial species seed is an indicator, then it would appear that the species are diffusing rapidly among the farmers.
- Farmers' comments suggested that they intend to plant fuelwood trees on 'favoured land', which is a promising possibility.

The specific issues identified for further experimentation on a wide base in efforts to assess possible viable options include:

- planting sites;
- spacing within the different configurations;
- performance of the various species;
- tree management practices for various end uses (fuelwood, fodder, soil conservation etc);
- compatibility with crops;
- resistance to insect and disease attack;
- · seed handling and storage.

### Experimentation with members of farming groups

In November 1984, KWDP decided that the trials on the 28 farms were sufficiently promising to justify on-farm trials of the species on a larger scale. An implementation strategy was worked out based on the previous experience.

It was evident that the idea of planting trees specifically for fuelwood had to be introduced into the community as an innovation. It was also clear that the men had to plant these trees to assist their wives in producing fuelwood, or they had to allow the women to plant the trees themselves.

The anticipated course of action touched on the culturally determined relationship between husband and wife and upon traditional tree and land ownership issues. Further group discussions with farmers were considered necessary to determine the most effective motivation components for such an 'awareness-raising' programme.

Formation of groups. Interested neighbours of the initial 28 farmers were brought together in groups. Where it was not possible to form a group on this basis, an already existing group in the area was used: e.g. a women's group, a church group. In two cases, it was possible to form a youth group and a men-only group. In total, 25 groups were formed with a total membership of 520 farmers.

The extension staff held, on average, three discussions per group. The group members were assisted in analysing their fuelwood situation, defining the problems and suggesting possible solutions. They were then encouraged to work out a course of action to meet their needs and to determine any need for external assistance. Seedlings of four fuelwood species were then distributed to the farmers. Each farmer decided independently on the quantity of seedlings, subject to a maximum of 250 seedlings per individual. In total, over 100 000 seedlings were distributed with an average of 150-200 seedlings per farmer.

The overall strategy, apart from learning more about the possible motivation components around which an effective awareness programme could be designed, was to learn more about various technical practices of farmers and the adaptability of the selected fuelwood species.

Group members' use of distributed seedlings. After distribution of the seedlings, the extensionists monitored what the group members did with them. An interesting mixture of planting sites and configurations was observed. Woodlots were attractive to the farmers in Lukume in the north and Kegoye in the south, and were also common planting sites in Ebusikhale and Eshianda in the south. Hedges, both old and new, were prominent in all sublocations, but particularly in Kegoye in the south. Planting in cropland was widespread in all sublocations. Windrows were prominent only in Eshianda in the south. Planting on terraces in cropland was observed in Kegoye.

For KWDP, these planting sites and configurations were further proof that the farmers could and were ready to accept the fuelwood species, and try them out to see how they could fit into the existing farm situation. Sometimes, the planting sites and configurations observed were surprising, e.g. in the case of woodlots in Ebusikhale, where woodlots had not been prominent in the resource analysis. Other observations were in keeping with observed agroforestry practices, e.g. in the case of Eshianda, where the resource analysis had revealed that farmers have a strong interest in windrows. In Mayoni, which is within the sugar belt, planting in cropland was confined to food crop fields, as would be expected, since sugarcane is not normally compatible with trees, chiefly because of its growth characteristics and the high level of mechanisation in sugarcane growing.

A broad spread of planting sites and configuration was observed in Chekalini in the north, where the farm are relatively large (compared with southern Kakamega) and farmers have more land available for experimenting with trees. In comparison, planting in existing hedges in the southern parts of Kakamega, especially prominent in Kegoye, was more or less dictated by the small parcels of land and the traditional practice of using hedges as a boundary marker and tree planting site.

Monitoring of the 25 groups continued, with KWDP's concern about end uses of the tree products after harvesting becoming an overriding issue. In this connection, a strong need was seen to investigate the following issues:

- When do farmers start harvesting fuelwood species?
- Do the harvested trees go into the kitchen or not?
- Do farmers harvest seed, who harvests it, and what is done with it?
- Does self-regeneration of the trees occur, and what methods of regeneration are used by the farmers?

Besides these issues, it was discussed with the farmers whether they saw possibilities of trying to raise interest and awareness in fuelwood issues on a much larger scale, and whether the species that were being tried out were appropriate. It was during this process of discussions that the mass awareness strategy evolved (see Section 5).

Eighteen months after the group members planted their fuelwood trees, harvesting became widespread. A sample of 109 farms (20% of the group members) was surveyed to ascertain harvesting practices and tree regeneration. The same sample has been followed up several times in periodic monitoring, and some of the sample farms have been visited regularly for discussion purposes.

### 5. MASS AWARENESS EXTENSION STRATEGIES

The initial on-farm trials had served to start dialogue with the farming community, first on an individual farmer basis and then on a group basis. Information obtained at the farmer level was used to lead discussion at the group level. These efforts were geared toward understanding the community, analysing the fuelwood situation as perceived by the community, and stimulating the people to identify possible solutions to their fuelwood problems.

The extension strategy was based on the principles of self-development enshrined in the concept of people's participation in project design ('bottom-up approach'). First, it had to be established whether or not the people felt a genuine need, and if they were prepared to take some action toward meeting this need. Then goals had to be set and steps worked out toward achieving them. The next phase was implementing the plan of action which had been laid out.

### Docu-drama

Because of the underlying cultural issues with regard to gender rights to plant, manage and harvest trees, an awareness programme based on the concept of popular

theatre (drama) was developed. The drama was seen as an educational forum through which information obtained from the community could be fed back to them, like a mirror reflecting the existing fuelwood situation. The community could thus be sensitised to the fuelwood problem (helped to recognise that a problem exists, possibly stimulating discussion oriented to positive action), initially at community level and then filtering into the households.

Local talent was harnessed in the form of musicians, comedians and actors. The cast consisted of local people, who were perceived as having intimate knowledge and understanding of the social and cultural norms of their own community.

To facilitate spreading of the relatively new idea of cultivating trees specifically for fuelwood (albeit also with other end uses), KWDP developed a catchword in Kiswahili, the national language of Kenya: 'Moto Mwaka', which means 'firewood all year round'. The Moto Mwaka theme was prominently disseminated during the drama activities and is now a popular word in Kakamega.

Prior to the drama performances, KWDP packaged seed of the species that had been tested on farms, together with a pamphlet on simple on-farm nurseries and care of seedlings. As the farmers already had been establishing nurseries on their farms to regenerate other species, improvement of traditional nurseries was seen as an opening. The improved nurseries described in the pamphlet were still appropriately cheap in terms of material input. The initial testing of the drama at 14 different sites attracted over 16 000 people, of whom over 7000 were adults. The drama performances were supported by other mass media materials such as posters and comic strips.

A week later, follow-up meetings were held at the sites where the drama had been performed. These discussions attracted about 4000 adults, who then took some of the seed packages home. The follow-up discussions were supported with demonstrations of pre-treating seed, establishing improved on-farm nurseries and other useful techniques such as root pruning.

Armed with the encouraging outcome of the mass awareness programme, the KWDP then entered discussions with farmers, local leaders and other agencies about how the awareness programme could be widened to cover a larger group of people at the least possible cost.

### Rallies and school field days

When KWDP began its work in Kisii District, it had the advantage of prior experience with farm trials and the doc-drama in Kakamega. KWDP opted to try out a similar mass extension strategy in Kisii, but with different logistics. This resulted in rallies and school field days organised in conjunction with school administrators, headmasters, teachers, community leaders and schoolchildren. At both types of gatherings, songs, drama and speeches were used to pass on messages to the participants.

An impressive number of people attended the rallies. Small meetings were held for discussion purposes within one week after the rallies. At the end of these meetings, the participants were given a packet of seed and a nursery pamphlet. The school field days were held in schools, and seed was given after the songs, drama and extension messages.

Monitoring the impact of this extension strategy is ongoing. For the time being, the rally and school field day activities are to continue in Kisii, together with other strategies.

### **Films**

For purely logistical reasons, the drama is now being developed into a series of films. Monitoring of the docu-drama strategy revealed that 73% of those who took seed did establish improved on-farm nurseries; however, the rate of transplanting slowed down with time. Evidently, a booster activity is necessary to maintain interest and motivation.

In Kakamega, a total of five films have been planned. Two have already been produced and released; production of the third and fourth films is underway. The films are to be shown at the various sites at certain intervals so as to maintain farmers' interest in the tree-planting activities.

Film 1 serves the function of sensitising the community to the prevailing fuelwood situation and, hopefully, stimulates dialogue. The film is shown approximately one month before the long rains.

Film 2 is shown one or two weeks after Film 1 and serves to promote interest and to assist in situation analysis and decision-making by the individual as to whether or not to participate in tree-raising activities to try to solve the fuelwood problem. The film incorporates some technical information on nurseries. Seed and a nursery pamphlet are made available to those individuals who show keen interest after the film show.

Film 3, to be shown about two months after the onset of the long rains, aims to 'remind' the farmer to plant out the seedlings. Possible planting sites for fuelwood species and possible spacing within the different configurations are indicated. Technical information is given about the advantages of the different configurations and spacings. Other related benefits are also shown, e.g. soil fertility improvement of the leguminous woody species, advantages for soil conservation in relation to tree planting on terraces, tree planting in cropland. A tree management manual will be given after the film show.

Film 4 is to focus more on tree management for different end uses, e.g. fodder, fuelwood, soil conservation. This film is to be shown six to eight months after the third film. Film 5 is to focus more on fuelwood consumption, storage and conservation. The details are yet to be worked out, but the film is to be shown four months after Film 4.

The films are all developed along the lines of doc-drama woven around a Moto Mwaka village. Local actors, comedians and musicians are used to portray the messages, which ultimately strive to create an environment in favour of a particular course of action. Deliberate efforts are made to avoid boredom so as to maintain interest. Efforts are also made to avoid creating distrust. Information is disseminated from farmer to farmer within the 'village', with the village elder being involved as a

figure of strength and wisdom. No direct involvement of KWDP staff in the information process is portrayed. Efforts are geared toward creating self-sustaining systems in the long run, based on an already existing infrastructure. For instance, local tree-seedling vendors with proven experience in tree-raising are shown playing a key role in the process of knowledge dissemination and utilisation across the village. The village elder is also seen to play a key role in sensitising the villagers to the changing situation that calls for new lines of thinking.

Farmers are in the forefront, explaining to interested neighbours how they have improved their situation by planting fuelwood species. Women are assisted by the husband, who either plants the trees or allows the wife to plant the trees, and can now 'show off' their well-stocked fuelwood stores.

Future plans have a training component aimed at interesting staff of other agencies working in the same area in the tree-planting activities, with the ultimate aim of cooperating with them in disseminating the knowledge through more widespread use of the films.

### 6. OBSERVED CONSTRAINTS

Thus far, KWDP has observed the following constraints to promoting the cultivation of fuelwood species, constraints which have to be taken into consideration when contemplating such programmes:

- Land tenure issues. Free flow of information may be limited where the relationship between land tenure and trees are strong. Farmers become highly suspicious of any tree-based activities, as they may be seen as a direct threat to their landholding rights.
- Frequency of farm visits. As frequent visits disrupt the normal routine of farm
  activities, there is a limit to the frequency with which detailed measurements and
  observations can be made. KWDP dealt with this problem by establishing Seed
  Production Units which doubled for demonstration plots and allowed for frequent
  and controlled monitoring.
- Conflicting messages emanating from different agencies. During our activities with the farmers, a few (especially those farmers who had planted trees on cropland) were advised to uproot the trees by agricultural extensionists, for fear that the trees could reduce crop yield or increase the incidence of insects or diseases (trees could provide a secondary host). As these fears are justified, there is a need for appropriate inter-agency linkages to provide a forum for exchanging experiences gained. This will help avoid conflicting messages to the farmer during the experimentation stages.
- Legal implications. Where land has been successfully adjudicated, the planting of
  specific tree/shrub species serves to mark the legal boundaries of each
  landholding. This legal provision may negatively influence the planting of trees
  within hedges, and these may be sources of dispute between neighbouring farmers.

Pest and disease control. In view of the adverse residual effects on human health of
most chemicals for controlling pests and diseases, KWDP does not encourage the
use of such chemicals. This is seen to conflict with conventional agricultural
recommendations to apply certain chemical-based pest and disease control
measures. KWDP advocates the use of traditional practices known to be effective.

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### TOWARD SELF-EXPERIMENTING VILLAGE GROUPS

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At the Langbesi Agricultural Station in Northern Ghana, a participatory extension method was devised. This is based on the creation of farmer groups which are encouraged to develop their own experiments in order to find locally appropriate solutions to their farming problems. Here, the extension method is outlined and examples of farmers' experiments are given.

### 1. INTRODUCTION

The extension method described here is designed to deal with village problems related to agriculture and to look for technical solutions which are socially and economically acceptable by the village and are geared toward a sustainable farming system. Stimulating the formation of village groups and training in the process of developing appropriate technologies are the initial steps. The idea is that the groups will ultimately be able to identify village problems, conduct simple experiments to test possible solutions and evaluate the results on their own. The role of the extension staff is one of stimulating thought, providing ideas for possible new technologies and gathering feedback to the project or research institute. The expected information flow is summarised in Figure 1.

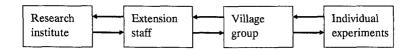


Figure 1: Information flows in a situation with self-experimenting village groups

### 2. THE PROJECT AND ITS SETTING

This method was developed in 1985 at the Langbesi Agricultural Station, after the 'contact farmer' approach, which had been used since the start of the project in 1971, was found to be ineffective. The project is located in the Northern Region of Ghana, in the zone known as the Guinea Savanna. The climate is characterised by one rainy

season from May to October, with an average annual rainfall of 900 mm. The soil is generally poor. The average area farmed per family is 1.5 ha, with a wide range between families. At least 90% of the farming population is engaged in subsistence agriculture.

In general, each family has two types of farms, the compound farm close to the house, usually smaller than 0.5 ha, and the bush farm 3-7 km away from the house. The bush farm is the main part of the total cropped area. The compound farm is permanently cropped with early-maturing grains such as millet and maize, and is fertilised with animal manure and house refuse. The bush farm is gradually changing from a bush-fallow system to a permanent cropping system. Here, fertiliser is applied on a very limited scale. Maize-based cropping systems predominate. Other crops are sorghum, millet, groundnut, bambara bean, various local beans and okra.

### 3. DESCRIPTION OF THE EXTENSION METHOD

In 1986 the project started to involve eight village groups in the development of an extension programme. It was planned to start working with an additional four groups each year thereafter. The first eight groups had already been formed the year before by contact farmers, as discussion forums on village problems and around one or two agricultural activities (village store, grain storage). The extension staff later stimulated more villagers to join the groups, and many from outside the 'circle' around the contact farmer became group members.

The average group size at the beginning of 1986 was 25 people. In total, 25 women participated, distributed over five groups. During group discussions (Step 2 in the framework of the method shown in Table 1), a wide range of village problems were mentioned, but most of them could be related to declining soil fertility. Therefore, the extension staff focused in the first year on crop and soil improvements.

The project staff gathered information from various sources: the National Agricultural Experiment Station (NAES) in Nyankpala, Ghana; the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in Ouagadougou, Burkina Faso; and the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria.

In group discussions, the extensionists tried to identify local ideas for improvements and already existing successful technologies geared toward sustainable forms of agriculture. They asked general questions (What are you doing at this moment to improve your soil?) and questions about their specific observations (Why are you growing pigeon pea in and around the maize/millet field?).

The groups' comments and ideas, the information from research institutes and the experience of the extension staff were combined and 'translated' into a number of simple on-farm experiments (Step 4). For example, in two groups, some farmers grew pigeon pea and commented that they liked the peas because of the time of harvesting (middle of the dry season). They had also observed that the following maize crop did very well on places were pigeon pea had grown. The project staff was

informed by NAES that high pigeon pea densities did not affect the cereal crop. On the basis of this information, an experiment was designed by the project staff.

Before discussing the experiments, a training session with the village groups was organised focusing on the idea of self-experimenting. A slide show entitled 'How to test new ideas' (World Neighbors, location North Togo) was used to start group discussion.

In Step 6 the groups discussed, adjusted and selected a number of experiments. Most of the adjustments were made in planting time, planting distances and choices of varieties. Each group was to select only four experiments, since we anticipated much extension staff involvement in the first year.

We advised the groups to choose individual group members to conduct the experiments, because group farms are not very common in the area. The project developed drawings trying to visualise some of the innovations. The management of the experiments was in the hands of the chosen group members, under supervision of an extension agent.

The extensionist visited the plot once every two weeks. He kept records of his and the farmer's observations during the growing season. During a field day organised in the growing season, the group members visited the various experiments in their group. After an experimenter had harvested, the extensionist came to measure the vield.

All the data from the experiments were gathered and statistically analysed by the project leader and the extension supervisor. Also the observations in the record books were analysed and summarised. The next step in assessing results was the evaluation meeting in the group, where the experiments and their results were intensively discussed. The experimenter was given the opportunity to express his view. The other group members then gave their comments and the whole group discussed the possibilities of practising the innovation and ideas for next year's experiments.

The extensionist took minutes of the meeting. Afterwards, the extension staff gave two group scores for each experiment: a score ranging from 1 to 5 for performance of the innovation (1 = poor, 5 = good) and a score for interest in practising the innovation or trying it again (1 = little interest, 5 = much interest). These scores, together with the minutes of the meeting, gave much additional information, e.g. about aspects other than yield which were valued by the farmers (see assessment of groundnut variety experiment in following section). Using the evaluation results, all eight groups planned new experiments.

Table 1: Framework of the extension method

Step	Actors	How	Output
1. Group formation	Extension staff	Agric.activity/ discussion forum	Village group interested in changes
2. Problem identification	ext. staff & village group	Group discussion	Awareness of problems and relations; priority list of village problems
3. Inventory technology	a. Project leader & ext. supervisor	Visits to research institutes	List of available technologies
	b. Ext. staff & village group	Group discussion	Village observa- tions, experiences and ideas
4. Design of experiments	Ext. staff & supervisor & project leader	Combine 3a & 3b in simple experiments	List of simple experiments
5. Training in conducting experiments	Ext. staff	Group discussion with visual aids	Village group knows how to test new ideas
6. Choice and adjustment of experiments	Village group	Group discussion (visual aids)	Experiment agenda for all groups
7. Management experiments	Individual members of village group & ext. staff	Experiment book kept by ext. staff	Experiments all over area in numerous replications

Table 1: Continued

Step	Actors	How	Output
8. Assessment results	a. Village group	<ol> <li>Yield &amp; observation ind. member</li> <li>Observation at field day</li> <li>Evaluation meeting</li> </ol>	Group score on tested innovations
	b. Ext. staff & supervisor	Statistical analysis of measurements	Statistical results
		2. Combining observations	Score for all groups
9. Embedding the technologies	a. Village group	New experiments	Skill in developing technologies
	b. Ext. staff	Training & information	Skill in developing technologies
	c. Project staff and village group	Input supply through village stores	Inputs for new technologies available

### 4. EXAMPLES OF EXPERIMENTS AND THEIR RESULTS

### Paired rows of groundnuts and maize/millet

In the existing farming system, sole groundnuts and cereals (either sole or in a mixture) are grown separately on the bush farms. Often, cereals are grown on a plot for a number of years before groundnuts are grown. Since cereal yields on the bush farms are declining, the project tries to encourage incorporation of more leguminous crops into the cropping scheme of the bush farms. In trials with NAES, farmers had positive experiences with a cropping scheme in which two rows of groundnuts are alternated with two rows of maize and millet intercropped in the same row.

The purpose of the experiment was to compare the current cropping scheme with one in which cereals and groundnuts are intercropped. It was anticipated that the groundnuts would have a positive effect on the cereals (nitrogen fixation), that no

competition for light would occur, and that paired rows would be easier to weed. In all eight village groups, this experiment was carried out on a 20 m x 20 m plot. Local millet and the maize variety LaPosta were planted at a distance of 70 cm x 60 cm x 2/10 seeds. The groundnut variety Chinese was planted at 70 cm x 15 cm x 1 seed. The cereals were fertilised at the recommended rates: 65 kg N, 37 kg P and 37 kg K per ha.

Table 2: Yield of paired rows of groundnuts and maize/millet compared with existing system of growing groundnuts and cereals separately (average of 8 experiments)

System	Maize kg/ha	Millet kg/ha	Groundnuts kg/ha *
Existing	1580	10	990
Paired rows	1455	23	895
LSD 5%	NS	NS	NS

<sup>\*</sup> unshelled NS = not significant

LSD = least significant difference

No significant difference between the two cropping schemes could be found. None of the groups mentioned any advantage of weeding in the new cropping scheme. Only after the next growing season can a complete comparison be made, when the cereals and groundnuts are rotated on half of the plot.

### **Groundnut-cereals rotation**

In a number of village groups, no planned crop rotation was practised. Other groups were aware that crop rotation increases yield, but had no idea of the extent of the effect. All groups were interested in comparing groundnuts with cereals as a crop to precede maize.

A plot of 20 m x 20 m was planted with maize (Composite 'W') in eight villages (planting distance 70 cm x 40 cm x 2 seeds). On half of the plot, groundnuts had been grown the previous year; on the other half, maize, millet, sorghum or a mixture of these. Fertiliser application was the same as in the previous experiment. The groundnut vines were not returned to the field.

Table 3: Maize yield with groundnut and cereal (maize, millet or sorghum) as preceding crop (average of 8 experiments)

Preceding crop	Maize kg/ha	
Cereal	1305	
Groundnut	1670	
LSD 5%	350	
CV (coefficient of variation)	20%	

At the 5%-level, a significant positive effect on the maize yield was found with groundnuts as preceding crop.

## Intercropping maize and pigeon pea

In two village groups, farmers already grew pigeon pea (Cajanus cajan) intercropped with maize or as border rows around their farms. They had noticed a positive effect on cereal grown after pigeon pea. In order to increase this effect, the project proposed increasing the plant density of the pigeon pea in the cereal. The objective of the experiment was to find out whether maize yield is negatively affected by increased pigeon pea population and to observe pigeon pea yield. It was assumed the maize would not be affected because the pigeon pea matures very late.

Eight experiments were carried out on plots of 20 m x 20 m. Maize (Composite '4') was planted at 70 cm x 40 cm x 2 seeds. On half of the plot, pigeon pea was planted at the same time, at the side of every second ridge (140 cm x 100 cm x 2 seeds). Fertiliser was applied at a rate of 30 kg N, 18 kg P and 18 kg K per ha.

Table 4: Maize yield sole and intercropped with pigeon pea (average of 8 experiments)

Cropping system	Maize kg/ha	Pigeon pea kg/ha	
Sole maize	1,500	-	
Maize/pigeon pea	1,425	47	
LSD 5%	NS	(not significant)	

No significant difference was found between the maize with and without pigeon pea. It can be concluded that the maize yield was not affected by the pigeon pea. The yield of the pigeon pea was very low, mainly because cattle entered some of the

farms before the peas could be harvested. The effect of the pigeon pea on next year's crop cannot be evaluated at this time.

### New groundnut variety

Farmers participating in on-farm experiments of NAES in a nearby area were enthusiastic about a new groundnut variety called Fmix. The village groups were interested in trying the variety. Fmix matures in four months, while the most commonly grown variety Chinese takes three months to mature. The experiment was carried out in four village groups. A  $20 \text{ m} \times 20 \text{ m}$  plot was divided in two to compare the varieties. The spacing was  $70 \text{ cm} \times 15 \text{ cm}$ 

Table 5: Yield of Fmix compared to yield of Chinese groundnut variety (average of 4 experiments)

Variety	Groundnut kg/ha (unshelled)
Chinese	925
Fmix	945
LSD 5%	NS

The germination of Fmix was poor and many young plants died, resulting in a lower plant population than of Chinese (38 000 versus 45 000 plants/ha). However, this was compensated by a higher yield per plant of Fmix. Overall, no significant difference in yield per ha between the two varieties was found.

### Soybean

In northern Togo, women grow black soybeans and use them to produce a protein-rich 'local maggi' comparable to the protein-rich fermented product of the dawadawa seeds of the *dorawa* tree (*Parkia biglobosa*). Women in the village groups in northern Ghana were very interested, especially because the *dorawa* trees are getting scarce. In some village groups, the use of white soybeans in local dishes was known, as soybeans had been distributed in food-aid programmes several years ago.

The project was eager to introduce soybean to women because of the following advantages:

- the high yield potential without any inputs of chemical fertiliser and insecticides;
- soybeans are relatively free of diseases and pests as compared with cowpeas and other beans;
- soybean is a nitrogen-fixing legume which can contribute to improving soil fertility;
- a short-cycle variety (90 days) is available which is relatively resistant to drought;

 soybean has the highest concentration of high-quality protein of any food crop (40% protein).

Four women grew the black soybean on a plot of  $10 \text{ m} \times 10 \text{ m}$  (spacing  $70 \text{ cm} \times 10 \text{ cm} \times 2 \text{ seeds}$ ). No fertilisers or insecticides were applied.

The average yield of the four plots was 820 kg/ha. In 1985, a common short-maturing cowpea (Sumbrizie) yielded 890 kg/ha at the experimental farm at Nyankpala, but with an application of 50 kg P<sub>2</sub>0<sub>5</sub>/ha and 3 sprayings (NAES Report 1985/1986). In the dry season, a soybean utilisation course was organised, in collaboration with World Neighbors, to train the women in the various uses of black and white soybeans in local dishes.

## **Evaluation meetings**

A total of 153 people, including 21 women, attended the evaluation meetings in the eight village groups. In general, the reactions to the extension method making use of on-farm experiments were positive. In three village groups, members had not been able to visit experimental plots of their fellow members. Five groups held meetings on a more or less regular basis without the presence of the extension agent. Using the minutes of the evaluation meetings, scores were given to summarise the viewpoints of the groups on the five innovations.

Each group was given two scores on each innovation: one for performance of the innovation and one for interest in practising it or trying it out again (see Table 6).

Table 6: Evaluation of innovations according to village group scores (average of 8 groups)

Innovation	Performance of innovation *	Interest to practise or try again
Paired rows	3.5	3.5
Rotation	4.5	3.8 **
Maize/pigeon pea	2.9	3.4
Fmix ***	4.5	4.8
Soybean ***	3.0	4.8

<sup>\* 1 =</sup> poor; 5 = good

The scores of the paired rows are not high. There was obviously no yield advantage and labour reduction (weeding) was not mentioned. It seems the groups prefer growing groundnuts in a sole stand and practise rotation (scores for rotation are higher). In three groups, the farmers suggested returning the groundnut vines to the land and spreading them. At present, the seeds are picked under a tree and the

<sup>\*\*</sup> average of six groups (two groups already practise it)

<sup>\*\*\*</sup> average of four groups

residues are left there or are collected to serve as animal feed in the dry season.

The performance score of maize/pigeon pea is low, mainly because the pigeon pea yield was low. Reasons mentioned were late planting of the pigeon pea, shading of the maize and destruction by cattle. In a few cases, farmers reported lower maize yields due to shading by the pigeon pea. However, all the groups wanted to try this idea again with the short-cycle maize (Safita-2) which they had seen on the project's experimental farm. They were convinced about the positive effects of pigeon pea on soil fertility.

The performance score of Fmix is high, although no significant yield advantage over Chinese was observed. Farmers noted many pods per plant and admired the size of the seeds. They also very much liked the fact that no premature sprouting of seeds occurs with Fmix.

The performance score of soybean is low, mainly because of problems with the timing of harvest (scattering of seeds when the pods are dry). The women commented that, because they were not aware, some of them harvested too late. The score for interest to try again is very high. (The score was given before the women participated in the soybean utilisation course.) The advantages mentioned were:

- · easier processing of 'local maggi' compared to dawadawa seeds,
- cash income can be generated through the sale of beans.

Members of six groups visited the project's experimental farm. All of them expressed much interest in the short-cycle white maize (Safita-2) and the red sorghum (Framida).

#### 5. DISCUSSION

Although the experience of the first two years with this method were very positive, there are many reservations as to whether the ultimate aim of self-experimenting groups can be achieved. In rural West Africa, the level of education, degree of organisation and general infrastructure are very low, and this will certainly hinder the establishment of such groups. More structured training toward a self-experimenting group character will be necessary.

In the first two years, the method is labour intensive (high degree of extension involvement) and it is doubtful whether this intensity can be substantially reduced in the third or fourth year (as planned) without affecting the output. Therefore, it is very difficult at this moment to determine the cost effectiveness of this extension method.

It is essential to work with low-cost innovations, very close to the existing farming system. Otherwise, no effective participation can be realised. The extension staff plays a vital role in starting the process of valuing and detecting indigenous knowledge and - where necessary - altering existing techniques step by step. This requires staff capable of enabling farmers to find their own way by helping them clarify their goals and the possibilities they have to realise them ('animation').

However, most education in West Africa leads to a 'teacher attitude' of

extensionists toward farmers. Therefore, much in-service training of the extension staff is necessary.

The project staff had the impression that the most common socioeconomic groups were represented in the village groups. It was obvious, however, that the groups were dominated by local leaders and innovators. In most cases, they were the ones conducting the experiments. Nevertheless, since the planning and evaluation is done in a group and the innovations do not require high investments, the innovations are within reach and applicable for all group members. Unfortunately, no figures are available yet on adoption rates of the developed and tested innovations.

The method of summarising the group comments into a score on the basis of minutes from meetings needs improvement, as it gives too much weight to the opinion of the leaders and includes a bias of the extension staff. Some kind of individual scoring might give better results, but will be more labour intensive.

In the development of new technologies, equal attention should be given to short-term productivity improvements and achieving a sustainable farming system in the long term. The first aspect is necessary to get farmers interested and to maintain their active participation. In many cases, these criteria need not be in contradiction and a technology can be developed which has positive effects in both the short and the long term.

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## FARMER-BASED RESEARCH AND EXTENSION IN ZIMBABWE

## Phiri Maseko, Ian Scoones and Ken Wilson

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Zvishavane lies in a semiarid area of Zimbabwe, receiving about 500 mm annual rainfall. Here, conventional development has largely ignored small patches of natural wetland, but local farmers have identified these resources as critically important. A process of farmer-based research within the Zvishavane Water Resources Project (ZWRP), an indigenous nongovernmental organisation (NGO), has generated strategies for improving the productivity and sustainability of these wetlands. Together with local farmer groups and village committees, community workers conduct research and plan and implement projects. This article describes how the project evolved and discusses the perspectives.

#### How it all started

For their doctoral research, the British students Ian Scoones and Ken Wilson studied the ecology of the production systems of Zvishavane. Long-term rural residence gave the opportunity for informal discussion and observation. There was no external requirement for the research to come up with any particular development proposal. This open-endedness allowed research to be directed along lines identified by farmers.

Individual interviews with farmers in their fields and at their homes provided the best framework for enabling an understanding of the basic issues. It was necessary to understand farmer terminology and local environmental classifications before dialogue could be properly started. Farmers pointed out that there were different kinds of environments in the region, with different ecologies. This was an essential component for recognising the different kinds of development initiatives that could work in different places. Similarly, it was necessary to tap indigenous knowledge about the problems of farming before subtle statements about relative costs and benefits could be understood in a development context. The long period of rural residence and practical experience of working alongside farmers was necessary to limit the imposition of 'outsider' perceptions.

Within this framework, a series of group meetings could be initiated. Farmers who attended were those who themselves wanted to develop wetland areas. The main aims of these meetings were to provide a space for articulation of local knowledge, and to translate this into practical measures. At these meetings, a series of issues critical to wetland development were discussed, such as soils, hydrology, cropping systems, competition and integration with grazing.

A group of local people became involved in these regular research meetings. Phiri Maseko (now project coordinator of ZWRP) was one of them. He had been experimenting for many years with micro-irrigation development on wetlands and had developed skill in constructing wells and small dams.

## Historical dynamics of land use and colonial law

Although it is now well recognised that African farming systems are dynamic, little consideration has been given by policy makers to patterns of change. The dominant thinking behind policy in Zimbabwe has been to reinforce a supposed trend of intensification of land use. It was assumed that shifting cultivation had been the precolonial method and, hence, putting fertility inputs into uplands was the only method of sustaining production under today's population pressure. This has presented a dilemma for policy makers, as fertiliser use in such dry areas is barely economic and cattle populations cannot be kept high enough to provide sufficient manure.

However, during the research discussions, farmers presented a wider scenario. They knew that an intensive system of wetland farming was dominant in the precolonial era. This system had largely been abandoned in the colonial period due to a variety of factors. One factor was the opportunity provided by the arrival of ox-drawn ploughs. This made the returns on the labour of opening large upland fields much more attractive than they had been when digging by hand was involved. Farmers thus shifted more of their attention to such places, and farmed more extensively.

A second factor was the growth in population in African areas, which at that time was mainly as a result of immigration of people expelled from neighbouring farms alienated for white settlers. Wetland farming alone could not cope with this increased population, without increasing in productivity more markedly than was possible or desirable at that time.

A third component was an enhanced ability of the population to weather the increased variability in food supply consequent on upland farming. This resilience was largely due to increases in livestock holdings, which could be traded during food short-fall. It also reflected access to urban wage-labour.

Administrative banning of wetland farming was linked to environmental concerns (especially in regard to settlers' drainage techniques). Yet, in practice, the ban also reflected the need to limit Africans' production to ensure white farmers' economic survival. This has been shown conclusively for winter wheat in the 1940s, but possibly also involved other crops such as maize, rice and vegetables on a more local basis.

With today's increasing land-use pressure, farmers recognise that intensification is necessary, but is only really viable on such wetlands. This is because only with sufficient water can returns on inputs be realised. Furthermore, in this dry region where the sandy uplands cannot be continuously farmed without great fertility interventions, these wet bottomlands maintain productivity on account of their

higher clay contents and (perhaps) nutrient inflows.

An understanding of historical dynamics thus led to a different conceptualisation of the problem and, hence, identification of different development opportunities. Had the students relied on secondary source material, they would not have understood this historical process. Unstructured key informant interviews were an effective method for investigating historical dynamics. However, casual interviews would almost always pick up the 'official' version of history as taught in schools and by demonstrators. The illegalisation of wetland farming had reinforced this. Once the system had been understood from a local perspective, archival and other material could be comprehended in a new light.

#### Phiri Maseko's farm

For many years, Phiri Maseko, who joined the research team in mid-1986, had been experimenting with the development of a patch of wetland within his 4-ha plot. Because of his nationalist politics during the Smith regime, he was denied work. He was determined to develop his plot of land so as to support his family. He made a number of discoveries about how to manage this land by controlling the hydrology. This involved him in a long battle with conservation officers, and he went to jail three times. However, eventually they had to concede that he had achieved a system that effectively conserved the land as well as greatly raising its productivity.

The main advantage with farming the wetlands in this area is that they stabilise production through maintaining more constant water availability. This enables successful farming during dry years and in the dry season. Also, they are usually clay-rich and the soils tend to have higher organic matter than the sandy uplands. However, there are also problems. Under heavy rains, they become very wet, making land preparation difficult. Water logging can damage crops and soil fertility and, occasionally, surface flows result in soil erosion.

A 30 x 15 m pond was dug on the upper margin of the wetland, where water naturally seeps out of the ground on encountering layers of clay. This pond captures water from heavy rains, preventing it being lost from the system and storing it for future use. Concurrently, the damaging effects of surplus water in the fields are prevented. Together with a series of wells, water is then circulated within the wetland to achieve supplementary irrigation, both during dry spells in the rainy season and also during the dry season. A third component of managing hydrology was the careful identification of areas where water would flow during exceptional thunderstorms, and turning them over to Kikuyu grass.

With this water supply, Phiri Maseko developed an intensive integrated system. Banana groves were established below the dam in areas often too wet for cultivation. Within these, bees are kept. Fish are farmed in the pond, and reeds suitable for basket-making are grown for sale. Several hundred fruit trees, especially citrus and mango, are planted within and around the fields, where they make use of the water supply and provide a valuable cash income as well as a food crop. A very diverse

cropping system is possible, with all the major cereals, including rice, grown intercropped with legumes. Vegetables are also grown, especially during the dry season. The cattle are maintained on abundant crop residues, banana leaves and grass cuttings.

The management of water in this semiarid area thus allows for a level of intensification which improves the economic position of the dryland farms and minimises risks. Other farmers in this area are forced to rely on large harvests in the few good rainfall years, eking out on storage and remittances from towns in the intervening years.

#### Participatory research and extension

Farmer groups are invited to visit and investigate this farm. Their excitement with what they see is rooted in their own awareness of the historical significance of wetland use. Many of the farmers have themselves wanted to make similar kinds of innovations but have felt constrained by the law. The direction in group meeting methodology is toward developing with the farmers an understanding of the hydrology and soils of particular wetlands within that area. A model is thus developed for discussing potential land-use innovations. This provides baseline agreement of the issues and options for specific extension at local sites.

Working in groups enables cross-checking of information and ideas. Farmers often dispute issues with each other, and this deepens their understanding of the complexity of the system. Farmer knowledge, like science, includes disagreement, debate and uncertainty. Farmers enjoy these meetings, as they learn from each other and gain confidence in their own abilities.

The research meetings play several interacting roles. They indicate new development options, provide local knowledge, stimulate farmers to implement own projects and promote diffusion of the ideas. The development options are matched to local situations. A uniform package for water development will not work, especially in a variable and patchy environment. But, most importantly, the process of involving farmers and establishing a local research and extension capacity leads to the empowerment of the local communities. Farmer-based research should not be used simply for more effective extraction of knowledge, which then forms the basis for typical 'top-down' development. Research should be seen as an opportunity for devolving power and establishing local capability for development.

## Institutionalising the farmer research-extension link

Out of the open-ended informal research meetings, the need evolved to start a project (ZWRP) to support this process of technology development and adaptive implementation by farmers for which it was necessary to apply for legal exemption orders.

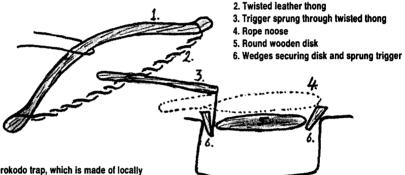
Initially the two students were involved in launching the project and supporting it administratively, but now it is run by local people. Considerable attention has been paid to keeping the project immediately accountable to the villages served. Staff are all local farmers, apart from the administrative assistant, who has a formal education.

The Zimbabwe Government is creating a devolved capacity for development through the village and ward development committees (VIDCOs and WARDCOs). Within this framework, the role of government extension workers and NGOs is to facilitate local initiatives. The project is involved in training VIDCO community workers in technical and organisational aspects of village-level water development and the establishment of farmer groups for exploring the possibilities of wetland development. The challenge remains to improve the project's capacity to enhance the ability of people at village level to research and critically analyse the local situation, then plan and effectively implement their own projects. These include the construction of wells, small dams, micro-irrigation systems, water harvesting and erosion control measures. The participatory research techniques developed will be the focus for this continuing training and empowerment process.

#### Lessons learnt

This description of the early phases of the Zvishavane Water Resources Project is not supposed to be a blueprint; all situations require different responses. However, a number of lessons have been learnt:

- There is the need for money to be made available for 'bottom-up' research with farmers, without the constraints of a particular project objective. This is rarely acknowledged by donor agencies.
- It is often the case that local farmers have already identified 'development windows'. These may be hidden from conventional project identification surveys. A little support for an existing trend or innovation may have a greater and more positive impact than the establishment of a full project 'package' from scratch.
- Involving local people in the research process provides a basis for creating local capacity for organising and managing a project, if it arises.
- Establishing an authentic, critical research process for identification of development opportunities will enhance the ability of the local community to reflect and act on their development needs. Having a local research capacity also ensures that the project responds adaptively to local requirements.



1. Naturally curving bow of hardwood

The Morokodo trap, which is made of locally available but termite-susceptible materials, is set on a game track. A mixture made from the bulb and fruit of the girizo tree is used to protect the trap from termites. A small hole is dug for the trap and camouflaged with soil and leaves. If an animal steps through the noose, it also steps on the wooden disk which sets off the trigger tightening the noose. Drawing: Roger Sharland.

# A TRAP, A FISH POISON AND CULTURALLY SIGNIFICANT PEST CONTROL

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In Southern Sudan, indigenous techniques used in hunting and fishing have been applied to stop termites from eating young fruit trees. Roger Sharland, who worked for many years with the Moru people, gives an example of how knowledge rooted in local culture can be adapted to solve new problems with new crops.

A major part of my work with the Moru and their neighbours, the Morokodo, in Muncri District was encouraging them to plant citrus trees, at first for their own use and later, when the trees yielded more, for income from the surplus. The area is marginal for citrus growing, as it has a long dry season. But the farmers had already seen the value of citrus, so they were willing to look after the trees.

Trees weakened by water stress in the dry season were easily attacked and killed by termites. The first response to this problem was to import Dieldrin, which effectively controlled the termites but raised new problems. As it is not locally available, its use leads to dependency. As the farmers are not accustomed to using chemicals and measuring precisely, there was much misuse of Dieldrin.

## Looking at local pest control

As using Dieldrin was obviously not a sustainable solution to the termite problem, I started to investigate how the local people traditionally control pests. I found many cultural techniques for preventing pest build-up but, except wood ash, no example of using local preparations on crops. There were, however, several examples of poisons being used for fishing and hunting. Some of these appeared suitable to adapt for use in farming.

One of the most promising of these was actually used by the Morokodo to control termites. The Morokodo make a technically fairly sophisticated type of spring trap to catch game. It is made from a wooden bow sprung with a piece of hide, and has numerous wooden and leather parts which are vulnerable to termite damage. The Morokodo have developed a mixture to repel termites, using a bulb they call boro and the fruit of the tree Catunaregan spinosa, called girizo in Morokodo and terinje in Moru. The bulb and fruit are pounded together with water into a concentrated pulp and poured over the traps.

The Moru do not have the same kind of traps as the Morokodo, so they do not know about the use of boro and terinie against termites. But they are familiar with

both plants as fish poisons, which are used to stun fish in pools and slow-moving streams. The Moru therefore know where to find these plants, and how to collect and prepare them.

## Old solution for new problem

Having 'discovered' this local preparation, we tried it on some trees in our fruit tree nursery to see whether it could be used to control the termites there. The termite species that attack living trees differ from those that attack dead wood, so it was important to find out if the preparation was effective against all types of termites. We also had to investigate whether the preparation had any damaging effect on living trees.

Some of our senior staff, who were familiar with using the preparation for traps, made the same mixture and poured it around the foot of randomly selected trees in the early dry season. Elsewhere in the nursery, other trees showing signs of termite attack were treated later in the dry season. The preparation proved to be very successful in both preventing and curing the termite attacks and, thus, helping the trees survive the dry season.

Since it is when the trees are weakened by water stress that they are most vulnerable to termites, the need for pest control is seasonal. Catunaregan spinosa forms fruit in the dry season, when it is most needed. Also at this time, there are no heavy rains which could wash the mixture away from the tree base. If a young tree is treated for the first couple of years, it is then normally strong enough to resist the termites.

## How strong should the dose be?

Having seen that the preparation was effective, we planned to continue experiments with methods more acceptable to formal science. We wanted to determine the optimum dosage so that we could give precise recommendations to farmers. However, as the civil war in Southern Sudan escalated, the experiments in the nursery had to be abandoned before completion. All we can say is that the concentrations used do not seem to make much difference: the local practice for the traps varies considerably with equal effect. Presumably, lower doses than those now being used would also be effective but, since the active ingredients are free and readily available when required, there is no urgent need to use lower doses.

The lack of a precise dosage was, to some degree, fortuitous as it led to further thought about using the mixture within the local cultural context. The farmers, who are also the hunters and trappers, do not use measurements in any of these practices. They evaluate in ways culturally very different from those of formal science, but equally valid for their purposes. They have finely tuned means of determining whether mixtures are right and which agricultural practices to apply. It was practising

farmers, i.e. those working in the nursery, who assessed the preparation as being effective against fruit tree termites. They then passed on this assessment via the extension network (also made up of practising traditional farmers) to other farmers.

One of the problems with using agrochemicals such as Dieldrin was that the measurement and precision needed was not within the farmers' experience. To introduce a locally-made insecticide based on the same premises of careful measurement would probably have made it another foreign concept, only relevant to those who had been to school, and would have raised the barriers to its acceptance.

## Culturally appropriate extension

The recommendation to the farmers that resulted was like this: 'Make a mixture of boro and terinje as you would prepare it to protect a game trap (for the Morokodo) or to use as a fish poison (for the Moru) and pour it over the base of the fruit trees in the first couple of dry seasons of the tree's life, to protect the tree from termites'. This was thus a recommendation firmly rooted in the indigenous knowledge of the people, but adapted for use in a different situation. It could be easily understood by the farmers, who recognised that the trees suffered in the dry season and, on closer inspection, could see the termite problem, for which they then had a remedy.

This is one of several examples of how indigenous knowledge can be used in agricultural development (Sharland 1989). A technology used by the Morokodo for termites and by the Moru themselves for a fish poison was applied to solve a new problem in a new crop. Within their farming culture, farmers throughout the world have ideas and practices which can be expanded and applied to a wider or different use.

My first objective was to find a way of preventing termites from eating fruit trees in the area where I was working. The technique is useful within that context, but is probably not well enough developed to extend to other areas, as our research facilities were limited and our 'scientific' culture requires more measurements. Our method of investigation, which relied heavily on indigenous knowledge, was valuable and quick in determining the local effectiveness of the product, but cannot give the precise information required for wider application. The important lesson is the value of applying local technologies in a way which suits the concepts of the local people, without worrying about Western measurements. These would have greatly slowed down the investigation and, in the midst of civil war, would have meant that an idea useful for the farmers might never have become available.

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## BEYOND THE PTD APPROACH

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Farmers' participation in rural development is, once again, a major issue in the development debate, considering the number of recent publications on so called Participatory Technology Development. Every development worker with his or her heart in the right place should be pleased to notice this increased attention. Yet, looking at our own field experiences, we feel there is something seriously lacking in the PTD approach (Haverkort et al. 1988) or Farmer Participatory Research (FPR, Farrington and Martin 1987).

We have been working for the last 4 years in an isolated mountainous area in the western part of the island of Sumba in eastern Indonesia. Together with the other staff of the Propelmas Rural Development Project, a small church-related NGO, we have been struggling to find ways to assist local farmers to improve their living conditions.

Reading the issue of ILEIA on PTD and thinking about applying this method within our own project, we face several questions. The major problem the new approaches try to solve is how to improve the effectiveness of agricultural research in meeting the needs of small, resource-poor farmers. But should not the central problem be how to improve the effectiveness of our efforts to improve these farmers' living conditions? Better research is only one part of this. The one-sided problem definition colours PTD as well as FPR and results in the strong technology orientation of both approaches. Why is it that we always think that other technology (either modern, appropriate, locally adapted or ecologically sound) is The Answer to the problems of small farmers? Social, political or economic constraints are frequently more limiting than technological constraints.

#### An example of the complexity of rural poverty

From our own 'resource-poor' environment we can give an example of the complexity of the obstacles facing small farmers. Propelmas tries to find ways to stimulate farmers' involvement in activities that will result in more food and/or income. One of these activities is growing green gram (*Phaseolus aureus*). Green gram is a crop that can be readily consumed or marketed. Farmers in this area enthusiastically join in this activity. They form small working groups, since they are used to cooperating for the purpose of cultivation. The farmers' groups provide a good basis for further organisation.

An evaluation of this activity makes many technical problems apparent. Yields of the new crop are quite low. Farmers cultivate green gram on steep hillsides and do not prepare the soil thoroughly before planting. According to their indigenous technical knowledge, these steep hills are the most suitable sites for green gram. If they plant in moist, relatively flat fields, the leaves grow abundantly but there are only few pods.

Further inquiry shows that there is another advantage for the farmers in cultivating green gram on these seemingly unsuitable sites. The crop grows on these sites with hardly any soil preparation, giving the farmers adequate results with very little labour input. This is very important, as labour is the most constraining factor during the season in which green gram is grown, as farmers are obliged to participate in traditional groups that cooperate in working the rice fields. An arrangement which was formerly part of a feudal system requires that the poorer farmers provide their labour to work the fields of farmers with more resources (cattle and land). Sanctions for not participating in this 'voluntary' provision of labour are to be found in the social, religious and political spheres, and would have serious consequences for one's daily living conditions (availability of food, protection, ceremonial and ritual services, help from others in non-agricultural activities).

If the PTD approach were applied in this case, would researchers only consider the factors of production and indigenous technical knowledge or would they also take into account the social background of the labour constraint?

This example illustrates the importance of analysing all aspects of farmers' reality when discussing poverty and ways to overcome it. Farmers' own knowledge is, we agree fully, the most important factor in studying this reality. But again, why limit ourselves to their technical knowledge, as seems to be done in the discussion on Indigenous Technical Knowledge (ITK)?

Within Propelmas, we do explicit research on indigenous ways of farmers' cooperation and organisation and on farmers' strategies to cope with food shortages. Through this research we try to gain a better understanding of how to help the farmers improve their living conditions. Perhaps in our project area the need for this type of research is greater than in other areas, where farmers work more independently and are more commercially oriented. But even then, there is more to indigenous knowledge than ITK suggests.

#### The necessity of conscientisation

It is already a long time ago that Paulo Freire spoke of the culture of silence. But until today the concept has not lost its relevance. Especially in isolated areas where local traditions are still very strong, the capacity of small farmers to analyse their situation critically and think of it objectively as something that can be altered through their own action, is very limited. Under these conditions a few visits by research scientists asking the farmers their major problems might not give the expected result. A precursor to any development activity is to bring farmers to a level of awareness and self-confidence which will facilitate active participation.

Apart from this aspect of effectiveness of our interventions, many NGOs, including ours, see it as one of their principal objectives to contribute to the building of awareness and self-confidence among small farmers as a prime prerequisite to a long-term development process.

## The need for community organisation

In the articles in the recent ILEIA Newsletter, little attention is paid to the need of small farmers' organisation, probably because the advocated approach to technology development sees the individual farmer as the major partner for discussion. Yet once the technology has been developed, how will farmers adopt it? Will the technology itself be convincing enough so that they will not need organisational support in applying it? Will the local political system not pull them back to the old ways? It is beyond the scope of this article to discuss the rationale of group formation or the building of local organisations (we can refer to an excellent discussion in Esman and Uphoff 1984). In our area, farmers' groups are useful for the following reasons:

- they enable effective communication between our project's very limited staff and a relatively large number of farmers;
- they help to better organise agricultural production, which is still largely being done in small neighborhood groups, and to coordinate it with other important activities such as house building and cultural ceremonies;
- they increase the opportunity for more equal participation of farmers in sharing ideas and inputs, rather than concentrating them in the hands of a few progressive farmers and/or feudal rulers; and
- they help build up negotiating power on behalf of the farmers in dealing with traders and the local government.

#### The institutional issue

An important issue referred to in the discussion on PTD as well as FPR is the relationship and the interaction between farmers, extensionists or facilitators, and researchers. The major line seems to be to increase direct contact between researchers and farmers, even to the extent that research scientists are supposed to have intensive problem-identifying discussions with farmers. We must question the replicability of such an approach in terms of sheer numbers. There are not even enough extension workers, let alone researchers, to interact closely with the farming community in developing countries.

In eastern Indonesia some of the most effective extension work is being done by a number of local NGOs. Problem-identifying, conscientisation and discussion on possible actions take place between NGO fieldstaff and farmers. During the last few years, the concept of a consultative service having close links with researchers and providing technical advice to local NGOs has been formulated and is now taking

shape in the form of a separate foundation. Researchers and scientists with a 'PTD attitude' have already been helping local NGOs by participating in field visits and farmers' discussions. But the area reached by the NGOs is limited, as is the number of researchers committed to village-level work. When it is already difficult to make local government extension staff aware of the necessity for a more farmer-oriented approach and to acknowledge that farmers can be sources of expertise, the task of converting research institute staff seems unachievable.

## Propelmas' approach

The criticisms of the PTD approach presented above are not derived from a theoretical analysis but rather are rooted in the experiences we have had (and the mistakes we have made) working on a small rural development project for several years. The project area of the Propelmas Rural Development Project is, by Indonesian standards, very sparsely populated, only 30 inhabitants/km². Nearly all its inhabitants are small, resource-poor farmers living at subsistence level. Maize, cassava and rice are the main food crops. Yields are low and external inputs are minimal: slash and burn cultivation is predominant. Soil fertility is declining because of decreasing fallow periods.

Government intervention in this area has been limited to some road construction, the building of a small village clinic (without staff) and schools, and tax collection. Money required for paying school fees and taxes has to be 'produced' on the farm; a portion of the yields of crops and livestock is sold on the local market where prices are extremely low. As is usual in such remote and isolated areas, local traditions are very strong and society organisation follows strict hierarchical, feudal lines. Strong dependency cycyrelationships with former feudal rulers limits the freedom of farmers to act to improve their living conditions.

In this difficult area the Propelmas Rural Development Project was set up by the Protestant Church of Sumba in 1976. Propelmas staff consists of six Indonesians assisted by two Dutch colleagues.

The strategy used by Propelmas differs from the PTD approach. Nevertheless, for purposes of comparison, we have attempted to describe our approach using the five-step model of PTD (Haverkort et al. 1988) as far as possible.

How to get started. Propelmas has been working in a small area in rural Sumba for more than 12 years. There has been a long process of trial and error to find an appropriate way to start activities in a new village. At present, when Propelmas assistance is requested by a local community, we start the process of cooperation between village and project by visiting the village to do a simple survey: what are the activities of the farmers, are farmers working together in groups, who are the official leaders, who are the informal leaders, what are the main problems according to the farmers, what are the sources of conflict? A questionnaire is used to collect the basic

data, whereas other information is gathered through informal interviews using a checklist.

From the result of the survey, we decide whether there is scope for a fruitful working relationship with the village or group and try to choose people who seem to be promising as key persons for activities. These key persons can be characterised as people who are able to coordinate a group of farmers, who are interested in development activities and seem to be honest in their intentions, not only hoping to gain personally from 'the rich project'.

Finding things to try. Together with these key persons, Propelmas tries to come into contact with a group or groups of farmers and asks them to call a formal meeting. Each group or groups may consist of 8-15 farmers, either all male or all female farmers. (From our experience, women farmers are much more active in development activities if they form their own groups.) If the farmer and their key persons are willing and able to organise such a meeting, Propelmas presents the results of the survey and explains its approach. The farmers explain how many people are interested in development activities and how they have organised small working groups. At the end of this meeting and based on the information available at that point, the farmers and the project choose an 'entry point' activity to start with. Our experience shows that it is more useful to start at a relatively early stage with a concrete activity, because this results in more and better information than what results from only discussing problems and possibilities with the farmers. A number of conditions has to be fulfilled to make an activity suitable as 'entry point'; the activity should:

- attract the attention of the poor farmers and respond more to their interests than to the interests of farmers with more resources;
- provide a first step to farmers' organisation;
- be relatively simple and should not require many inputs or knowledge from outside to be carried out;
- bring a quick result to those who participate;
- produce good possibilities for follow-up activities.

In our project area, growing green gram has proved to be a good entry-point activity.

Trying out. While carrying out this activity, we learn a great deal about the participants, their organisation and their problems and needs. There is an opportunity to discuss issues more informally with the farmers. The activity itself shows who is really interested and who is not. During the meetings of the groups that cooperate in growing green gram (for example), other activities can be planned. Several of these groups can meet together and form a larger organisation of farmers. The process of conscientisation is facilitated through meetings among farmers and between farmers and project staff, not as an exercise in itself but rather as an implicit component in all activities.

After the first entry-point activity, Propelmas staff makes an evaluation and

decides whether or not cooperation with a particular farmer group is to be continued. Important in this evaluation is whether there is a growing understanding and cooperation among farmers and between farmers and the project.

Sharing results. When cooperation between Propelmas and farmers groups is continued, other and more complex activities are carried out together. These may include activities outside agriculture, such as child health clinics and small courses on food preparation and preservation. When these activities include new technologies or otherwise require knowledge from outside, Propelmas staff itself teaches and capacitates as far as possible. If necessary, we try to find expertise from other sources. From the beginning, learning from each other is an important element in the relationship between farmers and project staff.

An important part of all teaching and capacitating work is discussion with regard to cooperation, leadership, joint decision-making and conscientisation. Most farmers are used to working together only in the traditional way, in groups that are formed for one occasion only, or for certain types of activities benefitting leaders more than ordinary farmers. The road to a farmers' organisation which functions in a democratic way is long and difficult.

Sustaining the process. In the Propelmas approach, the most important part of this step is evaluation and organisation. Activities as well as functioning of organisations should be evaluated and upgraded. Sustaining also includes the training of group members as local cadres for certain activities, such as child health clinics or cattle fattening. In this step - after a few years of activities - the farmers' organisations are further formalised. In this process of increasing institutionalisation of farmers' groups, Propelmas at first assists and actively intervenes when there are problems. Eventually, Propelmas withdraws and the farmers' organisation becomes independent. Propelmas continues to provide assistance but as an external advisor and facilitator only.

Summary of Propelmas approach. Trying to fit the Propelmas approach into the five-step model of PTD obscures some of its major elements. We therefore give a summary of our approach in our own terms:

- 1) Propelmas' assistance is requested, staff visits the village, (first informal contact with individual(s) requesting assistance).
- 2) Gathering of information, survey and discussions, analysis.
- 3) First assessment both within the project as well as together with farmers in a formal meeting.
- 4) Entry-point activity.
- 5) Evaluation of entry-point activity.
- 6) Follow-up activities, increasing complexity and scope; each activity evaluated.
- 7) While expanding activities, a process of organisational strengthening takes place, resulting in formalisation of farmers' organisation.
- 8) Propelmas withdraws from active participation in the organisation.

#### Conclusion

The complex strategy that is necessary for effective rural development will vary according to local conditions but should combine technology development with conscientisation and community organisation. Farmers should be supported politically and in executing activities by some sort of local institution. The strategy must be flexible enough to encompass activities outside agriculture, in case the most severe constraint in fighting poverty does not lie in agricultural practices but in other spheres. The processes involved should be iterative with increasing complexity of development activities undertaken by farmers and increasing organisational strength of farmers' groups. The ideal strategy for working to improve farmers' lives can only be found by bringing together the knowledge and experiences of farmers, fieldworkers and scientists. In this effort we must use tools that are designed not as products of our own preconceptions but rather according to the realities in each area.

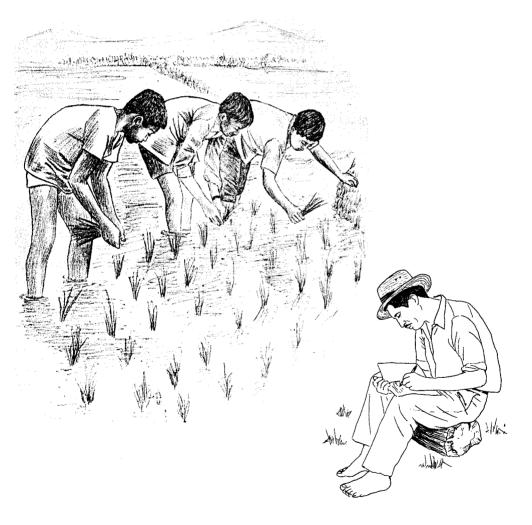
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PART II

Experiences of national and international research and extension organisations



# LEARNING FROM FARMER INNOVATIONS AND INNOVATOR WORKSHOPS: EXPERIENCES FROM BANGLADESH

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In their innovations, farmers are often ahead of the scientists. In Bangladesh, methods have been developed to gain insight into farmers' innovations and to help define ways in which formal research can support farmer experimentation.

## 1. INTRODUCTION

It will not be an exaggeration to say that the dawn of agriculture started with farmer innovation. Ever since that day, farmers have improved ways of growing crops through successive innovations. Crop varieties to suit varying needs, seed rates, land preparation techniques for different crops and soil types, and soil fertility management techniques are only a few examples. Farmers' innovations were the only source of improved cultivation methods available until formal research by on-station scientists started complementing it. All early breeding work prior to the era of Gregor Mendel was carried out by farmers (Galt & Mathema 1987). Breeding work and other such innovations are continuing today in order to enable farmers to meet the changes in environmental conditions, market prices, pest and disease outbreaks, family requirements from gradually decreasing landholdings etc. Poor farmers try to minimise risks through locally developed farming systems.

The diversified cropping systems and intercropping practices in Bangladesh are examples of innovations to minimise risk under rainfed conditions, while only a few patterns, mainly cereal-based, are followed in the more or less stable irrigated situation. Food shortages at family level have led to the development of ways to grow more food crops in a year, either by utilising the fallow period or by changing the existing non-cereal crop. In most low-lying areas of Bangladesh, khesari (Lathyrus sp.) used to be grown as a relay crop with deepwater amon rice. Now, in some areas, boro (winter) rice is being grown to replace khesari, and techniques have been developed to relay-transplant deepwater amon in the boro field. Deepwater amon is traditionally grown as a direct-seeded crop and growing of boro rice does not allow time for direct seeding. Development of techniques by farmers to transplant deepwater amon has enabled them to take two rice crops.

In new developed land (charland) with high erosion risk, farmers plant sugarcane

sets in individual deep pits, allowing a better grip against high current during the flooding period. Similarly, a farmer has been successfully raising tomatoes, cabbage and other winter vegetables in saline areas using stubble mulches and raised beds. The new technique keeps the topsoil moist, reducing capillary movement of subsoil salinity and eliminating the necessity to irrigate (with saline water, of course). On the red Madhupur soil, which becomes hard during the dry winter months, farmers avoid transplanting the traditional sugarcane crop during November-December. Rather, they raise seedlings at the homestead and transplant during April-May when the rains begin.

These are only a few of the recent innovations, in addition to the innovations made by farmers over hundreds of years through so-called 'Informal R&D' (Biggs 1980), in order to stabilise and increase production, increase income and profits, and reduce risk. Many others have reported about such informal research (Brammer 1980, 1982; Ashby 1984; Galt & Mathema 1987).

## 2. WHY WOULD WE BE INTERESTED IN FARMER INNOVATIONS?

During the past decade, scientists have been emphasising that the process of technology generation must take the farmers, especially the resource-poor ones, as the centre of all activities. Researchable issues must be identified based on the farmers' problems, aspirations, needs, resources, environments and risks under which they operate. Central to this is an adequate understanding of farmers' needs and aspirations, existing situation and constraints to increasing income and productivity, present level of management practices, why they are or are not following certain practices, why they have discontinued to follow certain practices, and linkages between different farming subsystems and between on-farm and off-/non-farm activities etc. Agricultural scientists, especially those in Farming Systems Research, are coming to a consensus that, in order to understand the resource-poor farmers and to generate technologies appropriate for them, farmers must be involved in various stages of research. Such a practice is termed by many as 'participatory research', though the dimension of the participation varies greatly from programme to programme.

A key reason for taking farmers as partners in agricultural research is that, from the experience generated through hundreds of years of trial and error, farmers have accumulated rich, valid and useful knowledge. Learning about the indigenous technology and process through which such technologies were developed or innovated is very important, because a) such innovations are made within the whole farming system under which the farmers operate, and b) they show that resource-poor farmers manage to modify and exploit micro-environments and climates (Chamber & Jiggins 1986). Chambers and Jiggins further maintain that farmers have to innovate and adapt in order to survive, as farming is a time-drive activity conducted under variable environments and economic conditions.

We also claim that, for their survival, resource-poor farmers are continuing with

their informal research and development activities. It is important that researchers and extensionists learn about such successful practices in order to design better research programmes and to develop extension programmes to popularise such practices among farmers operating under similar conditions.

#### 3. WHO LEARNS AND HOW?

The obvious answer is the researchers and the extensionists. Though many scientists find it difficult to learn from the experiments, experience and knowledge of farmers (Chambers & Jiggins 1986), there are many others who recognise that there exists tremendous scope to learn from farmers. But the point is, how do scientists learn from farmers? This involves procedural and institutional issues. Also the issue of social status cannot be neglected. Can the scientists sit in the classroom as trainees while an illiterate farmer is teaching? Further questions arise: How to identify an innovation? How do we learn the details of the innovation? What do we do with the new knowledge? In the following, we will try to answer some of these questions based on our recent experience in Bangladesh.

Innovations imply changes to improve existing systems. Various ways could be used to identify innovations (cf. Farrington & Martin 1987). Some possibilities are listed below:

- During field visits: While going on field visits, scientists or extensionists may come across a field or a number of fields with a practice which is not common in the area. Stopping at the site and talking to the farmer(s) concerned and to neighbours can give an initial feeling about the technology. It is important that, while on field visits, scientists not only keep their eyes open, but also keep their other senses alert.
- Purposefully asking the field assistant: Field Assistants working in outlying areas can
  be asked to gather information about successful farmer practices and send a rough
  report explaining some details of the practice. Scientists can then make follow-up
  visits.
- During surveys: Especially while developing case studies or unstructured surveys, it
  is quite usual that farmers will reveal some of their innovative practices (Gupta
  1986) through which they have overcome their problems.
- Through (other) extension workers: Since extension workers have contact with a vast number of farmers and also travel to almost every village, they are good sources for identifying farmers' innovations.
- From farmer meeting, field days etc.: During field days or any other meetings with farmers, information on unique farming practices may be obtained. Sometimes, farmers may voluntarily provide such information or researchers may ask the farmers about existence of any such practice.

In 1981, when the senior author was travelling with the Minister for Agriculture in North-West Bangladesh, the District Extension Officer, Rangpur, requested him to persuade the Minister to visit a potato-growing area where farmers were reportedly harvesting potatoes twice from the same planting and were also intercropping with potato. A field visit to the Ranipukur area revealed that large areas had been planted to potatoes for double-harvesting. Crops like cabbage, radish, wheat and chilies were being grown as intercrops. The practice was unique and the decision was taken to show it to other farmers, extensionists and researchers. A field day was organised at the site, and an Innovative Farmers Workshop was organised at Ishurdi, Pabna (see below).

During the 1984-85 winter season, the On-Farm Research Division (OFRD) of Bangladesh Agricultural Research Institute (BARI) was trying to grow wheat under minimum-tillage conditions in some parts of the country. When the Principal Scientific Officer of OFRD at Jessore was travelling in February 1985 to show some of the trials at Sailkupa to the Director (Research) of BARI, some farmers reported that villagers in Kushtia Sadar Upazilla were growing wheat as a relay crop with transplanted *amon* paddy, i.e. under zero-tillage conditions (Haque 1987). This was raised in the monthly regional research and extension workshop and the extensionists admitted the existence of such innovative practice.

In view of the success of the Innovative Farmers Workshop (IFW) on potato held at Ishurdi in 1982, the Extension and Research Project, BARI, Ishudi, decided to organise a workshop in 1983 on farmers' innovations in growing mustard, wheat and watermelon. For various reasons, the date had to be fixed after BARI's Central Research Programme Planning meeting. During this meeting, it was proposed to test if the new high-yielding mustard variety Sonali Sharisha could be grown under zero-tillage conditions like the traditional varieties. This was debated by the scientists, until it was passed by the committee. A week later, the IFW was held in Ishurdi. A farmer from Natore surprised everybody by saying that he has been growing Sonali Sharisha successfully for the last two years under zero-tillage conditions but with one irrigation. Next year, he will expand the area. Very good yield was obtained and no P & K fertiliser was applied because, if the recommended rate of P fertiliser is applied in the *amon* rice crop, further application is not required in mustard.

At the same workshop, farmers reported that sprouting of watermelon seeds could be hastened by 1) burying the seeds in cowdung heaps, 2) burying in earth near the *chula* (rural oven), or 3) first soaking the seeds and then tucking the pack of seeds in your clothes in close contact with your body. The body temperature keeps the temperature high, causing the seeds to sprout properly during the winter months. The farmer innovators also reported that wheat and watermelon could be grown together, using the remaining land in the watermelon field.

In that year, scientists were thinking about the possible performance of the same high-yielding mustard variety as an intercrop with pulses. Intercropping is a traditional practice in the pulse-growing areas of Bangladesh. During a field trip, it was revealed that a few farmers about 10 km away from the Regional Agricultural Research Station at Ishurdi were already growing the variety as intercrop with lentil.

Bangladesh suffered greatly in 1984 on account of successive floods. Farmers had to transplant twice or thrice. During a field trip in September 1984 in the

Tangail/Jamalpur area to ascertain the situation and to find out how farmers were adjusting to it, informal discussions were held with farmers trading rice seedlings on the highway. It was discovered that, since there was a chance of another flood, farmers were transplanting *amon* paddy in the upland where mustard is usually grown after harvesting jute, and they were keeping the traditional rice area on medium-high land free for mustard. This will allow them to grow both rice and mustard. Under normal flooding conditions, growing rice on upland without irrigation would have been almost impossible.

These are only a few of numerous examples of farmers' innovations. The point to emphasise here is that information about such innovations can be obtained through various means but, most importantly, deliberate attempts must be made to obtain the information. Many scientists and extensionists must have passed through Narshingdi on the Dhaka-Sylhet highway, but how many have really observed that the country bean (Dolichos lablab) is being grown using chili plants as a replacement for bamboo trellises? For such a practice, the chili variety is also important. It must be tall with a strong stem to bear the load of the bean vines. One must try to see with heart, not only with the eyes.

These examples further illustrate that farmers are continuing with their informal R&D and, in many cases, are well ahead of their counterparts on the research stations

There are also examples of farmers' research being triggered by on-farm research activities. As mentioned above, OFRD was testing minimum tillage techniques of growing wheat in 1985-86. At Sujanagar, Pabna, the performance of one ploughing only was as good as five ploughings. When asked, the farmers said they would like to test the technology for another year to see the year-to-year variations. At Daudkandi, Comilla, the OFRD scientists failed to persuade farmers to test the Kushtia practice of relay cropping wheat with deepwater amon. But one of the farmers later thought: 'Were the scientists really trying to fool us?' He then decided to sow wheat without tillage after the amon harvest instead of relaying, since the soil still had enough moisture. But he burnt some of the paddy straw left in the field in order to facilitate quick establishment of the seedlings. He had a good crop.

During the winter season 1986-87, Bati Shak, a newly developed leafy vegetable, and Tasaki Mula, a newly developed variety of radish, were tested under three fertiliser levels: 1) full recommended, 2) 50% of full recommendation, and 3) farmer's choice. It was observed that many farmers deliberately did not apply *chemical* fertiliser in Treatment 3 to compare this with the other two chemical fertiliser treatments.

Though there are many different ways of learning about farmers' innovations, personal discussions and innovator workshops were found to be very fruitful in obtaining details of the technologies. Some recent experiences with innovator workshops are described below.

#### 4. INNOVATIVE FARMERS WORKSHOP (IFW)

The 1982 innovator workshop on double-harvesting potato, popularly known as 'Ranipukur Technology', was the first known workshop of this type organised in Bangladesh. Therefore, there was no experience available on organising such workshops. At that time, the term 'progressive farmer' was used instead of 'innovative farmer'. The objectives of the workshop were (BARI 1982):

- to develop in the participants an awareness of the existence and usefulness of progressive farmers in the quest for technology development;
- to exchange data and experience of progressive farmers on the development of suitable techniques in multiple cropping using potato as base crop;
- to suggest measures to improve the existing arrangements;
- to gain lessons from progressive farmers for the use of extension workers and other farmers, and
- to identify areas for location-specific research.

The Thana Extension Officer was assigned to sit with the farmers and help them prepare a concise paper on the innovation. Four farmers were invited as resource persons, and 30-35 applied researchers and extension workers were selected as trainee-participants. Though many people were apprehensive whether university-trained scientists would actually sit as trainees, all the participants were fully motivated and participated with great enthusiasm. To them it was a big change.

On the first day of the two-day programme, about three hours were allocated to an overview by the District Extension Officer, Rangpur, the Senior Scientific Officer, Extension and Research Project, BARI, and the Thana Extension Officer of Mithapukur Upazilla, where the technology was innovated. The remaining one and half days were devoted to oral presentation by the farmer resource persons, group discussions and practical demonstration by the resource persons. Farmers were given 5-6 hours for oral presentation. Informality was maintained throughout the workshop so that the farmers become free of tension. At the end, the workshop participants came up with recommendations for a) adaptive research, b) extension, and c) production economists (Abedin 1982).

The Secretary of the Ministry of Agriculture attended the meeting, presumably to see if this was a gimmick or the scientists/extensionists were really learning from the farmers. He asked participants about what they had learned and checked with the farmers, and found that there were no discrepancies. A two-page proceedings was prepared, but the papers presented by the farmers were not included.

The 1983 workshop on oilseeds, wheat and watermelon was organised in the same manner.

By 1984, the Extension and Research Project was expanded to other areas and the Graduate Training Institute of the Bangladesh Agricultural University (BAU), Mymensingh, came forward to organise 'Innovative Farmers Workshops'. Here also, the extension service was requested to identify innovators but was not requested to prepare any written presentation. At BAU, this was definitely an unusual programme, as evident from the objectives:

- 'to familiarise the educationists ... in general, and those of the Bangladesh Agricultural University in particular, with the innovative rice farmers ....
- to achieve an in-depth knowledge and understanding for a possible change in the future curriculum of BAU in respect of rice cultivation ....' (Hossain & Islam 1985). Despite the good objectives, the workshop failed to attain them, mainly because too many innovations were tackled at once and there were too many participants (about 100). Farmers were given only 5-7 minutes for presentation and 3-5 minutes for discussion. In the proceedings, it was recorded: 'During these sessions, participating farmers generally sought solutions in different aspects of technological problems of rice cultivation from the participating scientists ....' (Hossain & Islam 1985). No papers or discussion notes were included in the proceedings. However, the process of organising the workshop was well documented.

OFDR organised another two-day IFW on 19-20 February 1985 at the Regional Agricultural Research Station, Jessore, on the innovation developed at Kushtia of relay cropping wheat and on potato, sweet gourd, *boro* paddy, mustard, groundnut, sesame and watermelon. One farmer innovator on each crop was identified by extensionists. The general format was like that at Ishurdi: 7 farmers attended as resource persons, and 32 researchers and extensionists participated. Since there were only seven speakers, they had enough time. Detailed proceedings including the handouts of the resource persons, details of the questions and answers, and the workshop recommendations were prepared (Haque 1985).

## 5. INFLUENCE OF INNOVATIVE FARMERS WORKSHOPS ON RESEARCH PROGRAMMES

As the effects of the recommendations of the Innovative Farmers Workshop held at BAU, Mymensingh, were not readily available, only the effects of the recommendations of the two IFWs organised by BARI are discussed here.

The IFW on double-harvesting potato recommended that adaptive/applied research should:

- test and verify the existing technology on potato cultivation as practised by the Ranipukur farmers;
- with the DTC (District Technical Committee), devise possible ways by which the
  existing technology at Ranipukur may be improved and modified to suit other
  areas of Rangpur, in particular, and Rajshasi Division in general, for wider spread
  and application of the observed technology;
- with Ranipukur farmers, explore other possibilities of crop combination aside from the existing ones (Abedin 1982).

As per recommendation, the following on-station and on-farm research programmes were developed in consultation with the resource persons who attended the workshops:

• on-station studies on the effect of direction of placement of the cut side on the growth and yield of potato; no difference was observed;

- studies on varietal suitability for double-harvesting potato;
- comparative study of different intercrops with double-harvested potato under rainfed conditions;
- effect of different management practices after first harvest of potato;
- profitability and productivity of potato intercropped with vegetables and relayed with onion;
- performance of the cropping pattern: potato + garlic + pointed gourd (potol) green manure.

At Ranipukur, farmers developed a pattern of potato + pointed gourd. Garlic and green manure was added by researchers. The pattern is now being tested at Multilocational Trial Sites at Palashbari, Lalmonirhat and Nilphamari.

Though the IFW at Jessore dealt with several crops, research programmes have concentrated on wheat relay cropping. The following research has been commenced since the workshops:

- survey of the details of the wheat relay cropping innovation;
- rate and time of application of P and K fertiliser;
- · seed rate trials;
- · suitability of recently evolved varieties for relay cropping;
- possibilities of relaying wheat with amon and broadcast in other parts of the country;
- determination of optimum and maximum overlap period.

It may be seen that the IFWs have significantly influenced the research programmes of BARI. Both the Wheat Research Centre and OFRD are collaborating in some of the trials.

#### 6. CONCLUSIONS

From the foregoing discussion, the contention of scientists that farmer innovations have to be well understood in order to generate appropriate technologies was found to be valid. Though some authors have mentioned organising IFWs, detailed methods have not been described. From the experiences gained in Bangladesh, it is suggested that farmer innovations are best understood in either of two ways:

- Person-to-person discussion: Researcher goes to the farmer, seeks appointment and
  discusses with him the details of the practice and its implications for other
  production and consumption activities. No interview schedule is used. The
  information gathered is shared with colleagues. The written version is also shared
  with the farmer.
- Innovative Farmer Workshops: Such workshops can be organised at research stations but also in a rural school, community centre etc. Farmer innovators are invited as resource persons. Maintaining informality is essential. A formal chairperson can be avoided; instead, a moderator can keep the sessions in order. The number of participants should not usually exceed 30. Enough time should be given to the farmers to explain their practice. Farmers should be helped to

develop confidence. After all, they have been used to only listening.

It is also evident that the process of learning about farmers' innovations has four stages:

- 1) Identification, which could be done by researchers, extension workers or farmers;
- Preliminary documentation: some preliminary information is collected to establish the relative importance of the innovation; it might be necessary to set priorities when dealing with more than one innovation;
- 3) Information sharing: at this stage, the researchers/extensionists try to understand the details of the innovation; detailed documentation is desirable for future use;
- 4) Action planning: at this stage, a set of practical recommendations is prepared for future research or extension programmes; if support of other development institutions or policy planners are required for the extension programme, if should be explicitly mentioned.

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## THE PROBLEM CENSUS: FARMER-CENTRED PROBLEM IDENTIFICATION

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'To a child, experience is something which happens to him; to an adult his experience is who he is. So in any situation in which an adult's experience is being devalued, or ignored, the adult perceives this as not rejecting just his experience, but rejecting him as a person' (Knowles 1973).

Extension workers and agencies in developing countries are coming to accept the idea that extension is a farmer-centred process and a problem-centred process. Hence it is important for them to know how to draw upon information provided by farmers at the village level, and to involve farmers in a process that will enable them to identify and solve problems themselves in order to achieve their own goals. Such a process is an essential component of the problem-census technique, an extension method in which farmers are fully involved as a viable human resource. This article discusses the steps involved in organising and conducting a problem census.

## 1. HOW TO WORK WITH FARMER GROUPS

For an extension worker to work successfully with a farmer group or the larger village community, he or she must want to explore problem areas with the group but be willing to let them identify and solve problems themselves. The prerequisites for such extension worker involvement are a total trust in the farmer group and the underlying group principles that explain their behaviour, and an understanding that a farmer or village discussion group is a socially determined reference group with common goals and a frame of reference based on common attitudes and values toward many issues, including new technology.

If the extension worker can establish that there is a common interest among the farmers in meeting to discuss problems, he or she is in a position to bring them together as a cohesive group.

The extension worker should let the group complete its task without interfering. His or her major concern is with group processes, not with content. 'Group processes' refers to how the group is communicating: who talks with whom; how much each member is contributing; which members, if any, are being ignored; who is emerging as a leader; whether key information is being suppressed; and so on. Extension workers often regard this approach as an abdication of their leadership role, but they are fooling themselves. Leadership is a group characteristic - it comes from the

group, not from the extension worker. It is absolutely essential to keep clear of group activities and let members get on with their job. Once the groups understand their task, they will determine the procedure to be used to accomplish it. In a problem census, the task is simply identifying and ranking problems on their farms or in the village.

#### 2. THE PROBLEM CENSUS

## Establishing a problem-census group

The discussion group may arise in several ways:

- A farmer or several farmers may approach the extension worker with a problem.
   He or she suggests to them that there could be more farmers likely to have the same problem.
- The extension worker can approach village leaders who are known to be influential among many farmers and point out that he or she is interested in meeting with local farmers to discuss their problems. In these cases, the worker should ask the persons contacted to check with the rest of the farm community they know (their reference group) and discuss between themselves whether it would be worthwhile to meet as a group to discuss problems. If the farmers say it would be worthwhile, they can arrange the time and place of the meeting.
- If the extension worker meets regularly with farm groups, one of these meetings can be used to conduct a problem census.

No matter which of the above approaches is used by the extension worker, the farmers must decide whether they consider it worthwhile meeting together in order to identify problems. It is pointless imposing such an idea on them without consensus (see case study).

The extension worker should ensure that the village leader knows of his or her intention to arrange a problem-census meeting. Village leaders should be involved in such meetings. It is sometimes preferable to work through the village leader in requesting farmers to meet to conduct a problem census.

It is important to involve the village leader in problem-census meetings so that he will be inclined to accept the outcome of the meeting and use his influence to carry out any decisions made there. If he is not involved in the meeting, he is certain to feel that his role as village leader has been undermined and he may resist any further efforts made by the extension worker to work with village members.

In all instances, it is for the community to decide who will attend the meeting. The usual expectation is for farmers to attend. In practice, women and children from households may also come to the meeting. Women in particular should be encouraged to participate in discussions and they should certainly be included in small-group work.

## Objectives of a problem census

The objectives of a problem census are to:

- bring together a group of farmers or encourage an existing group to meet with the
  goal of identifying major problems in the farming system of concern to them; if
  the meeting is made up of a more diverse membership of villagers, their problems
  are most likely to extend beyond farming to matters of concern to the total village;
- · create a learning situation which is farmer- or village-centred;
- identify existing attitudes and the extent to which attitudes differ between group members:
- draw on and rely on the combined knowledge and experience of group members;
- make possible a consensus on the problems that exist and their rankings;
- encourage involvement by all group members in group discussions to increase their motivation to share knowledge and experience and to gain new knowledge as a result.

The total output from group work far exceeds the information, experience and opinions contributed by any one person. Each group member gains from this shared experience, both in receiving new knowledge and in increased social awareness. For example, a farmer initially may consider a particular problem of paramount importance, but his view may change in favour of problems raised by other farmers. This compromise is made by many farmers, and is the first step toward group consensus.

In achieving these objectives, the extension worker has the following responsibilities:

- once the task is set for the farmers to identify problems and they have formed into a number of small groups, to leave each group to choose the direction taken in discussion to achieve this goal;
- to ensure that all participants have an equal opportunity to express views and provide knowledge inputs in group discussions;
- to act only as a facilitator, being concerned with *process* and not with the *content* of group discussion; the content is provided by participants;
- to contribute to any of the small groups only if and when asked; during the
  problem census, the extension worker's contributions are normally confined to
  clarifying to a group what their actual task is; the worker's ideas of problem areas
  are irrelevant at this stage and must never be disclosed;
- never to assume leadership or assume that he or she is leader. The extension worker is the 'helping hand', a facilitator who through careful structuring of the meeting ensures that the farmers work effectively toward the goal they have chosen. If the extension worker tries to impose ideas or influence the farmers he or she will probably succeed, but in doing so the meeting reverts to a pointless exercise in which farmers see no purpose in continuing since their goals cannot be fulfilled. Traditionally, the extension worker provides information to farmers but in the problem-census technique information-giving is the extension worker's least significant task.

#### Steps in conducting a problem census

Materials. Once the meeting date and venue have been decided, the extension worker should ensure that paper and pencils are distributed to everyone attending the meeting. He should also make available a number of felt pens and large sheets of butcher's or newsprint paper about  $50 \times 150$  cm, so that every small group can record the outcomes of their discussions. These sheets are displayed so that everyone at the meeting can see the recorded information. They can be attached to the walls of the room with adhesive tape in order to be seen clearly. They can be collected after the meeting and saved for subsequent meetings.

Language. Local people may not be able to participate if the discussion is not conducted in their native language. As with any decision made by the meeting, the extension worker should support the group's decision about which language they prefer to use. The extension worker need not be concerned if he or she does not know the language or is not particularly competent in its use. Using the language or dialect of the village ensures that communication between farmers is much more efficient and effective and places the farmers at their ease.

Locally recognisable symbols can be substituted for words if illiteracy hinders effective communication. Obviously, an interpreter will need to be provided if the extension worker has no knowledge of the native language. It is strongly recommended that the extension worker has several helpers; each issued with clipboard, sheets of paper and pen. Each helper is allocated one or more groups (depending on total number of groups). It is his or her responsibility to translate information coming from the group(s), as it is being recorded on the newsprint paper. This work is so valuable, because the extension worker can read any group's work, in his or her own language.

Statement of task. In order to help clarify the problem-census technique, Figure 1 shows diagrammatically the various steps involved in plenary and small-group activities. It should be referred to in conjunction with the following discussion on the problem census.

At the beginning of the meeting, the extension worker explains that the meeting was organised by agreement among the farmers attending, and that the intention is to identify major problems within the community. The task set by the extension worker will obviously vary from situation to situation, but a typical question would be: 'What are the most important problems you face in running your farm?' or 'What are the most important problems you face within the village community?' With the latter task it is obvious that the problems arising from the problem-census meeting will be diverse and will extend beyond the farm.

For the sake of simplicity, the remainder of this discussion on the problem census will deal only with farm problems.

Forming small groups. Once the task is clear to the members of the group, they are divided into small groups of no more than four to six people. Five is a comfortable

number to work with. Larger groups are more difficult to handle, since they tend to split into cliques, thus defeating the objective of involving everyone in the task set forth at the beginning of the meeting.

When groups are forming, it is essential that the seats be arranged in circles to ensure maximum interaction among group members. If chairs are not available and people have to sit on the floor or on the ground, each small group must still be arranged in a circle.

Small groups generally form quite naturally. However, if more than six people want to belong to a particular group, the extension worker will have to ask some of them to form another group. People coming from outside the village will usually form a group of their own; although they may sometimes choose to join small groups made up of local people.

Having said this, there is nevertheless no hard and fast rule on group size. Firstly, the extension worker must not insist on members shifting out of a group, even if the group has more than six members. Also, there is a limit to the amount of groups from which information can be processed and discussed. For example, 100 participants could divide into 10 groups of 10. No one at the meeting would have time to process and discuss outcomes of 16-17 groups of six.

A major advantage in dividing a meeting up into small groups is that it reduces the adverse influence of the few members who might normally be regarded as know-it-alls: those who talk too much and tend to dominate the meeting. They impose their own views, excluding the opportunity for discussion and the representation of all views and thus make if difficult for shy members to speak up.

The use of small groups also precludes any conflict or stalemate which could occur in a plenary meeting, thus speeding up the process by which farmers can reach consensus.

Selecting group recorders. When small groups are being formed, the extension worker asks each group to select a recorder. It is the responsibility of each small group, not the extension agent, to decide which member will be recorder and reporter. The role of the recorder is to list the final set of problems that arise from group discussions. Occasionally, the recorder may also report the outcome of group discussions to the meeting.

Individuals list their problems. Make it clear to the meeting that before group discussion commences, every member of each small group must write down the problems as they see them on their own farms (or in their own village). This is done without discussion with other group members. About 15-30 minutes must be allocated, because this is an important starting-point for group discussions. If everybody is going to participate and make a contribution to the group discussions, each group member must consider the problems that concern him or her. In meetings where not all participants are literate, additional time will be needed so that those who can write (usually younger family members) can list the problems stated by those who cannot.

Small-group discussions. Each individual then reports his or her information to the group, which discusses all the problems presented by all members of the small group. It is up to the group to reject any information considered irrelevant to the discussion and to decide on those problems which should be recorded. If a farmer's problem is excluded by the group as relatively unimportant but he still considers it important, it must be retained on this list. The plenary meeting will subsequently decide its importance when the recorded list of problems is displayed for ranking.

At this stage, the extension worker should make sure that everyone in each small group is involved in the discussion and that nobody in any of the groups is dominating the talks to the exclusion of others. It is usual, and quite consistent with the theory of small groups, that groups have sufficient social control mechanisms to prevent such dominance from taking place, without the direct intervention of the extension worker.

There is no set rule as to how long this step in the problem census will take: it may be 30 minutes to an hour or even more. It would be unwise to suggest a time limit since groups work at their own pace and the information being obtained is most important for future decisions.

Recording group discussions. After agreeing on a list of problems, each small group records them on the large sheets of paper. When all these sheets have been completed, it will be clear to the extension worker that all the groups have completed their tasks. The extension worker will then invite each small group to display to the meeting the information recorded for that group.

If the meeting is indoors, the sheets can be attached to the walls so that everyone can see the results. If it is outside, they can be attached to the side of a truck or suspended from a line or rope by clothes-pegs. It is a good idea for the extension worker to take to each meeting several sheets of plywood or the like, just in case a meeting will be held in the open.

Reporting group discussions. It is important that everyone knows what has been written and understands it. If anyone in the plenary meeting is uncertain as to what is meant by a recorded statement, it can be clarified by the group who prepared it. It is not necessary to be able to read to participate in group work and group discussions.

Identifying common problems. Once all the problems from the groups have been read out, the extension worker can then ask the farmers to compare lists and indicate which problems are common to some or all of the small-group lists. This may take almost as much time as the group discussion, but the time spent is worthwhile. The extension worker initiates this stage in the problem census by pointing to a problem on one group's list. He or she then asks each other group, in turn, to indicate whether they have recorded essentially the same problem. Those problems which are the same or similar can be identified on the worksheets with a common number, symbol or letter of the alphabet. Under no circumstances does the extension worker

make the selection or interpretation. All the work must be done by the farmer group members.

During this step in the problem census, any group can still claim that a problem they have stated should not be grouped under a common heading with others. It is normally expected that they will explain why this is the case. As these situations often arise, the whole discussion is left open and within the control of the farmers themselves.

Once the meeting has gone through all the lists and accounted for problems recorded by more than one group, the extension worker or a recorder writes down the shorter list of problems (together with the letter, number or symbol that identifies each problem), and reads them to the plenary meeting.

Placing priorities on problems. At this stage, the extension worker might conclude that the task has been accomplished because the problems have been identified, but this is not the case. The extension worker now asks the farmers to return to their small groups to consider the order of importance each group places on the short list of problems. It cannot be assumed, and usually is not the case, that every group will rank the problems they identified as most important.

Every farmer in the meeting has been exposed to new information and the problem-census technique gives him a chance to evaluate this information. As a result, the small groups may concur that the most important problem is one originally mentioned by one or only a few groups. Hence the need for ranking as an important additional group exercise. As with any group exercise, each group is allowed adequate time to discuss and rank the problems. Once small group decisions have been recorded on large sheets of paper, these are displayed so that all the farmers can see them. A simple example of ranking problems is shown in Tables 1 and 2 and relates to the case study presented later.

The extension worker can then work through these lists with the farmers, noting the extent to which any one problem is ranked as the most important by all or some of the groups. The one that has been ranked first by most groups will be regarded as the most important problem, and so on. Again, the decision rests with the farmers as to the relative ranking of these problems.

The small-group approach to problem identification provides a highly supportive atmosphere and has a unifying effect on the groups because they begin to work with a common purpose. They realise that they have problems in common with each other and that the extent of disagreement that exists between group members is not great, and certainly not insurmountable. Individual members do not feel threatened because they are not singled out to provide information to the whole meeting and they are working with people they know. All this leads to a consensus in the plenary meeting. This agreement arises because of compromise and varying shifts in the attitudes of farmers so that a decision acceptable to all farmers can be made.

Consistent with small-group theory, once the meeting agrees to take any specific action arising from the problem census, all members are committed and social mechanisms (sanctions), which normally operate in the village situation, will also be

employed to ensure that all farmers attending the discussion group are committed to action.

Most problem-census meetings take about three hours. Participants become involved during the census and will continue the discussion until they are satisfied that their goal has been attained.

#### Problem-census technique - a visual interpretation

Figure 1 depicts the various steps used in the problem-census technique and is divided into two major sections: plenary activities and group activities. The solid boundary around all members of the meeting means that they are a cohesive group irrespective of the extent to which they may break up into small groups for discussion. In group activities, there is a solid line dividing each of the four groups. This indicates that the members of each small group confine their attention to working within that group and do not have any communication with adjoining small groups. However, all groups are enclosed by a broken line. This indicates that all small groups are accessible to the extension worker so that he or she can listen to discussions in order to know what progress is being made in any small group.

During a plenary activity, the line between each small group is broken. This means that, during discussions and feedback involving the total meeting, the small groups can remain intact or re-form as a plenary group. During plenary sessions, the communication between members of all small groups is essential.

Figure 1 shows the extension worker as central to the farmer meeting at the beginning. This represents his or her role in organising the members into small groups and setting the task to identify key problems. When the plenary group is sorting out the final ranking of problems, the extension worker is free to assist in processing information. This does not mean the extension worker tells the group a preferred ranking. He or she is there merely to assist in the process. During the whole problem census, all farmers will realise that the responsibility for making decisions has been placed entirely on their shoulders and they will not be willing to allow this responsibility to revert to the extension worker. If, at any stage during the problem census, the extension worker either writes or reports information with which the meeting does not agree, they will certainly inform him or her of this. Figure 1 also shows that there is no division between any of the group members and the extension worker at the conclusion of the meeting. Although it is acceptable to the meeting that the extension worker takes on a leadership role in the initial step of the problem census, such identity does not exist at the conclusion of the meeting.

#### 3. CASE STUDY

This case study will give the reader some idea of the amount and quality of information that can be obtained from a problem-census meeting. This problem census was one of several held in villages in the northern region of Thailand (Crouch

1980). The village is not identified. This anonymity does not affect the validity of the case study.

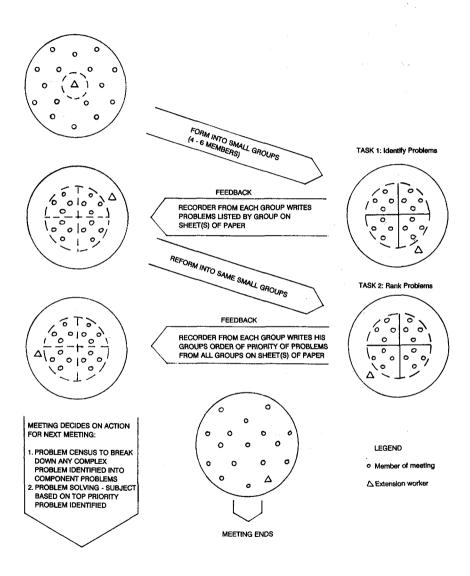


Figure 1: Diagrammatic presentation of the problem census technique

The problem census was arranged through a meeting with the village leader (Kumnun). Even at short notice, the Kumnun was able to contact 18 farmers who agreed to come to a meeting in his house. The problem census took 2.5 hours to complete.

As a basis for the problem census, the question was asked: 'What problems do you face in working upland farms?' Before handling this question, the 18 farmers sat in circles on the floor of the *Kumnun's* living area with 4-5 members in each group. The results of farmer discussions were written on sheets of paper and displayed on the walls of the room. These results are shown in Table 1.

Table 1: Problems in working upland farms cited in problem census

Problem	No. of groups with problem		
Need direct access to upland farms from village *	4		
Soil very hard to cultivate **	4		
Soil lacks fertility ***	3		
Soil looks poor ***	2		
Lack of water at cultivation/planting	4		
No money for investment ***	3		
Insect damage on rice and groundnuts ***	2		
No insecticides or herbicides ***	1		

- \* Family members now travel 10 km to upland areas (6 hr/day return trip).
- \*\* Group expressed need for tractors.
- \*\*\* Related problems.

Once the farmers had discussed the various problems, the small groups were asked to list what they saw as the four most important problems of the eight presented in Table 1. The result of the small-group discussions and the farmer consensus arising are recorded in Table 2.

Table 2: Importance of problems ranked by groups

Group	1	2	3	4	
Rank					
1	Direct access	Direct access	Direct access	Direct access	
2	Soils too hard	Soils too hard	Soils too hard	Soils too hard	
3	Soils infertile	Lack of water	Soils infertile	Soils infertile	
4	Lack of water	Soils infertile	Lack of water	Lack of water	

These results show that there was no change in the importance to all groups of access to farms and the physical characteristics of soil. However, although all four groups saw lack of water as a major problem, only one group ranked this as third in importance. The other three groups remained unchanged in their belief that soil fertility (chemical characteristics of soil) was more important.

No other problems were included in this set of four main problems. The farmers' immediate problem was direct access to the farms. The next two problems related to the physical and chemical characteristics of the soil. Finally came the problem of water availability. Short of offering detailed explanations, their resolving of problems relevant to water availability and soil fertility on the farm blocks is eventually dependent on the more immediate problem of gaining access to farmland.

The outcome may appear oversimplified because of the limited time available for discussion with the farmer groups. However, the farmers' expectations and motivation were raised as they recognised their common problems and saw how they could be solved. Each problem was logically linked and could be handled one at a time.

The effort and technical input of this farmer group were commendable and disclosed more information and understanding than an extension worker could hope to achieve alone. The problems in operating rainfed farms came together and were clarified.

The farmers involved in the village claimed that the problem census was successful. It helped them to organise and put into perspective the problems identified. Their level of interest and involvement was high because it was the first time that someone had asked them to give their opinions on farming.

The problem census was conducted in the northern Thai language. Since the author lacks this language, it was hard work concentrating on what was happening during the meeting. It is emphasised, however, the lack of language was not a barrier, since the author was kept fully informed by an interpreter of the outcome of group discussions, results obtained and decisions made. Any questions and observations to the farmers were also made through the interpreter. All key information was obtained as a result of the problem census and the original intent of the meeting was also retained throughout.

#### 4. CONCLUSIONS

The problem-census technique is a comparatively simple extension method which is both farmer-centred and problem-centred. It is a dynamic educational process aimed at changing the values and behaviour of farmers or a village community so that they can successfully adapt to continually changing situations. This goal is achieved by providing a social and learning environment acceptable to farmers.

The problem-census technique is not an end in itself. Problem-solving meetings are the logical consequences of a successfully completed census meeting. Through the problem census, extension becomes important in enabling the village community to acquire and develop problem-solving and decision-making skills. As the village community obtains these skills, it is better able to handle new problem situations without difficulty and independently of outsiders. Extension thus achieves its fundamental goal of enabling village people to become an effective and fully utilised human resource.

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## FARMERS' PARTICIPATION AND EXTENSION

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Participation of farmers and farmwomen in extension activities means they contribute actively and interact with the extensionists. What contribution? And what sort of interaction? Here, different types of participation are presented and discussed.

#### 'El Monte': participation in extension meetings

A grassroots extension worker visits a village I will call 'El Monte' in the Andean highlands. He exchanges views with various villagers, in particular, some of the heads of smallholder households, and detects a problem of white grub (*Premnotrypex vorax*) in potato fields. Among the people he visits, he also notices an interest in doing something about it. Besides, on the basis of a region-wide reconnaissance study, he knows that potato has been selected as a priority crop for the Government's agricultural development efforts in the area. Therefore, didactic materials have already been developed by his service, and credit is readily available at the Agricultural Bank.

As the village has recently been connected to the rural electricity network, a step-by-step multimedia campaign is designed at the District Office:

- Promotion, to announce the campaign and stimulate interest amongst the villagers.
- 2) Introductory meeting: Officials of both the Agricultural Extension Service and the Agricultural Bank will explain to the farmers the Government's interest in this campaign and the way in which the farmers may benefit from it. An extension handout will be distributed.
- Problem-focusing meeting: A slide series will be shown, which highlights the importance of controlling the white grub in potato. A discussion will be held afterwards.
- 4) Method demonstration: How do you recognise the different stages of the white grub in the field? When is control most adequate? How to do it? An illustrated practical brochure will be handed to those attending the meeting.
- 5) Result demonstration: At harvest the difference in production between treated and nontreated plots will be shown.
- 6) Rounding-off meeting: Discussion of results and possible questions.

During the campaign an average of 18 villagers, mostly heads of families, attend the meetings, out of a total village population of about 200 families. Ten farms go in for

credit and apply the technical recommendations. Of these, six attended meetings regularly.

In the situation described above, the participation of the farmers is limited to attending the meetings. A number of them has been contacted by the extensionist in advance. These contacts, and Government policy, influence his choice of the topic and the planning of the campaign. Those villagers interested in this particular offer attend the meetings; others have no reason to be there.

The interaction between extensionist and farmers, in this case, takes on the nature of instruction. The extensionist answers the question 'How can I solve the white grub problem in my potatoes?'. The existence of the problem, its importance for all farmers/villagers and its precise identification are considered known to the extension service. The farmers' previous knowledge of it, and possible solutions envisaged or even developed by (some of) them, are not explicitly taken into consideration.

# 'El Montanero': participative diagnosis

A colleague of the previously mentioned extensionist, using the same approach, hits upon the same problem in 'El Montanero', a village not far from 'El Monte'. Potatoes are affected by the white grub, and most villagers grow potato.

Back at the District Office, he plans a campaign similar to the one in 'El Monte'. However, some doubt creeps into his mind as to the relevance of this particular campaign to the majority of the farm families in the village. Together with his superior, he decides to add one more component to the campaign: a meeting during which the agricultural situation in the village may be analysed, and priorities may be weighed. This participative diagnosis will be held after the promotion, but before the first campaign meeting.

In order to implement the diagnosis, they take with them a series of 14 slides which represent the most important agricultural problems facing the farmers. The series includes slides of white grub, infested potatoes, poor grazing areas, undernourished cows, vaccinations, a simple installation for providing mineral salts to the cattle, layering wheat, inadequately pruned fruit trees etc. The extensionist and his superior try to include as wide a range of relevant agricultural activities and problems as possible in the series.

The meeting is attended by some 45 farmers, men and women from the village. In his opening remarks, the extensionist explains the objective of the evening. After that, he and his chief, who took an active interest in the matter, limit themselves to showing the slides, asking questions and stimulating discussion among the participants. With each slide, the following questions are put to the meeting:

- Do you recognise this? What is it?
- Does it occur in this village? Are there any problems related to it here?
- How important is this (problem) to you in comparison with others mentioned this
  evening?

Even if the farmers ask direct questions, the extensionist refers them back to the

group: How do the others view this? What do you do about it yourselves? The extension chief, in particular, sometimes has a hard time in refraining from answering the questions. After all, he is supposed to be the expert, isn't he?

After two hours of intensive discussions, the meeting has reviewed most of the agricultural and agriculture-related problems affecting the village. By raising different opinions and analysing them in the group, the extensionist realises that the village community commands a much higher level of technical background knowledge than he originally assumed. His chief is particularly impressed by the understanding of technical matters demonstrated by the villagers.

The extensionist now asks the participants which of the agricultural activities/problems has to be tackled first. Which topic should be addressed first by the agricultural extension service?

After a short discussion, it is agreed that dairy cattle husbandry is the most important activity for most of them, and also that the use of mineral salts causes serious problems. Although the farmers are convinced of the need of providing the cattle with minerals, many of them have observed diarrhoea in their animals after they have consumed the salt, so they stopped. Besides, some confusion exists around two different colours of salt available commercially. Some farmers believe that salt of one colour is the right one; others believe the other to be better. Also potatoes are grown by everybody in the village, mainly to prepare the soil before sowing new pastures. For most people in the village, dairy production appears to be their main source of income and concern.

It is agreed that a meeting and one demonstration will be dedicated to the topic of properly administering mineral salts to dairy cattle. At the meeting, the extensionist will clarify the different types and colours of salts available and their uses. He will also comment upon the importance of administering the salt properly in order to avoid undesirable side-effects like diarrhoea. A practical demonstration on how to administer the salt will subsequently be held at one participant's farm. The date and place of the meetings are decided upon immediately.

In this second example from the field, the extensionist has increased participation by the villagers through introducing a participative diagnosis. Forty-five people from the village have contributed systematically to the decision-making process. The first impression held by the extensionist, i.e. that the white grub in potatoes was a problem, was correct. However, weighed against other, more pressing ones, dairy cattle husbandry was indicated by the villagers as priority area number one for extension activities.

In this way, the interaction between the extensionist and farmers assumes the character of a dialogue. 'Which problems exist, toward the solution of which the agricultural extension service may contribute? What exactly is the problem? What has already been done about it locally? Which sector or problem has to be tackled first? How, when and where?' Not an open, uncommitted conversation, then, but a deliberate, combined effort to establish the link between the need for information and instruction on the part of the farmers and what the extension service has to offer. The knowledge and opinions existing within the farmers' community are made

explicit and provide the basis for determining extension objectives, messages and programming.

#### 'La Montana': participation through organisation

In the neighboring village of 'La Montana', a group of farmwomen has been organised. A special programme of the national agricultural extension service guides and supports the group. During their first years, the group was using 'participative diagnosis' techniques in order to formulate more precisely their problems and articulate their needs as far as agricultural extension is concerned.

The group was originally organised around the fattening of pigs, but has gradually been taking up more activities. That is how contact has been made with the public health service which, at the request of the group, has organised an extension programme in the village on first aid. Also, two younger women from the village have received additional education on the topic and are now performing first aid services at village level.

The agricultural extension service has been asked to initiate an extension campaign on fruit crop growing. The first meetings were held and, some time ago, demonstration plots were established with members of the group. Progress is monitored closely, not only by group members but also by other villagers. Although these initially looked upon the development of the women's group with apparent reserve, they now seem to be becoming more and more interested. Encouraged by their previous success in cooperating with the extension services, the women make plans to take on other activities as well. Marketing of their produce is one of these.

In this third example, participation takes on the form of organisation toward a certain (set of) goals. Training and extension activities with the group, from the very beginning, are geared towards creating autonomous user groups, capable of independent problem identification, prioritisation and decision-making.

In this case, agricultural activities in which the participants could profitably engage formed the basis for group formation. Initially, the extension service plays an important role in guiding the group. However, it plans to reduce its involvement systematically. As soon as the group shows itself capable of articulating its needs and channelling this information through to the relevant institution, the extension service gradually withdraws from the scene. Its task becomes one of providing information on certain topics, as one of many bodies with which the farmers' community deals.

#### Discussion: participation, influence and effectiveness

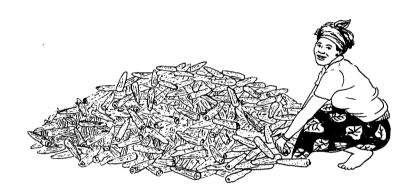
Some form of participation is present in all of the three situations roughly sketched above. The different forms vary widely, however, both in scope and intensity. At the one extreme, we see the farmers simply attending the meetings programmed by the extension service. At the other, we see the group growing toward a point where they

autonomously analyse their situation and call in the extension service they see fit in the particular case at hand, asking it to perform a specific, well-defined task for them. In the former case, the initiative lies completely in the hands of the extension service; in the latter, it lies with the organised farmers/farmwomen. Between the two extremes, we find the extension service adopting methods like 'participative diagnosis' and flexible planning, in order to increase the possibilities of the farming community effectively to influence the setting of extension objectives and content.

In fact, between the extremes mentioned above, we find an infinite number of possible forms of participation. Of these, I have only mentioned one. Many more exist around the globe, and effective ones at that. However, within the scope of this article it is impossible to do justice to the diversity of forms found in actual practice. It is up to the readers to evaluate their own extension efforts in terms of participation: How far do farmers/farmwomen indeed take part in the formulation of extension targets, the content and programming of extension activities? Up to what point does policy allow for such influence, or even encourage it? Which extension methods provide the best results in terms of participation and influence?

While comparing the situation in 'El Monte' with the one in 'El Montanero', we may appreciate the dangers to which an overly self-centred extension service is exposed. Objectives tend to be set, messages developed and means implemented according to an inherent institutional logic, which may become disarticulated from reality as it is experienced by the farming community. A more active participation by the farming population in 'El Monte' could possibly have resulted in a more relevant choice of extension activities. In effect, the intensification of participation in 'El Montanero' caused an important reduction of costs, as extension activities could be directed more accurately toward the farmers' needs and, at the same time, could be reduced by weeding out meetings on topics already known to the majority of the farmers in the community.

The case of 'La Montana' underscores the role of farmers' groups in articulating extension efforts to the needs of the farming community. This is particularly relevant to developing countries, where strong and widespread farmers' organisations - such as the ones that are at the base of Dutch agricultural development, to mention only one example - are mostly lacking. For this to happen, farmers' participation in decision-making must be actively pursued by rural extension services, through the use of approaches and methods which increase the influence farmers can exert upon extension programming. The cases of 'El Montanero' and 'La Montana' may help to indicate not only the desirability of such an approach, but also its feasibility.



# APPROPRIATE TECHNOLOGY FOR GRAIN STORAGE IN TANZANIAN VILLAGES

# Community Development Trust Fund

Community Development Trust Fund of Tanzania, P.O. Box 9421, Dar es Salaam, Tanzania.

A project to improve small-scale grain storage at village level was undertaken by a team composed of staff of the Community Development Trust Fund, the Institute of Adult Education and associates of the Economic Development Bureau. The work was carried out in the village of Bwakira Chini in Morogoro District, Tanzania. The goal of the project was to develop, in the course of discussion meetings with villagers, improved designs and strategies of grain storage appropriate to local conditions and to begin implementing these improvements. This article focuses on the approach taken to attain this goal.

#### 1. INTRODUCTION

# Project background

The idea for the grain storage project began in 1975, when the subject arose in discussions held in Dar es Salaam between the Community Development Trust Fund (CDTF) of Tanzania and the Economic Development Bureau. These discussions centred on ways in which participatory methods could be used in implementing village development projects in Tanzania. In May 1975, peasant farmers throughout the country were preparing for the first harvest of the Kilimo cha Kufa na Kupona (Life or Death Farming) Campaign, the objective of which was to increase the nation's capacity for self-sufficiency in food production. This campaign followed two disastrous harvest seasons which saw the country spending its entire foreign exchange reserves on food imports.

With reports indicating that a good harvest would be forthcoming from the first Kufa na Kupona Campaign, attention shifted to the question of food-crop storage. Would the result of this harvest be safe and properly looked after, or would the efforts expended to increase production be negated by heavy storage losses? The extent of storage losses in traditional structures was said to be between 25 and 40%. CDTF field officers had seen these losses on their village inspections and had often heard peasants mention crop storage as among their most pressing needs.

It was decided that the food grain storage problem needed urgent reviewing. The question was how to attack this enormous problem. CDTF believed that villagers themselves can go a long way toward solving their own development problems (be they grain storage, domestic water supply or anything else) on the basis of their own

skills and resources. It was proposed to attack the storage problem guided by this philosophy. Thus, it was necessary to begin by looking at the existing storage structures and systems being used by peasants in Tanzania and to build improvements together with the peasants on this basis.

#### Project preparations

Preparations, which began some six months prior to actual project commencement, included selection of the project site, collection of resource materials on storage and formation of a working group. Although these preparations were spread over six months, they probably did not add up to much more than 40 man-days labour input.

Selection of project site. Food grain storage problems are common throughout Tanzania, though they vary in type and degree from one area to another. Thus, there was hardly any place in the country that could be excluded as a possible project site. After some consideration and consultations with the Institute of Adult Education (IAE), it was decided that the project should be located in Morogoro District. The factors which contributed to this decision were:

- all the major food grain crops (maize, sorghum, rice) are cultivated in this area;
- the Faculty of Agriculture and the Ilonga Agricultural Research Institute, which is the centre for storage research in Tanzania, are both located nearby;
- communications with Morogoro from Dar es Salaam (headquarters of both CDTF and IAE) are good; much travelling would have to be done and it was important that this take up as little time as possible;
- it was felt that the District Authorities in Morogoro were sympathetic to the objectives and to the approach which the project proposed to employ.

It was left up to the District Authorities to choose the specific project village within Morogoro District. They chose a place where storage problems and the resulting losses were known to be great. Two preliminary visits were made to the village to collect some basic data on the environment and crop production and to inform the villagers of the pending arrival of the team.

The working group. A working group composed of representatives of CDTF, IAE and the Morogoro District Authorities was formed prior to the start of the project. Together with the two Economic Development Bureau associates who joined at the beginning of the project, this working group formed the core of the team which went to the village.

An attempt was made to stimulate a pre-project 'dialogue' about both storage problems and the proposed methodology among the participating institutions and with other Tanzanian institutions concerned with food production and storage. The project proposal was mimeographed and dispatched to 15 institutions in Tanzania. In addition, personal contacts were made and discussions held with most of these institutions. Out of these discussions emerged valuable information concerning the state of knowledge about traditional storage facilities used in Tanzania and the

extent of losses incurred. People were also identified upon whom the project team could call for technical advice and consultation during the project.

# Time period

The team spent a total of eight weeks in the village from the beginning of July to the end of August 1976. The months chosen for the project coincided with the harvest season in the village, when interest in storage was at its height. It is doubtful whether such great human resources could have been mobilised around the problem of storage at another time of the year. Though the villagers were rather busy, they were engaged in activities related to the issues being discussed in the project.

The period of eight weeks which was available had both advantages and disadvantages. Compressed into this short period, the developments which emerged from the dialogue were visible and became part of the consciousness of all who participated. The villagers realised the possibility that they could make real changes, and the impact and results obtained could be directly attributed to the methods used.

On the other hand, the time constraint meant that the team could not always wait for the level of group consciousness to rise to a certain height of understanding about a particular problem before moving on to another one. The time allotted for identifying and examining in depth various storage-related themes for presentation to the discussion groups was insufficient and, therefore, may have affected the richness of the dialogue experience for the villagers.

#### 2. THE VILLAGE DIALOGUE APPROACH

This project was as much concerned with the way in which to go about finding solutions to food storage problems as with the solutions themselves. The team felt that 'correct' solutions could be found only by using an approach that could stimulate the villagers' own creativity. This approach was 'village dialogue', which put the team in contact with villagers' perceptions of the grain storage problems. The team aimed not to impose an alien analysis of the problems on the villagers but to work from the basis of their perceived and understood reality. In this section, we shall describe village dialogue and how it was used in this project.

# Village dialogue

Tanzanian policy encourages mass participation in decision-making and the use of adult education as a vehicle for liberation. The relationship among adult education, participation in decision-making and liberation has been acknowledged for some time by Tanzanian planners. In particular, the discussion group approach was developed in Tanzania during such national adult education campaigns as 'The Choice is Yours' (1970), 'Man is Health' (1973) and 'Food is Life' (1975). Such discussion groups provide the possibility for engaging in 'the social act of naming the world' (Freire), through which individuals' awareness of their own reality increases

as does their confidence that they can themselves improve their situation. When discussion groups are also action/implementation groups, a balance between reflection and action is obtained and it is possible to mobilise human energies on a vast scale. Tanzania has seen proof of this in the thousands of pit latrines dug by discussion action groups during the 'Man is Health' campaign.

The methods used in this project were grounded in the experience of the discussion group approach in Tanzania. The team attempted to elicit from the villagers in a series of discussion meetings their perception of the reality surrounding village food supply and storage problems. A special committee on storage was appointed by the Village Council to help conduct discussion meetings and sift through the mass of ideas thrown up by these meetings. Such close liaison with a self-selected and voluntary committee of villagers was a vital check on the team's possible misunderstandings of the villagers' perceptions expressed during the meetings and was an invaluable contribution to understanding the problems in the context of village reality.

With the help of the Storage Committee, the team systematised what came out of the village meetings and gave this back to later meetings in the form of visual summaries or 'codes': large pictures drawn by a team member (Fig. 1 and 2). Such codes are thought to help discussants step outside of their immediate situation and view it more objectively. They also serve to focus the discussion on a particular significant aspect of village reality and thus help the villagers unwrap or decode it and thereby gain a more critical understanding which forms the basis for action.

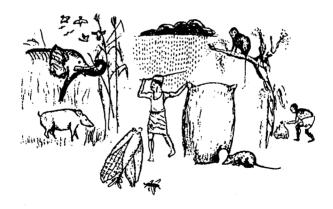


Figure 1: Code of food and storage problems

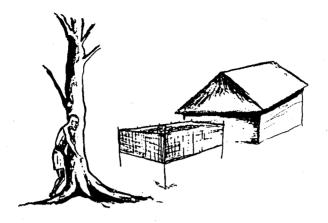


Figure 2: Code of crop theft problem in outside storage

The team systematised and returned everything the discussion groups mentioned as ways they use to protect grain and the reasons they gave for using these methods. In giving such knowledge back in systematic form, the team hoped to build up the villagers' confidence in themselves. They were able to see themselves as possessing a concrete science and technology.

It was only at this point, according to the dialogue method, that the team could begin to make contributions of science from outside the village. Having prepared carefully the villagers' confidence in their own resources, the team together with the Village Storage Committee could then present possible modifications or recombinations of existing technology. As a result of the preparation, villagers' reactions to the outside suggestions were, in most cases, critical. They were not overwhelmed by such suggestions and forced into passiveness. Instead, they were able to pick and choose among the elements of their own and the other storage systems which were introduced. In this way, the systems which they finally designed were, in fact, their own systems and therefore easier to put into practice.

To summarise, the team together with the Storage Committee had the following functions in the village dialogue:

- to examine the situation in the village and to identify storage-related themes;
- to present these themes to the villagers in a dialogical manner;
- to systematise the information gathered during discussions and return it to the groups; and
- to participate in the action which grew out of discussion.

# Formation of the Storage Committee

The first real step of the dialogue was the critical task of forming a Storage Committee in the village, which could be integrated together with the team. The Committee was chosen at an extra-ordinary meeting of the Village Council, during which the team explained the aims and intentions of the project to the village leadership.

The selection process for the Storage Committee largely predetermined its composition. The membership of the Village Council was almost entirely made up of the richer and more influential peasants, with only token representation of the poor and of women. Given the task of selecting the Storage Committee from among its own membership, the Village Council inevitably appointed the rich or 'progressive' farmers who were more aggressively interested in agricultural innovations. There was a danger, therefore, that the Committee might merely turn into a vehicle for these 'progressive' elements to make storage improvements which were appropriate to themselves alone and not the broad base of poor peasants in the village. The team members were aware of this danger from the beginning and carefully helped steer the Committee to the 'mass approach' by continually emphasising the need to hear from all types of villagers and to design improvements which would meet their varied needs. The political commitment of the team was extremely important on this issue, as the content and direction of the dialogue depends on the political intent and input of those who identify the themes and lead the discussions.

The Storage Committee was an important vehicle for entering into the reality of the village. The Committee also worked closely with the team planning meetings, listening to tape recordings of discussion group meetings and screening the many ideas and designs that surfaced from the dialogue. The job of leading the discussion group meetings fell solely upon the Storage Committee. They tended to dominate the early discussions but, later, as their appreciation of the method grew, their skills sharpened and their self-confidence increased, they learned to lead rather than dominate.

#### Organising the discussion groups

For the purpose of conducting the dialogue, the Storage Committee divided the village into four distinct zones of settlement. This was an alternative to the original idea of conducting the discussions in the existing ten-family adult education study groups. The team had thought that these small adult education groups would have a higher level of cooperation than the larger, less permanent zonal groupings and, therefore, a greater possibility of discussing and implementing real changes. The Committee, however, noted that discussions could not be held with all the small adult education groups in the short period of time available. They stressed that full coverage of the entire village was essential to our work. In the final analysis, the Committee proved to be correct. The full coverage provided by the larger zonal groups was important in understanding village reality and preparing the 'mass base' for the implementation phase.

The Storage Committee was disappointed by the poor attendance of villagers at some discussion group meetings. On occasion, they even went to the extent of 'rounding-up' potential participants. When this happened, it could be attributed more to poor organisation and preparation than to lack of interest on the part of the

villagers. In spite of the problems encountered, one can argue that attendance was in fact very good, considering the time devoted to participation during the busy harvest season. The villagers put a total of some 900 man-hours into the formal discussion meetings alone. It was only the dedication of the Storage Committee members which made this possible.

## Eliciting village reality

Village life is a unity; its analysis requires consideration of the constituent parts in relation to the whole. In trying to identify grain storage problems, the team was first led back by the villagers to the crop production system. Discussion groups told us, for instance, that any improved storage system must provide for home-drying of grain at least as efficient as that presently used. But why is home-drying important? Because maize is harvested while it is still moist. Why is it harvested in this condition? Because farmers cannot protect the crop from destruction by wild pigs. But can nothing be done about the wild pigs? This requires a level of cooperation the villagers themselves say they do not yet enjoy.

Such an example highlights three important reasons why the dialogue approach places such a problem area as grain storage in the context of the total village reality:

- 1) The significance of some seemingly technical detail of a development problem can easily be misunderstood. For instance, well-meaning experts might have argued that farmers should not harvest their maize while moist; they should let it dry in the fields and then store it in such and such a way. Such an unfortunate common 'outside' approach would be bound to fail because it lays down rules for the farmers and takes no account of the reality of wild pigs.
- 2) The dialogue approach generates awareness of interrelated development problems that can be taken up in turn. For instance, the planning committee of the village had already discussed block farming in relation to the problem of protection against pigs. While outside the specific scope of this project, the dialogue method produces village awareness of interrelated problems and is thus a useful tool in village-level development planning.
- 3) By pursuing problems back to their origins, discussion groups confront what are sometimes called 'limit situations', i.e., points where they quite genuinely say, 'Tumeshindwa!' ('We have failed!'). By defining and objectifying limit situations and then by focusing human energy on them, they are ultimately overcome.

It is the experience of bursting through a previously limiting situation that constitutes the liberating effect of adult education. For instance, villagers at first thought that rats, like pigs, were uncontrollable. The dialogue accepted and posed the villagers' experience of rats as a limit situation. The team did not simply contradict the villagers, saying 'Oh yes, rats are controllable. You may not know how, but we, the experts, do.' Instead, the Storage Committee discussed the matter with discussion groups at length, until the villagers themselves realised that there existed in the village resources and skills that could be deployed in order to control rats.

#### Recording the dialogue

The project intended to sustain and develop the village dialogue with the help of both audio and visual inputs. All formal discussions in the village were to be tape-recorded and transcribed, and a summary of the analysis was to be made for distribution to members of the team and the Storage Committee and for inclusion in subsequent discussion group meetings. This proved impossible on account of the large volume of recordings and the fact that no experienced transcriber could be found.

Recording of the discussions was not abandoned and it proved to be a valuable input into the dialogue, even without transcription. Members of the team and the Storage Committee, either individually or in groups, frequently replayed the tapes of the preceding group discussions in order to sharpen their perceptions and deepen their understanding. In addition, members who had been unable to attend some meetings in the village could keep abreast of developments in the dialogue and add their own contributions.

Pictorial codes were drawn by the team's artist on the basis of discussions by the team and the Storage Committee on the progress of the dialogue. Wherever a theme in the dialogue needed expansion or clarification, a code was designed by the team as a whole in order that future discussion group meetings could focus on that topic. This method proved to be very effective in drawing out the kind of information that the discussion groups needed in order to expand their knowledge to the point at which they were ready to come to terms with their situation. It also served to stimulate discussion when it seemed to be lagging by drawing out contributions from individuals who had difficulty relating to the otherwise exclusively verbal dialogue. In this way, the breadth of the dialogue was expanded to include some people who were not accustomed to speaking at public meetings.

#### Role of women

The attendance of women at discussion group meetings and their participation in those meetings which a few did attend was very poor. This was the situation in spite of special efforts made by the Storage Committee to encourage more women to come to the meetings and to speak. Seating at the meeting places was re-arranged so that women could have a place to sit as a group in the circle instead of their customary place outside. In addition, the Chairman of the meeting intentionally tried to direct questions on a particular topic in order to elicit the opinions of the women. All this was to no avail. The team even had to give up on its attempt to involve a woman as Storage Committee member.

This lack of participation by women is one of the major shortcomings of the project. For, while it is the men who are responsible for building storage structures, it is the women who look after the produce once it is placed in the store as part of their role of maintaining the household. Only the women have any idea about the condition of the stored crops or even how much food remains in the store. Thus,

women stood to gain more from the dialogue in terms of controlling their environment than did the men.

The attendance and participation of women at the village's normal adult education classes was much better than at the discussion group meetings held in this project. This may be because the women viewed the discussion groups as formal meetings in which they customarily do not participate. The presence of a number of prominent village leaders as members of the Storage Committee might well have enhanced this impression and increased the women's reserved attitude.

# Balance between reflection and action

Following the completion of the initial discussion group meetings during which the villagers discussed food and storage problems and their existing storage systems, the dialogue reached somewhat of an impasse both within the discussion groups and within the team itself. At the centre of this impasse was the question of whether or not some concrete attempt to demonstrate a solution to the storage problems expressed should be attempted at this point. The villagers themselves became impatient, insisting that their expertise had been exhausted and demanding that they be told by the team what they should do.

Even within the team, the opinion was expressed that it was time to show the villagers that the team really did have some answers to the storage problems. It was questioned whether this was not a reversion to the traditional 'expert' role of outsiders, mixed with an appetiser of discussions. It was decided that the team's contribution needed to be fitted into the framework of the dialogue which was emerging in the discussion groups and not superimposed outside of that framework, where its effect would be antidialogical.

Right up to the end of the team's stay in the village, there was a constant dialectic on the balance between reflection and action. There was always the danger that premature action would be carried out in an authoritarian manner, as the decision to act would be made by a few individuals and not through a consensus. Similarly, the dangers of inaction were great, as they could stall the project's momentum and not produce fresh material for the discussion groups to reflect upon.

At the start of the implementation phase, the question again surfaced as to whether the Storage Committee should build a 'model' structure at some public place in the village for everyone to see how to construct improved storage. The Committee argued for a long while but finally decided that its work was to produce real, usable improvements, however small, and that there was not one storage 'model' which was applicable to everyone in the village. Therefore, no models should be built, only improvements made on structures actually used by the farmers.

# Evolution of the dialogue

The sequence of actual discussion group meetings did not precisely follow a neat division among 'analysis', 'design' and 'implementation'. In practice, these areas of

discussion very much overlapped, with design questions leading to re-analysis of the problems and implementation requiring redesigning of improved storage systems.

Discussion focused on a variety of storage systems which would be appropriate for the rich, middle and poor peasants in the village. Rich peasants were more interested in a protected sun-drying crib; middle and poor peasants were more interested in a rat-proof, modified dungu (see Fig. 5). All groups generally embraced the idea of using insecticides on their stored crops.

#### Sharing ideas and experiences

Another important dimension of the dialogue method was to stimulate sharing of ideas among villagers, many of whom did not know what storage systems their neighbours were using. In general, there was greater sharing of ideas and willingness to experiment among the richer peasants. The poorer peasants, with less ability to bear risks, were more suspicious and critical of proposed ideas; however, when convinced of the benefits of an improved system, they began implementing with as much enthusiasm as their neighbours.

The actual design process involved much detailed discussion between members of the Committee and villagers about subjects such as types of hardwoods used for constructing dungus, experience of rat behaviour, and prior experience with insecticide. This interchange of ideas and experience among the villagers in the course of a village engineering design process was perhaps the most mobilising and enriching aspect of the project.

#### 3. SEQUENCE OF EVENTS

The project's work programme is shown in Figure 3. During the first three weeks in the village, the team was to undertake, through dialogue with discussion groups and through physical measurements, an assessment of the dimensions of the storage problem, its causes and the extent of village resources for solving it. Beginning in Week 3, a second round of discussion meetings was to look critically at the full range of technical possibilities open to the villagers and to make explicit the likely implications of each design or modification proposed. Near the end of Week 5, implementation was to begin. The system for evaluating the new constructions was to be activated in Weeks 7 and 8.

There follows an account of the real-time sequence of events in the village. Discussion groups did not necessarily limit their considerations to neatly defined topics such as 'causal analysis' or 'design range'. Discussions ranged more freely, and it was the task of the team, including the Storage Committee, to systematise the results of these discussion meetings. Implementation began in the sixth week.

Description of work	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8		
Dimensioning the probl	em xxxxxx	XXXXXXXX								
Resource survey	XXXXXXXXXXXXXXX									
Causal analysis	XXXXXXXXXXX									
Visual inputs	XXXXXXXXXXXXXXXXX									
Design range	XXXXXXXXXXXXXX									
Transcribing tapes		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
Design implications	xxxxxxxxxxx									
Construction					XXX	XXXXXXX	CXXXXX			
Report writing &										
reproduction						XXX	XXXXXXX	XXXXXX		
Instrument monitoring							xxxxxx	(XXXXXX		

Figure 3: Work programme of CDTF Village Grain Storage Project

#### Village Council and Storage Committee

During the first week in the village, the team met with the Village Council to explain its intentions, to discuss storage problems generally, and to ask the council to nominate a Storage Committee. The original idea of the Storage Committee had been that it would be constituted by two members from each of the five existing committees of the Village Council. However, the team also noted that it would be best if the individuals also had keen personal interest in storage problem. In fact, the Ward Party Secretary (Katibu Kata) and several village councillors immediately thought of individuals who were not only interested in storage but had undertaken storage improvements themselves. First among these was a former vice-chairman of the village, who was to become the Chairman of the Storage Committee.

Village councillors nominated others, not necessarily following the quotas suggested for representatives from the several committees. Subsequently, other interested persons asked to become members and still others were invited to fill gaps in the committee, e.g. the lack of elders (wazee). Two government servants were also included, the Ward Education Coordinator and the Ward Agricultural Extension Officer (Bwana Shamba) - later replaced by the Divisional Bwana Shamba when the former found it difficult to attend meetings. In all, the Storage Committee numbered ten.

After the Village Council meeting, the team met briefly with the newly constituted Storage Committee to organise a joint programme. The next meeting with the Storage Committee began by listening to some of the tape recording of the Village Council meeting and then developed into a wide-ranging discussion of the storage problem. A summary of this meeting is presented below because it demonstrates very well the level of consciousness of the Committee and shows also that many of the themes which emerged in later discussions were present from the start, if only in the minds of a few villagers. These themes became the base for a catalogue of

storage knowledge existing in the village, which became elaborated through the dialogue and continued to develop as local research was conducted by the Storage Committee.

## **Example of discussion within Storage Committee Meeting**

## Tape

# Counter Subject and Speaker

- One committee member recalls having seen a storage structure raised on only six supporting posts (this is significant, as the traditional designs use as many as two dozen posts, making it virtually impossible to protect from rats).
- Another committee member recalls seeing people dig trenches around their free-standing storage structures, across which rats could not leap (the team later learned that this innovation originates from a 1959-61 campaign in the area, especially around Kisaki).
- 118 Ward Education Coordinator expresses doubt as to whether a small committee on storage can really succeed in mobilising the people to improve storage.
- Reassurance by the IAE team member. He reiterates the Storage Committee's responsibility to engage the villagers in dialogue. Can they do this?
- 138 Chairman of the Storage Committee worries that the committee does not have the necessary technical knowledge.
- A committee member who is also a Muslim religious teacher and Village Secretary reminds the committee that, in his opinion, the villagers themselves have a great deal of knowledge of storage in their heads, although they do not practise it.
- Mentioned in this meeting: digging trenches, smearing used tractor oil on posts used in construction, use of bamboo for construction, warning against the use of bamboo which is attacked by insects.
- A committee member who was to become one of a core of four members who conducted experiments interjects that, although many people in this village know about the possibility of outside, free-standing storage, they are afraid to use it because of the presence in the village of thieves, especially young men who do not farm but just lie around and wait for a chance to steal.

- 168 Committee member: 'People shouldn't frighten one another away from development!'
- Ward Education Coordinator notes that even if one builds an outside structure, it will still be within the home compound and therefore relatively secure.
- 178 Committee member asks the outside team about its technical contribution.
- AEI team member re-emphasises that we are not bringing a previously worked-out design or solution, but want to work with the Storage Committee in taking the existing storage technology and improving it with small modifications.
- 213 Committee member who is also the Ward representative to the Divisional Development Committee emphasises that we must end up by building something. Words are not enough. Action is required.
- Chairman of the Storage Committee returns to the problem of rats and the indefensibility of the storage system *inside* a house. People must move their storage *outside* the house. Other committee members agree.
- 223 Committee member notes that large storage containers (*lindo*) are made by sewing the bark of certain trees into cylinders. This is adequate for rice which doesn't suffer much from insects. For other grains, there is also an insect problem, not just a rat problem.
- Ward Education Coordinator proposes that our goal should be more permanent storage structures than used at present. He lists four hardwood trees he says are very permanent.
- Team member asks why the people don't already use such trees in constructing their storage.
- Committee member answers that the villagers do not harvest enough to trouble themselves about storage.
- Another committee member says that people do use these hardwood trees for their houses.

These excerpts are significant for the light they shed on the Storage Committee. In this meeting on 10 July 1976, one hears many anxieties expressed: the people will not build outside their homes because they fear thieves; the people do not harvest enough to worry about improved storage; rats cannot be controlled inside houses;

the Committee does not have adequate technical understanding of the problem. Against these anxieties there is also expressed a wealth of experience with storage improvements and an underlying confidence in the people's good sense. The Committee is obviously a group of people with considerable experience. They are not, on the other hand, people with very much formal education. They are mostly farmers, and such people are to be found in all Tanzanian villages.

Five weeks later, members of this Committee were busy cutting out rat-guards from old paraffin tins (madebe) together with farmers from a section of the village where greatest initial resistance to the idea of outside storage had been encountered. Half a dozen new outside structures had been started by these farmers. Committee members visited these and discussed with farmers structure modifications that would minimise the number of supporting posts and hence the number of rat-guards required. The Committee had become very self-confident. It had become a smoothly functioning team of villagers that took existing knowledge from fellow villagers, systematised that knowledge and put it together with knowledge from outside the village. The committee had developed a continuing relationship with such outside resources as the University Agricultural Faculty in Morogoro and knew how to demand knowledge and support for future storage improvements when required. One of the major results of this project is the creation of the Storage Committee as a continuing human resource.

#### 4. OVERVIEW OF RESULTS

From the start the efforts of the external team were combined with those of a village ad hoc Storage Committee appointed by the Village Council. In the course of more than 20 formal meetings over eight weeks, clear lines of low-cost improvements of existing grain storage structures and methods emerged from the people themselves and were systematised by the Storage Committee. This process involved discussions with villagers concerning the nature of storage problems, their causes, dimensions and significance within the full range of food problems and priorities in the village. Existing village structures and methods of storage were elicited and discussed critically. Since the village is composed of many tribal groups, a rich variety of structures and methods existed, but had not necessarily been shared even by close neighbours. This existing range of storage technology was combined with inputs of low-cost storage technology developed in other countries such as Nigeria and Mexico. Further discussions ensued during which the 'foreign' technology was criticised, modified and added to the stock of possibilities already known in the village.

Modifications in grain storage systems. Three major streams of modifications were agreed upon by groups of villagers who started implementation under the supervision of the Storage Committee:

- Improved Sun-drying Crib: outside, sun-dried, insect-protected, rat-proofed, elevated storage (Fig. 4);
- Improved Dungu: outside, fire-dried, insect-protected, rat-proofed, elevated storage (Fig. 5);
- Kihenge: inside, fire-dried, in-roof (dari) and subsequent transfer to rat-proofed, insect-protected woven cylindrical storage (Fig. 6).

These three modifications of existing storage systems correspond to the expressed needs of peasants having different socioeconomic positions, resources and harvest sizes.

Benefits. Immediate benefits of the project include the construction of 15 improved, rat-proofed storage structures with a capacity of 25 tons of food grains in this harvest season, and the use of insecticide by 25 peasant farmers on some 12 t grain. The value of crops saved from destruction by rats and insects through these improvements during the first six months is estimated to be as high as Shs 10,000 (the approximate value of ten tons of cereal grains.)

Medium-range benefits include a greater awareness and understanding on the part of the villagers of the principles of grain storage and the technical and social variables which affect storage in their environment. In addition, the creation of the Storage Committee means that the village has a mechanism for evaluating and assessing the modifications made and a vehicle for the continued mobilisation of villagers in incremental improvements of their storage systems. The Storage Committee could also become a permanent manpower resource for similar operations in the entire Division, as well as in the village.

Long-range benefits of the project include the development of methods of village dialogue and participation for use by several Tanzanian institutions in training their rural workers and in running their programmes. Furthermore, the project's considerable documentation, including 25 hours of tape-recorded reflection by peasants on their own food and storage problems, is a rich source for the creation of post-literacy reading matter, radio programmes and other educational materials.

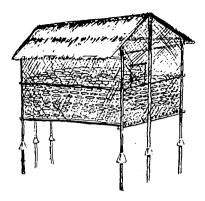


Figure 4: The improved sun-drying crib

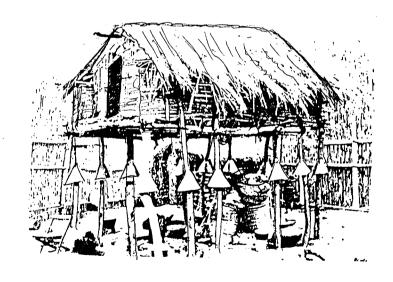


Figure 5: An improved 2-ton dungu with rat-guards

# Dari Kihenge

Figure 6: Inside, fire dried, in-roof (dari) and subsequent transfer to rat-proofed, insect-protected cylindrical storage (kihenge)



# FARMER-TO-FARMER WORKSHOPS ON SMALLHOLDER DAIRY COW RAISING IN THREE VILLAGES IN NORTHEAST THAILAND

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Farmers often develop different solutions to similar problems. When given the opportunity to visit each other's farms and discuss their different techniques, they can learn about other options which might improve their own farm systems. The researchers who facilitate and record these exchanges learn about the farmers' needs and interests, and can plan their supportive activities accordingly.

#### 1. INTRODUCTION

During Rapid Rural Appraisal (RRA) of small-scale dairy farms in Northeast Thailand (Simaraks 1985) under the Farming Systems Research Project and of dairy training for smallholders under the Ley Farming Project, it was noticed that - when farmers from different localities were allowed to converse among themselves in the village environment - they could effectively exchange their knowledge, identify their problems and suggest solutions to some problems. An experienced farmer could identify a drought-tolerant variety of grass and explain to peers from other villages how to establish backyard pasture.

Farming Systems Research (FSR) gives important consideration to participation of farmers in solving their own problems. With this in mind, researchers with the FSR Project at Khon Kaen University agreed to set up a series of meetings at which dairy farmers from three localities or villages, i.e. Ban Sam Jan and Ubonratana Land Resettlement in Khon Kaen Province and Ban Haui Rai in Chaiyaphum Province, could freely discuss their opinions and problems and visit each other's farms. The RRA study had revealed that the three villages had different management systems and different problems. It was speculated that the meetings would bring about exchange of knowledge and technology transfer between villages. In addition, the researchers hoped to develop an effective methodology of farmer-to-farmer extension from this kind of meeting.

The broad criteria used for setting the meetings, which were called 'farmer-to-farmer workshops' (hereafter in this report, simply 'workshops'), were that each village must have a turn to host the other two villages, the workshops should be arranged in village environment, and the researchers should have very little to do with the farmers' discussion but should act as facilitators by suggesting topics, encouraging wide and specific discussion, and should concentrate on data collection.

The main objectives of the workshops were:

- to give the farmers an opportunity to exchange their opinions, experiences, technologies and suggestions for solving their problems;
- to give the researchers an opportunity to understand the farmers' problems and management systems from their standpoint;
- to use this result as a base for future development of methodology for farmer-to-farmer extension.

#### 2. METHODOLOGY

# Phases of the workshops

The workshops could be divided into three main phases: introductory phase, farm visit, and group discussion.

Introductory phase. To become familiar with each other, each farmer was asked to tell his or her name, main family activity, number of dairy cattle, etc. The farmers were divided into groups of 7-10 persons from the three localities. Each group was asked to participate in a few activities designed to create acquaintance and unity among them. A few researchers were assigned to help organise the activities and the rest were assigned to observe and record changes of behaviour expressed by the farmers.

Farm visit. After completing the group activities, the host farmers in each group were requested to take their guests to their own farms and explain their dairy cow management or even demonstrate some skills. Meanwhile, the guest farmers were encouraged by the researchers to ask relevant questions.

Group discussion. The objectives of the workshops were to provide an opportunity for the dairy farmers from the three localities to exchange their opinions, experiences and guidelines for problem solving. It was therefore necessary that at least one farmer (usually more) from each village was in each of the three discussion groups. The participating farmers were selected from dairy farmers from each village by their leaders. Per discussion group, two or three researchers were assigned to act as facilitators and to record the discussions. About 26 farmers took part in the workshops.

#### Workshop activities

First workshop. The first workshop took place at Ban Haui Rai with the following sequence of activities:

 registration: the farmers and researchers were given name tags after informal self-introduction:

- group activity: the farmers were divided into three groups and played a few games to make them more familiar with each other;
- · farm visit;
- group discussion, for which the farmers were divided into groups.

The locations for the discussion arranged by the host farmers were school temple and village centre. Each discussion group selected their chairman. This workshop took a total of six hours (10 a.m. -4 p.m.).

Second workshop. The site for the second workshop was Ubonratana Land Resettlement. After the first workshop, researchers met and agreed that the group activity should be cancelled because a) it did not fit the age groups of the participating farmers, and b) the farmers already knew each other. The other modification was the restriction of the number of farmers in each discussion group for more effective discussion and data collection. The remaining activities were arranged as in the first workshop. The total time used was seven hours (10:30 a.m.-5:30 p.m.).

Third workshop. Ban Sam Jan farmers hosted the third workshop. Only slight modification was made. The number of participating farmers in each discussion group was reduced to 3-4 persons. After the second workshop, the researchers were able to identify suitable farmers for group discussion. Here, the farm visits included the old and new sites of the Ban Sam Jan dairy project. Since it was the final workshop, one more topic was added to the discussion: comparison of advantages and disadvantages of dairy management practices between the three systems.

## Discussion topics

Different topics were assigned to each workshop for discussion. The topics were derived from two main sources: from the key questions of each village dairy system obtained from the previous RRA, and from discussion with each group leader prior to the workshops. Thus, the topics were set according to predominant aspects and current problems of each dairy village. It was expected that good aspects of one village may be adopted by other villages, or problems existing in one village may be prevented from occurring in other villages. For example, Ban Haui Rai has a very good cooperative group. Having learned from this workshop how the group was formed, the farmers in other villages might follow this example. The set topics were as follows:

#### Ban Haui Rai:

- cooperation among farmers;
- feed supply for dairy cattle, especially backyard pastures and concentrates;
- management of fresh unprocessed milk for transportation.

# Ubonratana Land Resettlement:

- pasture-cash crop rotation (lev system);
- future plan after termination of the Ley Farming Project;
- problem of spoilt milk;

concentrate feed.

#### Ban Sam Jan:

- future plan after moving to the new site;
- · survival strategies;
- · improvement of pasture and concentrate feed;
- dairy herd size.

#### Data collection and report writing

Data collected by means of tape recording and note writing were compiled, analysed and summarised by a few assigned researchers. The results were discussed by all participating researchers through several meetings which included:

- one meeting after the first workshop to improve the effectiveness of the next two workshops;
- · one meeting after the final workshop for analysis of the results;
- one meeting on the report writing schedule;
- · one meeting on format and correction of the draft report;
- one meeting on final editing.
   Prior to the workshops, two planning meetings were held.

#### 3. RESULTS

Information obtained from the workshops was abundant. However, only important and relevant results are presented here.

#### Ban Haui Rai workshop

Farmer cooperation. Most farmers thought that cooperation was good in that it created unity, responsibility and a democratic attitude among the members and better bargaining power with government services. They would like to set up more cooperatives. All the farmers wished that they and other dairy farmers in Northeast Thailand were under one cooperative, supported by the government office concerned. The farmers from Ban Haui Rai had demonstrated a good cooperative system which was appreciated by all. The main reason for them to form a cooperative was marketing problems. Since the beginning of dairying, they had difficulties in terms of distance to market, seasonal variation of demand etc. They also realised that farmers from other areas did not have to take responsibility for marketing, which was provided by a government department.

Backyard pasture. Farmers from each village managed their pasture differently. Ban Haui Rai farmers preferred Guinea grass (Panicum maximum) in their backyard pasture, while most farmers in Sam Jan preferred Ruzi grass (Brachiaria ruziziensis) and some legume (Stylosanthes hamata cv Verano). The Ubonratana farmers grew mainly S. hamata and Macroptilium atropurpureum cv Siratro. Different management

systems stemmed from different sources of information, trainings, environmental conditions (e.g. topography), landholdings etc. Ban Haui Rai pastures were well managed, but the farmers complained about poor grass regrowth after several years of repeated cutting. They also complained that shortage of forage seed prevented them from expanding the pasture area. They thought that the pasture management techniques at Ubonratana could be applied at Ban Haui Rai.

Handling fresh unprocessed milk. Ban Haui Rai farmers transported their milk to the Khon Kaen University plant (105 km away) by bus each morning. Ubonratana farmers also delivered to the plant (75 km away) each morning, using a small truck provided by the project. Ban Sam Jan farmers delivered their milk twice daily (morning and evening) by motorcycle, but would like to use a pickup truck in future. Milk was kept overnight at Ban Haui Rai in plastic bags covered with crushed ice in an insulated container. Ubonratana farmers put milk cans overnight into an insulated case with blocks of ice. The farmers from Ban Haui Rai demonstrated a good example of cooperative work in handling fresh milk, which was appreciated by the farmers from the other two villages.

Other relevant information. Most of the farmers regarded concentrate feed as important for dairy cattle and thought there should be a government office responsible for support service in this respect so that they could easily buy concentrates at a reasonable price. They also wanted to try to preserve feed (fermented cassava chip) for their dairy cattle for the dry season when feed availability is limited. They acquired this knowledge from Ubonratana farmers.

# **Ubonratana Land Resettlement workshop**

Ley system. The Ubonratana farmers appreciated the ley system (rotating pasture and cash crop) because, after establishment of legume pasture in the first year, only gypsum and a small amount of triple superphosphate fertiliser were required every other year. They further explained that, although the legume may not establish well in the first year, in the following year it would outdo the weed, imperata grass. The legume was undersown when the cassava crop was knee-high; by the time the crop was harvested, the pasture was ready. Ban Haui Rai farmers thought it would be difficult for them to include Siratro in their cut-and-carry system, because Siratro is tough. The Ubonratana farmers, who had learnt to produce seed, offered Verano seeds to the Ban Haui Rai farmers in case of future need. After listening to the discussion, the farmers from Ban Sam Jan thought the rotation system was better than permanent pasture, which they had been using.

After project termination. The Ubonratana farmers indicated that they would continue dairying as a cooperative group after termination of the Ley Farming Project, but they wanted the university to assist them in milk marketing. Ban Sam Jan farmers intended to continue raising dairy cattle as their major source of income. They wished to have close relatives trained in artificial insemination in order to be more

self-reliant in this respect. They also wanted to organise into a cooperative. They suggested that many problems would be solved if the university would buy their milk without delayed payment. The Ban Haui Rai farmers said that dairying was secondary to cropping, but milk marketing took much time and labour away from cropping. The problem would be solved if the university would buy all their milk, leaving them more time from cropping and dairy cow raising.

Problem of spoilt milk. At Ubonratana, milk spoilage occurred more frequently than in the other villages because milk was not kept cool enough during overnight storage and transportation. The farmers wished the university could build a milk collecting centre or processing plant closer to their village. Ban Sam Jan farmers blamed the insufficiently clean milking procedure for milk spoilage. The Ban Haui Rai farmers concluded that milk spoilage was caused by mixing the evening milk with the morning milk, and also speculated that rising temperatures during the long transportation may also cause milk spoilage.

Concentrate feed. Ubonratana farmers fed concentrates according to milk yield, i.e., more feed for higher yield. The ingredients were derived mainly from locally available crop residues, e.g. cassava leaves, leucaena leaves, rice bran. Mineral mix was brought from the university through the Ley Farming Project. Ban Sam Jan farmers had been buying their concentrate from the university but a few farmers mixed their own concentrate according to the formula obtained from the Dairy Promotion Organisation of Thailand. They also fed concentrates according to milk yield. As they gave less importance to pasture, their production costs were higher than in the other villages. The Ban Haui Rai farmers gave less importance to concentrate feed because it increased production costs. They occasionally gave their milking cows leucaena leaves, rice bran and cassava chip, and said that regular mineral supplements were necessary.

Other relevant information. The farmers from Ubonratana and Ban Sam Jan sold part of their fresh milk to the private market, where they received a higher price (12 vs 6 Baht/litre at the university milk plant). However, the private market was not stable. Ban Haui Rai farmers sold all their milk to the university; they had previously experienced marketing difficulties and had no project to support them, so they were more concerned with market stability.

## Ban Sam Jan workshop

Future plans. The group from Ubonratana, where cooperative work was very weak, planned to strengthen their cooperation, especially in tackling the milk marketing problem. The Ban Sam Jan farmers, who were about to be relocated to larger landholdings with ownership rights, planned to build bigger cattle sheds and use dung to produce biogas. Some wanted to increase cattle holdings and expand pasture at the expense of paddy and cassava land. They reasoned that raising only a few dairy

cows was a high risk operation. The Ban Haui Rai farmers wanted to increase milk production slowly because they were uncertain about marketing.

Advantages and disadvantages of the three systems. Advantages of the Ban Sam Jan system were the short distance to market and low transportation costs, but support services (e.g. veterinary service, artificial insemination) were irregular. Although the Ubonratana farmers received loans without interest and other services from the Ley Farming Project, they suffered from transportation costs (long distances) and frequent milk spoilage. The Ban Haui Rai farmers had been receiving good supportive services from the nearby livestock station but had to pay high transportation costs and some of them had to pay back interest loans to the bank.

Other relevant information. The Ban Sam Jan farmers believed that pasture deterioration as a result of overgrazing could be remedied by adding manure. They were confident that they could survive even if the university stopped buying their milk. Most farmers from the three villages agreed that each family could not increase dairy cattle holdings beyond ten, because labour and land size were limiting factors. They suggested that the university should hold more of this type of workshop.

#### 4. DISCUSSION

#### Methodology

Group activity. The games introduced as group activity with the purpose of helping farmers from different villages become acquainted with each other were not suitable in many respects. Older farmers thought that the games were for kids. As there were too many farmers in each group, some participating members were not active, and the village meeting place was too small. Some researchers suggested that this type of group activity was suitable for students in a classroom or other types of people. If the farmers were left alone, they would have their own way of introducing themselves in accordance with their social context.

It was suggested that the group activity be changed into informal introduction among participating researchers and farmers. Therefore, the group activity was employed only in the first workshop. However, this does not mean that group activity designed to make participating farmers familiar with one another is not necessary. It is vital for group discussion because, if they are not familiar with one another, discussion will not go on. An appropriate activity should be introduced or developed for this purpose.

Farm visit. The objective of the farm visit was to allow the farmers to observe dairy and related activities. It was a very useful tool in the workshops. It provided opportunities for the host farmers to explain their reasons for their practices and their suggestions. It stimulated questions from the visiting farmers. The farm visit also helped generate interactions during group discussion. Nevertheless, the farm

visit met with varying degrees of success in each village. At Ban Haui Rai, this activity was considered less successful because the researchers lacked experience. The farm visit was done following the group activity, during which the aim of getting to know one another was not achieved. During the farm visit, the farmers were then trying to become acquainted with each other rather than concentrating on observing and asking questions.

The farm visit at Ubonratana Land Resettlement was successful. Here, the farmers were not divided into groups as had been done previously. The whole group visited few farms and were briefed by the manager of the Ley Farming Project. After briefing, they were allowed to interact freely. It was observed that they separated into small group unconsciously. Each group started discussion with the host farmers (while inspecting the pasture). The size and composition of each small group kept changing, depending on their interests. At this point, the researchers kept a distance from the farmers to allow them to discuss freely but, at the same time, could record the discussion. They noted, for example, that the Ban Haui Rai farmers were impressed by the ley rotation system and collected some legume seeds and grasses for their own pasture.

The farm visit at Ban Sam Jan was also considered successful. It was arranged like the previous visit. The host farmers were experienced farmers and had been raising dairy cattle as their major source of income. Moreover, the visiting farmers had a chance to compare between the old and new sites of the Ban Sam Jan group.

Group discussion. The group discussion in the village environment was very valuable to both the farmers and the researchers. The farmers felt comfortable when talking. The group discussions were managed slightly differently in each village. This may have had some effect on the result of the discussions.

In the first workshop, farmers were randomly divided. The better speakers and/or more experienced farmers dominated the others within a group. On the other hand, a group without active members could not generate much discussion. Therefore, in the second and third workshops, farmers were classified and divided according to such criteria as leadership, experience, speaking ability and sex.

The number of participating farmers was another problem. In the first workshop, there were too many farmers in a discussion group. This caused confusion and difficulty in recording. A chairman was appointed in each group to keep the discussion flowing. However, the discussion became more formal and distracted some farmers. In the next two workshops, 3-5 farmers were assigned to each discussion group according to the above criteria. This made the discussion more effective and every member became more active. The researchers could also facilitate discussion and record better.

Two to three hours were set aside for group discussion, but it took much longer. The farmers spent more time on the topics which they knew very well or with which they had some experience than on some other topics such as how to market their milk or improve their pasture. If there are more villages involved, this methodology

would have to be modified. All farmers should be allowed to visit each village in order to save time, budget and data collection.

#### Discussion of the results

It was notable that most of the farmers wanted to set up a cooperative group to obtain supportive services from the government. It is possible that supportive services are vital to dairy cow raising or that the farmers are used to free contributions from governmental or nongovernmental sources and want to exploit this as much as possible, or both. In any case, the government departments or projects concerned must be careful in giving supportive services. This should be done in such a way that the farmers are least dependent on the services.

According to the farmers' objectives, the cooperative would be classified into two types. The first is a permanent type for the purpose of obtaining the supportive services, such as facilitating the purchase of concentrate feed, mineral mix, seeds and fertiliser and provision of the required information. The second type is a temporary arrangement in order to solve problems in marketing fresh milk whenever these occur.

The importance of the seniority system within each village varied. Ban Haui Rai is an old village where the degree of kinship is high, so seniority is important. This was illustrated when there was a conflict within the group, and rules and regulations of the cooperative were violated. This had to be settled by the older members of the group. In the case of Ubonratana Land Resettlement, the villagers recently moved in from different areas, the degree of kinship is low and the seniority system plays a small role. Only a common interest such as milk marketing can attract the villagers to work together. Cooperative spirit is lacking. Similarly, the farmers in the recently established Ban Sam Jan are more individually oriented and seniority is less important. The rich farmers became money lenders for the poorer ones.

Nevertheless, farmers from all villages wanted to form a dairy cooperative group in order to help one another. They suggested that the government departments or projects concerned should enforce rules and regulations for the group. It is noted that this suggestion originated from the village where they could not enforce their own regulations. Village groups' lack of ability to regulate themselves may be caused by weak supervision by the project concerned.

Since the farmers from the three dairy villages received their training from different sources, they were managing their pastures differently. It is very difficult to conclude at this stage which management system is best. Each project had its own assumptions and objectives and designed the pasture management system accordingly. It is doubtful whether the farmers' objectives were included in the design. However, the farmers did not completely follow the lines along which they were trained. They made their own decisions and modified the technologies, such as the milk-cooling system at Ban Haui Rai. Now that farmers from each locality have learned from examples of other systems, it is hoped that they will improve their own operation from this opportunity.

Transfer of knowledge and technologies could be clearly noticed in the workshops, e.g. knowledge on collection of species of grasses or legumes by Ban Haui Rai farmers, ley rotation system, milk cooling system. Importantly, the farmers learnt from the workshops that they were not alone in struggling to solve their dairying problems.

#### 5. CONCLUSIONS

- 1) The workshops should consist of mainly two activities, i.e. farm visit and group discussion. After a simple introduction, farmers should be allowed to become acquainted with one another in their own way. An overnight stay with the host families is suggested but not necessary. If the farmers participating in the workshop are not familiar with one another, an appropriate group activity should be developed.
- This type of workshop could provide a channel for transferring knowledge and technologies among farmers.
- The workshops provided an opportunity for researchers to understand small-scale farmers and their decision making.
- The workshops are valuable for designing objectives and management of future projects.
- 5) This methodology is recommended for future projects in determining who are engaged or have interest in the same activity.
- 6) This methodology can be modified to suit different objectives and conditions.

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# FARMERS EXPERIMENT WITH A NEW CROP

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Farmers were having problems with the official wheat-growing technology until some began developing technologies of their own. It now looks as though future wheat production in Thailand will be based on their alternative technologies. John Connell tells how a 'minimalist approach to PTD' stimulated their development.

Thailand is a major rice exporter, but has no history of wheat growing. In view of rising consumption, the Government began promoting wheat in 1983, mainly in the irrigated paddy fields of the Upper North after the November/December rice harvest. The region is mountainous, and the paddy fields in small valleys and on lower hill slopes present a diverse production environment.

The recommended production technology was meant to avoid waterlogging in the paddy soils. It involved full soil preparation, raised seed beds, row seeding and furrow irrigation, but this led to problems. For instance, raised seed beds prompted farmers to irrigate by letting water flow unattended, overnight or longer, through the channels between the beds, leaving the soil completely saturated. The technology itself was viable, but would have required a long and costly training programme before it could be adopted widely by farmers.

Some of the extension agents did not promote wheat aggressively and were satisfied to enlist a few farmers interested simply in trying the new crop. These

agents were also aware of alternative technologies, e.g. broadcast sowing or minimum tillage, and suggested that the farmers also try these out on small areas. In the first village where farmers started doing this, 11 of 23 farmers who tried growing wheat used a total of 12 different component technologies. With 2 varieties sown in 4 distinct soil types, a total of 24 specific interactions of technology/variety/soil-type occurred in their fields.

Two factors stimulated farmer experimentation: technical options were presented to them, inviting comparison; and plots were kept small, limiting not only the farmers' risk but also the possible monetary return, so that their initial motivation for looking at the new crop was their interest, not cash.

In the following seasons (1988/89 and 1989/90), this approach was consciously applied in 13 villages through extension workers of various government and NGO programmes, and bilaterally-funded highland development projects.

# Farmer-developed technologies

At all sites, 15-50% of the farmers began investigating alternative technologies in the first year, and more in the second. Most farmers tried only one new component, but each village had at least one experimenter who compared two or more. The components investigated covered the whole range of management practices from soil preparation, through small equipment development, to irrigation. Most importantly, the technologies the farmers tried were not limited to the initial options presented. These were just the starting point.

Three key production technologies have emerged out the farmers' experiments:

- minimum tillage or direct drilling of seed into unprepared paddy soil, applicable
  where farmers have no access to tractors for tillage, or where weeding would be
  facilitated by row seeding;
- broadcasting seed onto prepared soil followed by harrowing to cover the seed, applicable where quick seeding is desired and farmers have access to tillage equipment/labour;
- dibble or hill-seeding, applicable in rainfed production on sloping land, usually by minority hill-tribe farmers.

Farmers in separate areas have converged toward these technologies with little outside influence on their decisions. While the main technologies have crystallised, farmers are still evaluating and modifying them. In one village, for example, farmers have used six harrowing methods, giving different seed cover and seed depth.

# Limits to farmers' technology development

Some limits to this unguided process of technology development could be seen. The farmers' evaluation of the technologies was hampered by their tendency to use the chosen technology over their whole field, so comparison could be made only with the

crop in a previous year or in a neighbour's field. The farmers often attributed crop performance to the most obvious difference in technologies, e.g. broadcasting vs row seeding, when some other factor such as irrigation practice actually had greater effect on yield.

An attempt was made to overcome this analytical weakness of the farmers. In a post-harvest meeting in one village, the farmers counted the number of people whose yields fell into each of four yield levels on a rough bar chart. On this basis, they discussed different management practices in relation to yields achieved. Thus, what had been learnt by individual farmers became common knowledge for the group, and factors which some farmers had not considered important were recognised.

# Toward participatory extension

Despite its limitations, this approach in the Thai Wheat Programme helped identify a number of viable production technologies. With these, farmers can expect to achieve grain yields of 2.5-3.5 t/ha in irrigated areas and 0.8-1.5 t/ha under rainfed conditions. These technologies have been applied in only a few villages so far, but all extension workers growing wheat this year were informed of them in a preseason workshop. It will be interesting to see how this information is used and what technologies now appear in farmers' fields.

This approach allows a step-wise adoption of participatory extension. If participatory strategies are to be widely adopted by government agencies, they must fit into the existing bureaucracies. Much participatory work has been done with special funds and committed workers, which government agencies find difficult to replicate. The Wheat Programme's approach could be adapted and better defined to permit its use for general extension of new crops and component technologies. This approach should appeal to extension departments on purely pragmatic grounds, as a means of delivering appropriate technologies to farmers in diverse environments, and stimulating farmers to generate appropriate technologies.

Adoption of such an extension approach would not require great changes in existing procedures. It would thus give extension departments experience with participatory work, preparing them to adopt more participatory strategies in the future. While the extensionists play a role in developing appropriate technologies, research institutions could then focus their scarce resources on the issues which farmers cannot handle well. The interaction between research and production could be facilitated by organising joint tours by scientists and extension workers to farmers' fields to identify any recurrent problems, and any farmers' innovations that could be added to the extension 'basket of technologies'.

Many PTD workers might regard this as a superficial attempt at participatory work with farmers. The extension-farmer contact (merely presenting technical options) may be minimal and there is little attempt to form farmers' groups. Extension workers could easily apply this approach mechanically with little of the mutual

respect between extension worker and farmers that is implicit in genuine participatory interaction. Even so, the approach does have two effects:

- it stimulates farmers' latent ability to experiment, and
- it tends to modify extension workers' behaviour to be less directive.

During a visit by scientists to the first village where this approach was used, the farmers enthusiastically led them from field to field, explaining the various technologies. The scientists then went on to another village 20 km away, where the extension worker had insisted that the recommended technology be followed exactly. And the crop was indeed excellent. But here the farmers stood by shyly, somewhat concerned whether they had done the right thing with the new crop, while the scientists did the talking, making comments and suggestions for further improvements. This approach then, in leaving the final choice of technologies to farmers, injects a minimal but effective participatory content into the extension work. Thus, the farmers experience a sense of accomplishment and self-determination from their investigation and adoption of new technologies.

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# FARMER-BASED METHODS: FARMERS' DIAGRAMMES FOR IMPROVING METHODS OF EXPERIMENTAL DESIGN IN INTEGRATED FARMING SYSTEMS

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Examples are given of how farmers' diagrammes can help set on-farm research priorities, improve experimental layouts and design integrated farming systems. While our examples concern the integration of aquaculture and other enterprises, the procedures are just as useful for those wanting to integrate agroforestry, livestock or any new enterprise into the farming system. These procedures are now being tested and refined in several projects in Africa, South Asia and Southeast Asia (Maclean & Dizon 1990). A great deal of research still needs to be done before quick and easy methods for many farmers to synthesise new integrated farming systems will be ready for wide-scale use.

#### 1. INTRODUCTION

Continued degradation in farmed environments and poverty in farm households challenge Farming Systems Research and Extension (FSRE) practitioners. Today's farming systems in South Asia have salinised 59 million ha of irrigated land and desertified 150 million ha of rainfed cropland. In Sudano-Sahelian Africa, 5 million ha are salinised and 142 million ha desertified. Each year 3349 ha in Africa and 1571 ha in Southeast Asia are deforested. In Africa and Asia roughly half the population does not get enough calories for an active working life, 30% of the children are malnourished and less than 10% enjoy access to sanitation (World Resources Institute 1988). FSRE practitioners must concentrate on designing new farming systems that rehabilitate or regenerate farm environments and economics.

Regenerative farming systems for degraded farmland need to integrate trees, fish, animals, vegetables and crop enterprises. Trees serve many purposes including protecting land and providing investment. Likewise, animals in an integrated farm provide inputs to other enterprises as well as meat, milk, hides and investment. Fish are valuable products and provide high-quality protein. Fish production systems recycle important nutrients and organic matter. Integrating such an array of enterprises on a farm gives not only greater economic security but also ecological protection. Diversity of flora and fauna spreads income and inhibits pests and diseases. Waste and byproduct flows between enterprises cut external input bills and

recycle nutrients (Lightfoot 1990). Farming systems of such diversity have been designed by farmers of old, but these are few and today forgotten (Marten 1986, Ruddle & Zhong 1988). The examples in this paper illustrate farming systems that integrate trees, fish, livestock, vegetable and crop enterprises. Much more research needs to be done if these kinds of environment-friendly systems are to become commonplace in degraded tropical ecosystems.

Farmers must participate in the design of integrated farming systems. A decade of designing integrated farming systems on research stations for farmer demonstration has taught this (Edwards et al. 1988). The multitude of options and compromises that each farmer must decide upon to finetune enterprises to farm circumstances dismisses simplistic notions of improved versus traditional technology trials.

Variety, fertiliser and cropping pattern trials dominate most national on-farm research programmes in developing countries. While no one denies the importance of understanding components, at some time the overriding environmental and management interactions must be taken into account. This is especially true where these interactions overshadow treatment effects. Fuzzy findings are compounded by the small numbers of farmers involved in on-farm trials. Most national on-farm research teams can barely cope with a dozen trials with 5-10 cooperators each. It is very hard to find national research systems with experiments on large numbers of farms that address environmental hypotheses at the farm system level.

Few scientists have written pleas for testing system level hypotheses with very large numbers of farmers (Sumberg & Okali 1988). Likewise, few have pleaded for the participation of farmers in the research process (Chambers et al. 1989). However, with the rapid rise in interest in environmental issues and enterprises like agroforestry, demands for participatory methods for system level change will increase.

We anticipate a demand for field procedures wherein very large numbers of farmers can quickly and easily participate in designing environment-friendly farming systems. Current methods of questionnaires and component technology trials limit participation in understanding and number. This paper advances the notion that farmers' diagrammes can improve field methods in on-farm research. Our methodological improvements are directed at increasing the number of farmers able to participate and orienting technology testing to the level of the entire farm system. We illustrate how farmers' diagrammes can help set on-farm research priorities, improve experimental layouts and design integrated farming systems.

#### 2. FARMERS AND VISUALISATION

The theory behind farmer diagramming is that illiterate farmers visualise better than they verbalise. Farmers see their farms in pictures; they can describe farms better by drawing than by talking.

Left and Right Brain Research has shown that different people have a proclivity to communicate with different types of messages. Here, we use Egan's definition of communication as the creation of a common understanding by the exchange of messages (Egan 1988). These communication differences are also related to the experiences and exposure of the individual. Recent research has suggested that individuals' memory references and subsequent communication concepts are linked to two distinct memory networks. One stores formal or semantic references, while the other stores experiences or episodic references (Tulving 1989).

This research has inferences for the process of communication between people with high and low exposure to formal education (Minnick 1990). Communication patterns of illiterate farmers rely primarily on concrete, visual, hands-on references whereas scientists rely more on abstract terms and symbols. To us it seems imperative that knowledge elicitation with farmers entail visual communication to ascertain their reality.

One technique that may be useful to us is the cognitive psychologists' notion of concept maps (Novak 1977). Where maps originate from farmer concepts, they portray their realities and associations of farm systems. Our use of this methodology has groups of farmers drawing concept maps of their experimental designs and farming systems. Pictures of the concept map at completion document farmers' perceptions for future communication references.

#### 3. PROCEDURES FOR FARMER DIAGRAMMING

Farmer diagramming procedures are extremely flexible. However, they require their proponents to have skills in eliciting information. A group of farmers is gathered in a comfortable place where there is plenty of flat ground to draw on. Large sheets of paper can substitute for the ground where farmers feel comfortable with pens and paper. The researcher, who should be accompanied by someone who will record and observe the process and products, explains what information is sought. This explanation usually requires researchers to start the drawing, maybe even providing a stick or seeds to start it off. As soon as farmers understand, however, they should take over and start afresh. From here on, researchers step back and farmers take over. During the process, researchers should be sensitive to who is participating and encourage the silent parties, e.g. the women. The whole process usually lasts up to about two hours. Many farmers can participate at the same time. Indeed, as many as 15 farmers can still form a workable group.

Although the drawing process is continuous, it is best described in phases. In the first phase, the method is explained to farmers or they are asked to help researchers understand their concepts. This is an important and often difficult reversal for those who are usually telling farmers what to do. The second phase comprises preparing the ground, or materials if pen and paper are used, to make the drawing. In the third phase, farmers are prompted to start the drawing. Soon, in a fourth phase, farmers will take over as their understanding crystallises. This usually manifests itself through farmers running around to find symbols for their drawing. In the final phase, the full drawing or farmers' concept map is recorded by the research team and verified by the group.

Eliciting knowledge from farmers is a skill that requires plenty of practice. Farmers must feel at ease. This can be helped along with humour. Humour encourages the self-conscious and less confident to draw. All attempts at drawing should be incorporated; there is no such thing as a bad drawing or someone who cannot draw. Encourage everyone to participate. Often the shy ones can be put at ease by offering praise. The drawing itself should be as large as possible and uncluttered. Elicit all the information needed for one element before going on to another. Be fairly mechanical about this. Clarity in the diagramme is also preserved by being specific about each element. Make sure any symbols represent the element precisely, as confusion can soon set in.

# 4. TYPES OF FARMER DIAGRAMMES

# Diagrammes for determining what technologies to test with farmers

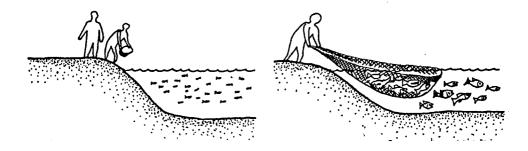
This example from eastern India shows how diagrammes of improved technologies can help determine what technologies to test with farmers. Groups of farmers were shown diagrammes of improved technologies. Each diagramme, which had been prepared by researchers on large sheets of paper, was explained to the group. They were then asked what changes they thought were necessary for the technology to work on their farms. After much discussion and with the changes made, the group was asked to select those technologies they would like to test on their farms. All the technology diagrammes selected were then shuffled and handed back to the group for them to sort in order of priority for on-farm testing.

One of the improved technologies entailed stocking fish into flood-prone areas called *chaurs*. The researchers' diagramme of this technology, as seen in Figure 1a, shows the farmer putting fish fry into the *chaur* in July and netting the fish in December and January. When the farmers saw this diagramme, they pointed out that some of the fish were not caught. Indeed, they worried that many, if not all, of the fry might escape during floods. The risks of loss were high. The group suggested a modification to this technology, which is shown in Figure 1b. Farmers would like to see some kind of net enclosure in which the fish fry could be placed and allowed to grow. They felt that this would ensure that what fry went in had a good chance of being taken out.

#### Diagrammes for determining how to test technologies with farmers

The following example from eastern India shows how diagrammes of experimental layouts and activities can help determine how to test technologies with farmers.

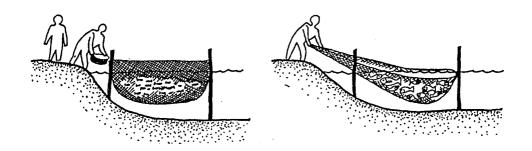
A farmer, while showing us a researcher-designed rice-fish experiment on his farm, asked how fish growth might be improved. We asked the farmer to draw diagrammes of the experimental layout and calendar of experimental activities over the year. In the experimental field, the farmer dug two trenches about 2 m wide and



Fish stocked in July

Fish harvested in December-January

Figure 1a: Researchers' design of technology for fish culture in 'chaur' areas, Uttar Pradesh, India



Fish placed in confined net in July

Fish collected in December

Figure 1b: Farmers' modified design of technology for fish culture in 'chaurs', Uttar Pradesh, India

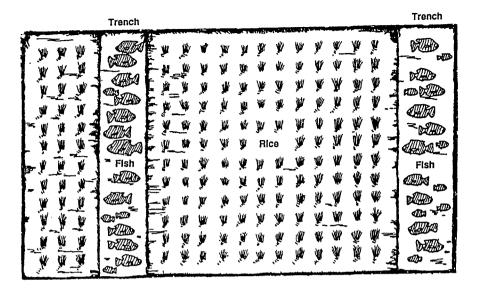


Figure 2a: Researchers' design for rice-fish experimental field layout, Uttar Pradesh, India

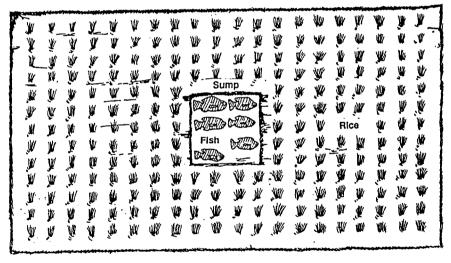


Figure 2b: Farmers' design for rice-fish experimental field layout, Uttar Pradesh, India

1 m deep (Fig. 2a). He transplanted rice in the first week of July and put in fingerlingsof rohu (Labeo rohita), catla (Catla catla) and bhakur (Cirrhinus mrigata) 15 days after transplanting (Fig. 3a). At transplanting and 45 days later, he top-dressed with urea. The farmer added cattle manure to the trench daily from transplanting until October, after which he applied the manure once a week. The rice crop was harvested in the last week of December. The fish were fed with rice bran and mustard oil seed cake daily up to November and thereafter on alternate days. In October, he added grass carp (Ctenopharyngodon idella) fingerlings because the rohu and catla were growing slowly.

When asked how he would improve the test, he drew another set of diagrammes. His experimental layout (Fig. 2b) showed a single square shallow sump, 0.5 m deep, in the middle of the field in place of the two deep trenches. His calendar of activities (Fig. 3b) showed rice transplanting in June rather than July, harvesting both rice and fish in the late November, and grass carp and *bhakur* fingerlings being stocked 15 days after transplanting. Manuring practices remained the same, but rice bran and oil seed cake applications were doubled. After harvesting fish, he will dig out the sump and plough the field in preparation for a winter wheat crop. This he hypothesises will result in acceptable fish yields in a shorter time, while maintaining rice yields. The additional wheat will also increase overall returns for the land and water resources.

#### Diagrammes for determining integrated farming system designs with farmers

The following examples from Vietnam, Bangladesh and Malawi show how diagrammes of material flows between aquaculture, agroforestry and agricultural enterprises can help determine the design of integrated farming systems.

Vietnam. Farmers' knowledge about interactions in their rice-shrimp system was elicited from four innovators who, with coloured pens on newsprint paper, drew pictures of land types, enterprises and flows between them. The whole process of explaining what was needed, giving examples and drawing the pictures took about 1.5 hours.

The obvious material flow of water from the trenches to irrigate vegetables on dikes made from trench mud and grown in rice straw mulch exemplified to farmers what we meant by material flows between enterprises. These, along with more complex transfers, are shown in Figure 4.

Immediately after trenching, chicken and cattle manure from the homestead are moved into the rice field trenches to induce phytoplankton blooms for the fish and shrimp to feed on. Although the shrimp diet is primarily natural, they are fed during their first two months with other farm-grown byproducts. Germinated rice grain, cassava flour and rice bran are typical shrimp feeds along with coconut and peanut oilcake, trash fish from the irrigation canals, and duck or chicken carcasses. Also placed in the trenches are mango and eucalyptus branches, which keep out cattle and poachers, and provide an undisturbed habitat which shrimps need.

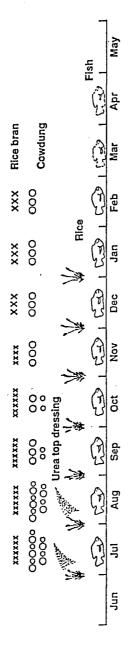


Figure 3a: Researchers' seasonal calendar of operations and inputs for rice-fish experiments, Uttar Pradesh, India

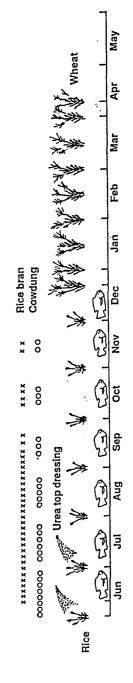


Figure 3b: Farmers' seasonal calendar of operations and inputs for rice-fish experiments, Uttar Pradesh, India

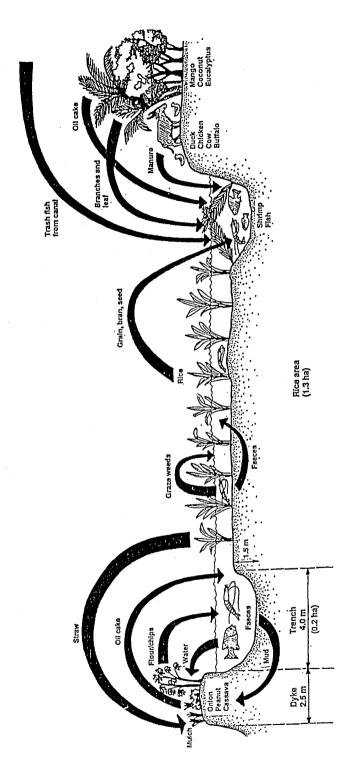


Figure 4: Material flows between enterprises of rice-dike integrated farming systems in Mekong Delta, Vietnam

Farmers learnt that rice crops benefit from shrimps in two ways: shrimps eat so many weed seedlings that weeding expenses can be reduced by one third, and chemical fertiliser application can be reduced by 30% without reducing rice grain yield.

Bangladesh. A widow's homestead had 24 broiler chickens, bees, pigeons, a fish pond and the usual trees, vegetables, and root crops found in Bangladesh homegardens. After inspecting each enterprise, we formed a circle with her and some ten neighbours to draw out on the ground all the enterprises and material flows between them. Using a stick, the widow drew boxes of each enterprise and then etched arrows between them to show material flows (Fig. 5).

We were told of manures collected from animal pens being placed in vegetable plots, rice fields, compost heaps and the fish pond. Tree branches provided support for vegetables crops and protection for the fish pond. The pond also provided irrigation water for an adjacent vegetable plot. Feed and fertiliser inputs for the fish pond were purchased, while home-grown rice bran was given to the animals. Similarly, other potential pond inputs like tree leaf, ash and compost were used in other enterprises.

From the diagramme, ideas emerged on better integration to reduce usage of some external inputs. The widow could reduce costs of external inputs and better integrate her pond if, for example, lime were substituted with household ash. Purchased fertiliser could be substituted by compost. Puntius may feed on tree or legume leaves just as well as purchased rice bran.

Malawi. Four farmers drew on the ground a diagramme of how fish ponds were connected to other enterprises on their farms. First, they outlined the pond and then named the materials that they put into the pond. The first drawing was made by etching the ground with a stick. This diagramme was abandoned because the many linkages became confused. The farmers started again using ash and, wherever possible, objects to represent the products of other enterprises that were going into or leaving the pond, as shown in Figure 6.

The farmers used fruits of guava, papaya and avocado to represent the input of rotten fruits into the pond. Leaves of leucaena, pumpkin, wild vegetables and cowpea represented the input of leaves into the pond. Some maize bran was used to represent its use as a fish feed. Other inputs like cattle, sheep and goat manure were represented by lumps of soil. The main outputs from the pond were sediments for the vegetables gardens, water for irrigating vegetables and, of course, fish.

During the process, farmers learnt of new inputs from each other. Some did not know that guava and avocado fruits were good pond fertiliser, others that fish would eat cocoyam leaves. That pond sediment could be used to 'fertilise' vegetable gardens was also new to some farmers.

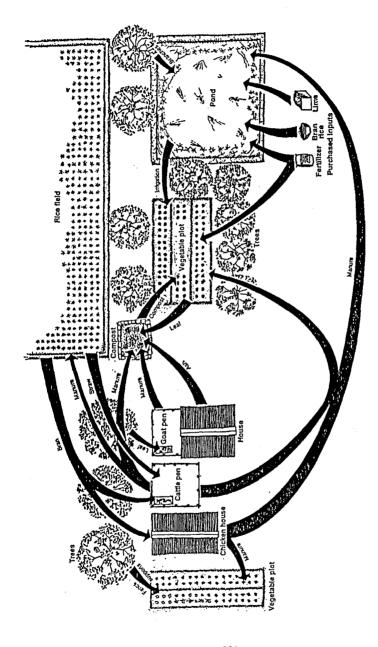


Figure 5: Material flows between homestead and ricefield enterprises of integrated farming systems in Mymensingh, Bangladesh

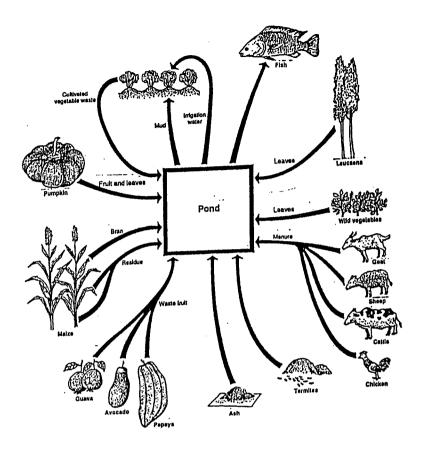


Figure 6: Material flows between fish pond and other enterprises of integrated farming systems in Zomba, Malawi

#### 5. CONCLUSIONS

We call for FSRE practitioners to concentrate on designing new integrated farming systems that rehabilitate or regenerate farmer environments and economies. In this, we anticipate a demand for field procedures wherein very large numbers of farmers can quickly and easily participate in designing these environment-friendly farming systems.

We advance the notion that farmers' diagrammes can improve field methods in on-farm research, because visual images, not talk, communicate to farmers. In drawings, everything can be seen at once, and mistakes can be easily and immediately corrected. Drawings stay on the ground for passers-by to join in and comment, garnering wider views and greater consensus. Farmers remember what they learn because the pictures stick in their memory. Researchers and extension workers learn about traditional knowledge. The diagramming process builds self-reliance and confidence among the farmers to incorporate new technologies from extension and become more active partners in the development process. Thus, we reverse the one-way flow of information from expert to farmer.

# Acknowledgements

We would like to acknowledge the scientists who helped us with the farmer interviews: in Vietnam Drs Nguyen Anh Tuan, Le Thanh Duong, Duong Ngoc Thanh and Nguyen Quang Tuyen from Cantho University and Mr O. Magistrado from IRRI; in India Dr Ajay Kumar from Rajendra Agricultural University, Pusa, Dr K. Tirkey from Birsa Agricultural University, Ranchi and Dr V.P. Singh from IRRI; in Malawi Dr R.P. Noble of Chancellor College, University of Malawi, Zomba and Mr S. Chimatiro-Phiri from ICLARM; in Bangladesh Drs M.V. Gupta and M.A. Ahmed from ICLARM.

At ICLARM, we thank Jay Maclean and Dr Roger Pullin for commenting on the manuscript and O.F. Espiritu, Jr for his fine artwork.

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# SMALL FARMERS IN AGRICULTURAL RESEARCH: FARMER PARTICIPATION IN POTATO GERMPLASM EVALUATION

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#### 1. INTRODUCTION

Why is it that rural people's knowledge, such an enormous and rich resource in poor countries, has been largely ignored by those countries' governments? Ignorance of farmers' own investigations into the local agricultural system can increase official research costs, delay the introduction of innovations and, in some cases, lead to quite inappropriate development interventions. One of a number of efforts to incorporate farmer experience and knowledge into the research process (cf. Farrington & Martin 1987) was undertaken at the International Potato Center (CIP) in the late 1970s and early 1980s, resulting in the formulation of a 'Farmer-back-to-Farmer' model of development research: the farmer works alongside the researcher in identifying the problems, working out possible solutions and subsequent technology testing and adaptation. If the technology is neither adopted nor adapted, it is a failed technology and both farmer and scientist go back to the drawing board (Rhoades & Booth 1982).

One of the great advantages of this model is, paradoxically, that it allows the research focus to go beyond agricultural production in a way that Farming Systems Research has not always managed. The original CIP research which led to the Farmer-back-to-Farmer model involved seed potato storage. More research has involved the study of peasant seed systems which include household seed management, production practices and a whole set of exchange relations linking

households and markets. The model builds on the fact that most rural people who farm also store and eat the food they produce and use byproducts as feed; many also process the food and exchange it in a market.

As a consequence of this comprehensive involvement in the food system, farmers are assiduous if opportunistic plant breeders, evaluating food plants as crops, as sources of family nutrition and as commodities. The existence of several hundred native potato varieties in the Peruvian Andes with a wide range of characteristics is due to the careful selection and subsequent evaluation by farmers of naturally occurring crosses.

Official germplasm improvement programmes have often lacked this broad, farmer perspective, concentrating instead on narrower production considerations, especially improved yield. Many of the new rice varieties, for example, were selected for high harvest index, raising yields but also severely reducing length of the stalks, which are a crucial source of forage during the dry season. Selections are also frequently made on research stations with near optimum conditions - very different from the circumstances of most small farmers. Where breeders are familiar with peasant farming, their secondary selection criteria may coincide with the farmers', but would it not be better to incorporate farmer criteria into the breeding process itself?

To understand the alternative perspective which farmers can give to breeding programmes, we introduce the farmer concept of 'the friendly potato'. This is a rough translation of the Spanish la papa simpática. The term 'simpático' is usually applied to a person and describes someone who is obliging, understanding, adaptable, one of the gang, in general, someone you like to have around. When applied to a potato, it seems to capture very well what farmers look for in a new variety - that it fit well into their food system. The term was coined by one of the farmers who participated in a series of variety trials organised by the Peruvian National Potato Seed Programme during the 1987-88 season. This paper presents some of the results of those trials and, in so doing, attempts to spell out in some detail what it means for a potato variety to be simpática.

#### 2. BACKGROUND AND METHODS

The Peruvian Andes is the centre of genetic diversity of potato (Hawkes 1978). The crop accounts for over 60% of the economic value of the fifteen major highland crops and it is the most important ingredient in the highland diet (Fano 1988). Potatoes are cultivated in diverse mountain ecologies. They are mainly grown on the steep sides of intermontane valleys and in depressions and ravines of the *puna*, high-altitude lands which separate these valleys from the desert coast to the west and from the lowland jungle to the east. Some valleys face east and are directly open to the warm, humid air currents of the jungle.

These distinct physical environments in which potatoes are produced have different kinds of problems and needs. With such vertical and horizontal variation,

the strategy of Andean farmers has always been to cultivate in many different ecological zones, as well as many different genotypes, so that it is common for households to have a 'farm' of 15-20 small parcels of land located at different altitudes and in different micro-environments (Murra 1986). The extent to which such diversification is possible also strongly influences the kind of economic roles potatoes play for different households, and both the ecological and economic considerations will influence the kind of variety selection they make (Prain & Uribe 1986).

Systematic breeding work in the Peruvian highlands began in 1947 under Ing. Carlos Ochoa. The dominant breeding criteria then were yield, rusticity, resistance to late blight, frost and resistance to potato wart (*Synchytrium endobioticum*). Selections were made under a range of conditions and at altitudes between 3300 and 3900 m above sea level. Two varieties were released during the 1950s and widely adopted by farmers (Ochoa 1961).

More recent breeding work in the Central Highlands has been carried out under narrower environmental conditions, mainly in the experiment station located in the flatter, more fertile floor of the Mantaro Valley. These conditions are similar to those enjoyed by a small minority of large commercial producers who have been the main beneficiaries of the varieties released (Franco et al. 1979; Prain & Scheidegger 1987; cf. Chambers & Ghildyal 1985).

Peru has also initiated several programmes to produce high-quality seed of the new varieties, most recently in the 1960s (Ministerio de Agricultura, n.d.; Ezeta & Scheidegger 1985). These programmes were not generally successful, mainly because the 'improved' seed was not very good and the farmers' seed was not as bad as had been thought (Horton 1984, p.8). A new seed programme began in 1983 using modern techniques of heat therapy and rapid multiplication (Bryan et al. 1981) to produce virus-free seed for distribution to farmers (Ezeta & Scheidegger 1985).

The programme has so far been mainly working with modern and native varieties already known and used in particular regions. But there is also a need for the seed programme to link up with the breeding programme in order to facilitate the introduction of new genetic material which more successfully meets particular needs. The farmer expertise already identified in both surveys (Prain & Uribe, in preparation) and other trials (Scheidegger 1986) could be tapped in order to identify appropriate germplasm.

Five locations in the Mantaro, Cunas and Yanamarca Valleys were selected with altitude ranging between 3550 and 4000 m. No attempt was made to cover the whole range of ecological and economic diversity. For example, we did not include the large commercial producers who make up 10-15% of the area planted to potatoes, since the programme is mainly concerned with addressing the needs of the vast majority of small producers.

Apart from the restriction to peasant farmers, the small amount of planting material available limited the number of locations that could be chosen and the number of farmers who could participate. The same set of clones was planted in each location. Only an incomplete set of clones could be planted in the highland

experimental station located in the Mantaro valley bottom (3250 m) for comparison, because of the shortage of planting material. To increase farmer input and stimulate the swopping of opinions and experiences, we divided the clones into two groups (Table 1) for two farmers in each location.

Cooperators were selected from among the large number of farmers with whom good working relationships were established in previous work of the programme on the basis of their particular interest in potato varieties. In one case, a small neighbourhood group within a village offered to carry out the selection work jointly. This is a high altitude zone which suffers severe frosts and the crop is mainly for subsistence. Under such circumstances, individual participation in experiments is more difficult and the group involvement offered a wider impact.

Most of the material (Table 1) came from two CIP breeding programmes: the nematode (*Glodobera pallida*) programme and the frost and late blight (*Phytophthora infestans*) programme; some further clones were provided by the Peruvian national potato breeding programme. A Columbian variety and a Bolivian native variety were

Table 1: List of clones used in farmer selection trials, 1987/88

CIP code	INIPA code	Trial name	
Group 1			
G3		Tumbes	
HFF20.2		Chota	
UFF12.2		Huaral	
		Chejche (Bolivian native variety)	
		Capiro (Columbian variety)	
	S-24.73	Chuco	
	S-229-72	Yauri	
		Yungay (control)	
Group 2			
683246.12		Huaraz	
280179.7		Tacna	
375597.15		Huanta	
HFF4.2		Huacho	
UFF4.1		Yauyos	
P3		Perricholi (Peruvian variety, just released)	
	PI-15-19	Chavin	
	PI-29-19	Aija	
	PI-2-8	Mayocc	
		Yungay	

also included. To facilitate discussions about the different clones and their characteristics, a name was given to each clone. The successful modern variety Yungay, which is widely distributed in the Central Highlands, mainly due to its 'rustic' characteristics, was included in both sets of clones as control. It was assumed the clones would need to show some notable additional advantages over Yungay to be of interest to farmers.

Farmers were responsible for selecting the fields and designing the trials. In most cases, they chose to plant all 50 tubers of each clone in one row. Foliage development at these altitudes is limited so that soil cover normally does not surpass 70%. Thus little inter-variety competition is to be expected. Farmers used their own seed as a border around the trial and to fill up the field. In some cases, the plot was too narrow and each clone was planted in two adjoining rows. There were no 'spatial' replications laid out but, in farmer experimentation, 'temporal' replication is considered a more relevant way of dealing with variation (see below).

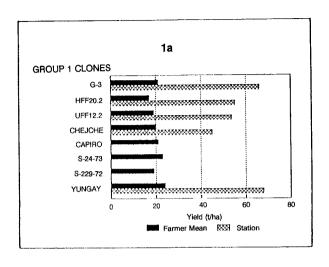
The team was present at all plantings and later visited each site every 2-3 weeks to discuss with farmers the performance of clones during the growing cycle. Each farmer was given a notebook to record details of the trials and observations about characteristics. In addition, we noted farmers' comments. We were present at each harvest to weigh output and record the family's observations. In most cases, we were able to arrange for the two farmers in each location to visit each other's plots to look at the different group of clones, stimulate further comments and arrange exchange of clones after harvest.

Three 'group evaluation sessions' were organised for all farmer cooperators (with two representatives from the neighbourhood group) to encourage joint discussion, exchange of opinions and expression of priorities. The first session in Quicha Chico evaluated the two trials during the growing season; the second evaluated the two harvests in Marcavalle. In the third session, held in the programme's experimental station after all the harvests were finished, all the yield results were displayed and our own summary of farmer comments made during the season was available as a memory aid.

#### 3. RESULTS

#### Yield evaluation

There is a clear 'yield gap' between the optimum conditions of the station and the real conditions of farmers' fields (Fig. 1). More interesting, however, are the genotype/environment interactions. The native variety Chejche and the clone UFF4.1 might have been weeded out on the basis of poor station yields but performed reasonably well for farmers. Conversely, very good station yielders like 375597.15 or P3 did not perform spectacularly for farmers. The clone 280179.7 was one of the better yielders on-station but was the second poorest performer in the farmer trials. When located in a food system context, it was firmly rejected by two of the four farmers who planted it because of its small, deformed 'characterless' tubers.



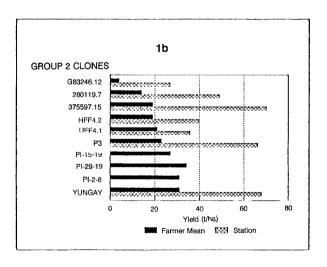


Figure 1: Average farmer yields and experimental station yields

These results suggest that genotypes selected for yield under optimum conditions may not be the ones farmers would choose.

Whilst these yield results show how necessary on-farm selection trials are, it is also clear that there is need to look beyond yield and yield stability data at other evaluations which farmers consider important.

## Evaluation of food system

Farmers spontaneously evaluated varieties using 39 criteria, which fall into seven distinct categories (Table 2).

Physiological and agronomic. Many observations were collected relating to foliage volume, stem number and stem thickness, which were often discussed generally as 'good development' or 'little development' of the stand. A variety with a small stand was a cause for some concern and, in one case, was fed some extra urea at hilling-up time. But all farmers agreed that 'what counts is what is below the ground'. All had experience of excellent-looking stands that did not produce tubers. One of the most popular varieties at the end of the trial, G-3, had one of the smallest, weakest stands in all experiments. As one farmer said when she harvested a large number of good-sized tubers of this variety, 'the worst is now the best'.

Earliness, which is evaluated in terms of velocity of emergence and velocity of foliage development as well as maturation time, is an important characteristic for farmers, especially for its contribution to household nutrition. Early varieties are desirable to fill seasonal scarcities in food availability which occur in the Andean environment. In most of the highlands, rain falls from about October to March or April and, since the vast majority of peasant farmers have no irrigation, this is the growing season, with main harvesting taking place in May or June. Severe frost between May and late September also make it risky to attempt earlier plantings in the higher areas. With these climatic constraints, farmers try to grow varieties with different vegetative periods. Early varieties relieve the boredom of a constant diet of wrinkled potatoes, which is all that is available from January onwards of the previous season's harvest. Farmers agreed that 'it is acceptable to produce less if it is earlier'. That was why the national programme clone PI-15-19, though not the highest yielder, was of special interest.

Earliness also has important economic implications if the household's need for new food has already been met. These varieties can catch the higher off-season prices in the markets and bring needed cash into the household.

Other agronomic evaluations with economic implications concerned uniformity of emergence and stolon length. Uniform emergence of plants contributes to easier, more efficient cultural practices. Stolon length affects the efficiency of the harvest. If the tubers are 'laid like a hen's eggs', close to the plant, harvesting will be quicker and less costly. Labour is released for other tasks - very important for a time of constant labour shortage - and more of the production gets into the sack.

Table 2: Criteria mentioned by farmers participating in the evaluation of clones and new varieties of potatoes.

Criteria	Desired Level	Implication/explanation	Importance subs/mark <sup>1</sup>
Physiological-agronomic			
Velocity of emergence	high	indication of earliness	1/1
Uniformity of emergence	high	facilitates timing of agricultural practices	1/1
Velocity of foliage development	high	indication of earliness	1/1
Maximum foliage volume			2/2
Stem number	medium	similarity to native varieties	2/2
Stem thickness	high	less lodging	1/1
Leaf size	small	better hail resistance	2/2
Stolon length	short	easier to harvest	2/2
Earliness	options	early varieties for first food and early season prices, late varieties for high yields in main harvest	2/2
Performance in environment			
Resistance to frost	high	better yield	2/2
Recuperation from frost	rapid	better yield	2/2
Resistance to hail	high	better yield	2/2
Recuperation from hail	high	better yield	2/2
Pests and diseases			
Resistance to Andean weevil	high	Andean weevil is the most important pest, but no good resistance was present in the material	3/3
Resistance to Epifrix sp.	high	lower spraying costs	1/1
Resistance to Phoma andina <sup>2</sup>	high	lower spraying costs	1/1
Number of rotten tubers <sup>2</sup>	low	lower spraying costs	2/2

Table 2: Continued

Criteria	Desired Level	Implication/explanation	Importance subs/mark <sup>1</sup>	
Incidence of powdery scab	low	better appearance for marketing	1/2	
Incidence of wart	low	better appearance for marketing	1/2	
Yield and size distribution				
Yield <sup>3</sup>	high		2/2	
Percentage of first size tubers ('calidad')	high	better price, easy to harvest	2/3	
Total number of tubers	medium	enough seed for multiplication but also first size	a- 2/2	
Percentage of small tubers	low	shorter harvesting time	1/1	
Tuber characteristics <sup>4</sup>				
Skin colour (primary/ secondary)	strong colored	easier marketing, better price	1/3	
Skin anomalies		easier marketing	1/2	
Tuber shape	options	either native shaped or modern looking with shallow eyes	1/2	
Percentage of deformed tubers (cracks, secondary growth)	low	easier marketing	2/3	
Uniformity in tuber shape	high	varietal recognition	2/2	
Flesh colour	yellow	indication of culinary quality	2/1	
'Wateriness' (ease of squeezing out juice)	low	indication of culinary quality	2/2	
Cooking and eating quality				
Cooking time	short	less fuel consumption	2/1	
Skin splitting at boiling <sup>5</sup>	options	indication of culinary quality	1/1	
Ease of peeling (raw/boiled)	easy	soups/village processing	2/2	

Table 2: Continued

Criteria	Desired Level	Implication/explanation	Importance subs/mark <sup>1</sup>
Texture	flowery or sticky	both for boiled potatoes	3/1
Taste	not qualified	must have distinctive taste	3/1
Storage behaviour <sup>6</sup>			
Dormancy period and sprout growth	long, slow	maintain quantity and quality of seed and consumer stock	2/2
Water loss	low	maintain weight for marketing	1/3
Tuber rotting	low	more produce	2/2
Appearance after storage	not winkled	for marketing	1/3

<sup>&</sup>lt;sup>1</sup> Importance give to this criterion by farmers as perceived by the researchers, with respect to varieties destined for subsistance ('subs') and for marketing ('mark'); 1 = low, 3 = very high importance.

Performance in environment. One physiological characteristic evaluated by farmers with environmental implications is leaf size. Several trials suffered hail storms, and Capiro and UFF12.2 were both identified as surviving the hail better because of smaller leaves. Farmers were also, of course, interested in frost resistance and recuperation from its effects. However, during the 1987-88 season, there was little serious frost and a further season was considered important to evaluate this criterion.

<sup>&</sup>lt;sup>2</sup> Farmers refer to late blight (*Phytophthora infestans*) with the same term 'rancha'. Since in the agro-ecological level referred to here, late blight symptoms in the foliage are not easily seen, and since farmers pointed out phoma leaf spot symptoms, 'rancha' is translated as '*Phoma andina*' in the case of foliage deseases. On the other hand, when 'rancha' refers to rotten tubers, it is translated a '*Phytophthora infestans*', since *Phoma andina* does not affect tubers.

<sup>&</sup>lt;sup>3</sup> Yield, deformities and other tuber characteristics are evaluated by farmers in relation to soil fertility and depth, soil colour (content of organic matter), quality of land preparation, previous crop, and altitude. While farmers prefer varieties that perform well in all soils and at different altitudes, they are willing to accept varieties with narrower agro-ecological adaptation.

<sup>&</sup>lt;sup>4</sup> The whole set of tuber characteristics is synthesised by farmers in the term 'friendliness' ('papa simpática').

<sup>&</sup>lt;sup>5</sup> Farmers consider varieties that split after normal boiling as of better culinary quality. However, as farmers boil for their own consumption usually a mixture of varieties, a certain degree of boiling consistancy should be maintained and therefore varieties splitting after very short cooking time are not acceptable.

<sup>&</sup>lt;sup>6</sup> Only random data on storability could be obtained because of the worsening security situation. We include here information from other work in the same areas.

Pest and diseases. Pest damage tended to be observed mainly in the harvest rather than preharvest, with special attention being given to the Andean weevil. However, one farmer noted in the preharvest period that PI-2-8 appeared to resist a serious attack of Epitrix better than the other varieties.

Yield and size distribution. Although harvest yield was sometimes assessed in general terms as 'very good', 'reasonable' and 'little', evaluations were usually more specific, relating to what farmers call the 'quality' (calidad) of the yield, which means the percentage of first-size, better-priced tubers produced. Since most farmers grow modern varieties as primarily a cash crop (Table 3), 'quality' in this special sense assumed major importance in these trials\*.

Table 3: Importance of different type of potato varieties among farmer-experimenters

Location	Farmer	Ту		
		Modern*	Native commercial**	Gift***
Marcaville	1	S	V	V
	2	U	V	V
Chicche-La	1	V	v	V
Libertad	2	V	V	S
Cunas	1	S	V	U
	2	V	S	U
Quicha Chico	1	V	v	S
	2	V	V	S
Acolla	1	V	S	U
	2	S	V	U

*	For sales, food (soups), chuño	U	unimportant
**	For sales, food (boiled), chuño	S	somewhat important
**	* For food (boiled), chuño	V	very important

<sup>\*</sup> Farmer-experimenters generally manage between two or three different classes of potato varieties. 
'Modern' refers to the varieties developed as part of the national breeding effort, 'native commercial' to indigenous varieties which are individually selected often for their commercial potential and have names which are known over a wide area. Their main culinary and commercial characteristic is their floury texture, a characteristic which commands a higher price. 'Gift varieties' (papa regalo) comprise a large range of indigenous cultigens that are grown in mixed plantings and are almost exclusively for subsistence. They are an important element in exchanges between farming households and have individual names that are usually known only within a local area.

For these varieties, in both highland and Lima markets, there is at least a 60% price difference between second- and first-size potatoes. When supplies are abundant, this can rise to over 100%.

Several clones had unspectacular 'quality' (Table 4). They received few comments and often contradictory ones, indicating unstable performance across different environments. Others, such as G83246.12, were found to be poor across all of the trials and, together with their poor yield, suggest that they have no future in farmers' fields. Capiro came out very poor in 'quality' but yielded reasonably well, producing a large number of small tubers. It had, however, some additional characteristics which varieties with poor 'quality' need to show to be cultivated. Apart from its hail resistance noted earlier, farmers also commented on its floury taste.

The clone P-3 showed the opposite tendency. It had a generally good 'quality' rating, but an equal number of farmers noted that there were very few tubers. This causes problems when the farmer comes to select seed for the following year's planting. Varieties must produce an adequate quantity of small tubers for seed, since self sufficiency in seed is the basis for Andean potato farming (Prain & Uribe, in preparation).

The farmers were particularly happy with the clone G-3, which produced good-sized tubers but also sufficient number to allow maintenance of the seed stock.

Tuber characteristics. Apart from size and number of tubers, farmers also commented on skin and flesh colouring and form. Colour is another feature which effects marketability, since coloured potatoes usually fetch a higher price that white ones. This was an additional attraction of G-3, whose bright red colour was variously described as 'pretty', 'lovely' and, more circumspectly, 'interesting'. Its elongated shape also provoked comment: one farmer described it as 'like a bull's horn', a characteristic typical of native varieties. Even the coloured skin of Capiro to some extent compensated for its lack of 'quality', according to some farmers. The two other coloured clones, G83246.12 and 280119.7, had too many other disadvantages to be of interest: the former had miserable yields and the latter had many deformed tubers and lacked a typical shape.

Farmers were concerned about tuber deformities and anomalies in skin texture, because of their effect on marketing. More generally, they considered it important both for the market and for subsistence that a clone have a uniform shape so as to permit its clear identification as a variety.

Cooking and eating quality. The information on kitchen performance was collected during the weeks after harvest, when each of the households had had a chance to try out all the clones they had harvested. Cooking time of particular food crops and varieties is of importance in these high altitude regions where wood is scarce and kerosene expensive and difficult to obtain. The clones PI-2-8 and G-3 and the control variety Yungay were said to be difficult to cook.

There were many comments from farmers on taste and texture of different varieties. Taste was evaluated in general terms as 'pleasant' or 'unpleasant', whereas

texture was more specific, describing the 'flouriness' or 'stickiness' or 'wateriness' of particular varieties. PI-15-19 got the highest negative score as unpleasant and watery and the native variety Chejche received the highest positive score. S-24-73, 375597.15 and Capiro were also appreciated by several farmers.

Table 4: Frequencies of 'quality'\* ratings for clones in selection trials

Clone	Rating		
	Good	Poor	Total
Group 1			
G-3	3	0	3
HFF20.2	1	0	1
UFF12.2	2	1	3
Chejche	1	1	3
Capiro	0	3	3
S-24-73	2	0	2
S-229-72	0	1	1
Yungay	2	1	3
Group 2			
G83246.12	0	4	4
280119.7	2	2	4
375597.15	2	1	3
HFF4.2	1	1	2
UFF4.1	2	0	2
PI-15-19	0	2	2
PI-2-8	1	0	1
Yungay	3	1	4

<sup>\* &#</sup>x27;Quality' is the term used by farmers to refer to the percentage of first-size tubers.

Storage behaviour. No systematic data were collected about the storage behaviour of the different clones because of the worsening security situation. Table 2 includes information obtained during previous work in the same areas.

#### 4. CONCLUSIONS

The first conclusion from the results of these trials is that the yield of a variety under optimum conditions is a very poor indicator of its likely adaptability or acceptability. Breeders are generally aware of this problem and attempt to test their clones under a range of environments.

But we have also seen that, whilst the adaptability of a clone can be better evaluated through testing under variable farm conditions, acceptability will depend on a wide range of farmer evaluations. However, peasant farmers are not looking for the ideal variety. The evidence suggests that farmers seek to manage an ideal range of varieties which answers their food system needs (Prain & Scheidegger 1987). Individual varieties are selected in terms of their fit both with diverse ecological conditions and diverse uses. They are often allocated specific ecological niches where positive characteristics flourish and negative aspects least express themselves. They are evaluated in terms of two main uses: as a cash crop and as a household food. Although some varieties will mainly satisfy one requirement rather than the other, there is considerable overlap: some preoccupation with the taste of varieties mainly destined for the market suggests that all varieties in times of hardship may be required to feed the family. A 'friendly potato' is a variety which satisfies one or other requirement whilst maintaining this flexibility.

Two 'friendly potato' candidates emerged from the post-harvest group evaluation held in the experimental station:

Clone G-3 mainly satisfies market requirements. It is late emerging and has a weak stand, but tubers are formed close to the plant, facilitating the harvest. It performs well in the area. Hail storms do not seriously affect it. It produces a reasonable number of large tubers with enough smaller ones for seed. It has an attractive colour and shape for the market. It is better for use in soups then for eating boiled.

Clone S-24-73 mainly satisfies household needs. It has rapid emergence and matures quickly. It has a strong stand with many stems. It can stand up to light frost, but may be a little susceptible to hail. It produces plenty of good-sized tubers. It has well-shaped, white-skinned tubers that 'look like a native variety'. It cooks quickly and tastes good.

Even though the farmers appreciated these clones, they were not ready to endorse their release as varieties. We discovered that farmers have a long-term view of variety selection which is based on a detailed knowledge of ecological and climatic variation. One farmer commented on the very light frosts which had fallen that season and the need to subject the varieties to a stiffer climatic test. All farmers wanted to see how the varieties performed in different soils and with a possibly different rainfall pattern. We realised that, though no farmer will ever suggest laying out an experiment with four replications side by side, farmer replications occur over time, in different seasons. A further year of experiments will continue with minimum input by the programme.

The complexity of both the local ecology and the household economy is amply reflected in the 39 criteria which farmers consider in their evaluation of varieties. Breeders can never hope to satisfy this diversity in one variety. Not only are the numbers daunting. In some cases, the actual desired level of a particular criterion is variable. We saw that, in the case of earliness, there are two desired options: short vegetative period to overcome seasonal food scarcity and to take advantage of higher market prices and a longer vegetative period for obtaining maximum 'quality' and

yield in the main harvest. What breeders can do is recognise the need for a range of varieties which satisfy different segments of the farmers' food system, rather than an ideal type variety.

Beyond the first major selections of the breeding pipeline, farmers are best qualified to evaluate how far the new material is 'friendly' to the different segments of their system. By involving farmers as partners, breeding programmes have the chance to be more cost-effective in the development and release of varieties well-adapted to local and national food systems.

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#### FARMERS AS EXPERIMENTERS

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Farmers, like agricultural research scientists, are experimenters. Modern agricultural science rests upon the foundation of at least ten millennia of informal experimentation by anonymous subsistence and commercial farmers. The nature of this farm-based spontaneous research has rarely been systematically studied. This article explores farmers' experimentation with potatoes in Peru.

Among the world's most experienced potato farmers and consumers are found in Peruvian communities located 2500-4500 m above sea level. Both cash income and household consumption depend on the hardy potato crop more than any other. Since the potato production system here is both ancient and well defined, experimentation rarely takes on a radical character. Three kinds of farmer experiments with potatoes can be defined: curiosity experiments, problem-solving experiments and adaptation experiments.

# Curiosity experiments

Farmers, like most human beings, are curious. It is not uncommon for farmers to set up an experiment just to test an idea that comes to mind. These experiments may or may not have an immediate practical end. CIP anthropologist Gordon Prain (pers.comm.) tells of a farmer in the village of Chicche (Mantaro Valley) who developed the hypothesis that varieties expressing apical dominance would yield fewer but larger tubers which would bring a better price than varieties without apical dominance (more shoots, but smaller tubers at maturity). To test this hypothesis, he has now planted two rows in his courtyard garden: one row with apical dominance and another row without. Although this experiment may ultimately have a practical end, it was stimulated fundamentally by curiosity.

#### **Problem-solving experiments**

Farmers are keen to seek solutions to old and new problems through experimentation. In fact, propensity to experiment and try out new ideas may be more pronounced in areas of diversified agriculture and poor extension services than in developed countries with less diversification and excellent research and extension facilities. Recent perceived increases in insect damage in the Andean region and

farmers' attempts to overcome them through experimentation are cases in point. For example, increased attacks of the Andean weevil (gorgojo de los Andes) in improved potatoes led farmers to test effects of sunlight on seed. They spread potatoes to be used for seed in the sun for short periods (Prain, pers.comm.). The effect was to drive the worm from the tubers. Tests are always done first on a small scale and later amplified if successful.

### Adaptation experiments

Adaptation experiments are conducted by farmers after they acquire a new technology or observe a demonstration technology promoted by an extension agency. Adaptation experiments can be of two kinds:

- when farmers are testing an unknown component technology within a known environment; and
- when farmers are testing a known technology within an unknown environment, such as a zone of colonisation

Experiments of the traditional potato zone. Farmer selection and use of new varieties are a case in point. In the potato production zones of the Andes, the most intense interest in experimentation revolves around new cultivars. Planting of new cultivars, however, sets in motion a number of experiments on best use of those varieties in specific locations (farmers generally plant in several agricultural zones and at different times in the production cycle). Since the highland zone is where potatoes do best, experiments are aimed at discovering which variety does better than another, given the forever changing disease and climatic conditions.

Throughout the growing season, farmers monitor carefully the growth and performance of the new variety. If the farmer likes what he sees, then he amplifies production, restricted - of course - by the amount of seed available. Depending on the market and seed supply, the farmers will put more and more of their land in the new variety. In the meantime, they maintain and replenish their 'germplasm banks'. Tubers will be counted, storability observed, processing qualities tested and so on. The storehouse of knowledge about varieties is being built up through such experimentation, allowing farmers to talk for hours about varieties.

Experiments of the nontraditional potato zone. Peru's ceja de la selva (eyebrow of the jungle) is a tropical hill zone (also called the montana) which links the high Andes with the lower Amazon Basin. The human demographic shift is downward. Highland Indian and mestizo populations are colonising the lower elevations. All across this high jungle, tens of thousands of settler farmers carry out systematic experiments in an effort to define for themselves appropriate land-use and cropping patterns which will provide best for their needs. These experiments are doubtless similar in form to the literally thousands of experiments which have been conducted by farmers throughout the ages. The colonists of the high jungle bring with them their own

agricultural systems/technologies and food habits to this new environment which must be understood and ultimately mastered. Experimentation is one of the fundamental strategies involved in the settlers' attempt to learn about and control their environment.

The 15-member Colquechagua family, which resides in the high zone of the Colorado River, one of the tributaries of the Chanchamayo river, provides a good example of how a household experiments. Among their subsistence goals is to produce enough vegetables on their land so they do not have to buy in the local market. Experimentation follows a 'start slowly, start small' pattern. They bring back from their highland communities a few small sacks of the seed they want to try. In the first year, they brought approximately ten potato varieties: Mariva, Revolution, Renacimiento, Yungay, Huayro, Huamantay, and several varieties of a native type called chaucha. The first year they planted only a few kilos of each. Gradually, they eliminated the varieties which did not do well, while they doubled the amount of seed planted in the more adapted varieties. During the first year, all chaucha varieties were eliminated due to their susceptibility to late blight (Phytophthora infestans). In the second season, Huayro and Huamantay were eliminated. This left only 'hybrids', among which the two varieties Mariva and Yungay yielded best. After four years of experimentation, they were relying mainly on the variety Mariva. Small-scale experiments continued each year with newly acquired varieties.

In addition to cultivar testing, the Colquechagua family tried different periods of planting. They first used the schedule of the *sierra* planting calendar; then they shifted to the drier season. Mental notes were kept on performance, disease and insect attacks, and rotation needs. Over time, as they gained experience, they learned how the crop performs best.



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