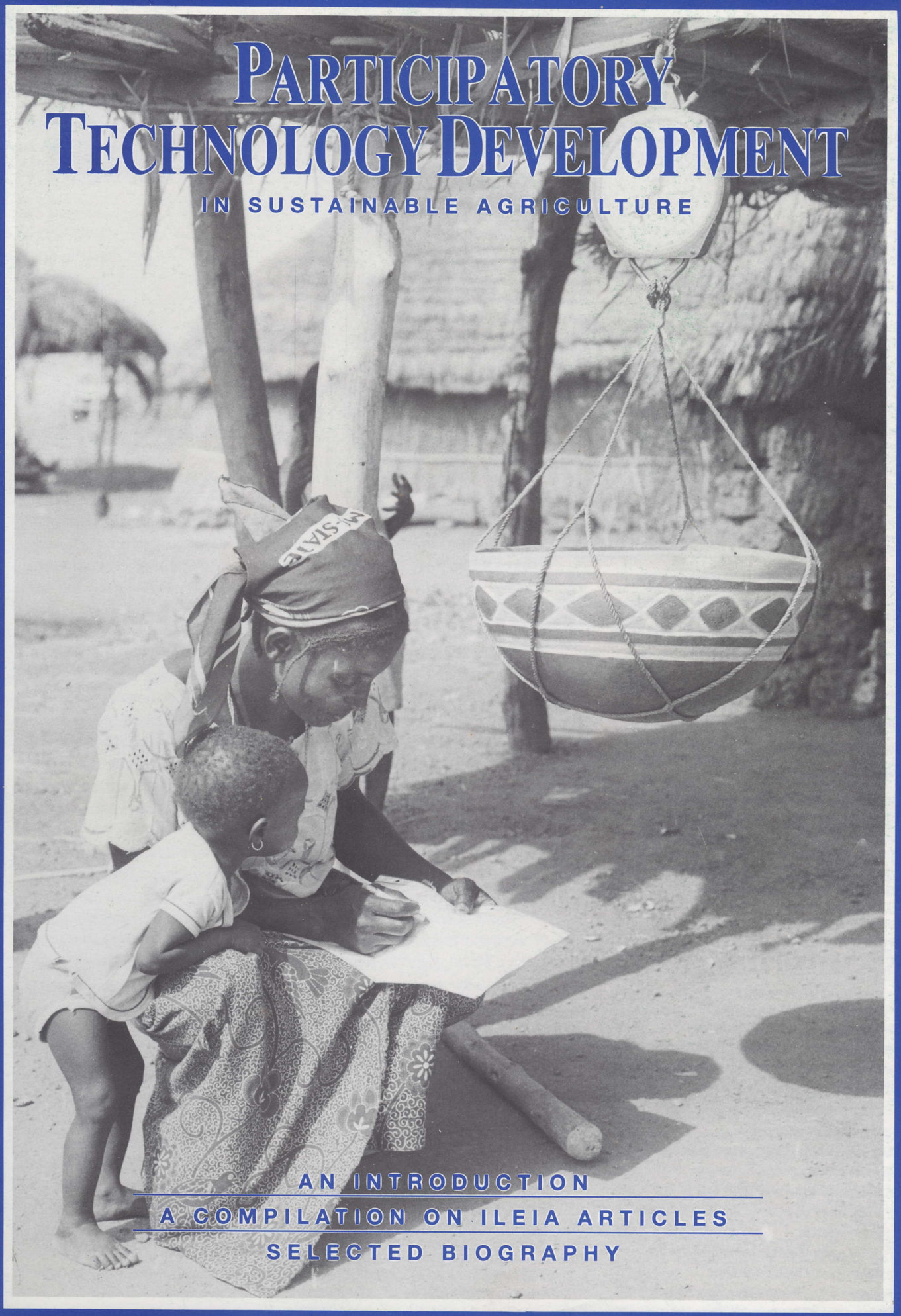
PARTICIPATORY TECHNOLOGY DEVELOPMENT

IN SUSTAINABLE AGRICULTURE



AN INTRODUCTION

A COMPILATION ON ILEIA ARTICLES

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Colophon

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. widely accepted and adopted as a valid approach to agricultural development, complementary to high-external-input agriculture,
. recognized as a means to balance locally available resources and local knowledge with modern technologies requiring inputs from elsewhere,
. valued as a useful perspective in planning and implementing agricultural research, education and extension,
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Contents

Introduction

At the present time, agricultural scientists and policy makers, researchers, development workers and extension staff in developing countries are paying increased attention to the use of locally available resources.

Economic and ecological reasons have led to a re-assessment of the technologies used in agriculture and practice has proved that the approach of "Low-External-Input and Sustainable Agriculture" can lead to remarkable improvement of agricultural systems. Practices such as soil and water harvesting, agroforestry, integrated pest management, intercropping, crop/livestock integration, microclimate management and the use of unconventional animals and plants in food production receive much more attention than in the past. Experts expect a great impact from these practices, especially in the (semi)-arid rainfed areas and other areas which so far are considered to have a low production potential, because of their alleged "low resource base".

This change in thinking about agricultural technology has also led to a rediscovery and re-assessment of Indigenous Technical Knowledge. An increasing number of publications support and document the argument that farmers have a wealth of knowledge on their own environment, have developed specific skills to use this environment, and are very active and creative in adapting the way they use the environment for reaching their objectives.

In line with this, the roles and functions of agricultural researchers and extension workers as well as the way they work together and work with the farmers is due for a re-assessment. Recent literature on farmers' participatory research and farmers' participatory extension as well as international seminars and workshops on this subject bear witness to the present interest in participatory technology development. In practice, there are quite a number of experiences, where extension workers, development workers and/or researchers have successfully worked together with farmers in the development of their technology.

Professionals in this field working along these lines are increasingly being recognized as pioneers in a powerful approach; an approach which needs to be developed further.

There is an increasing awareness amongst these professionals of the need to systematize and document the methodology of participatory technology development and make it available to other professionals by means of case descriptions, field guides, training manuals and training modules.

This publication consists of a compilation of articles published earlier by ILEIA. Some articles (PTD and sustainable agriculture, To make the flip, Concepts and activities) were taken from proceedings of the 1988 workshop "Operational approaches for participatory technology development in sustainable agriculture". The other articles have appeared before in various issues of the ILEIA Newsletter. The "Selected bibliography" was taken from a book entitled ***Joining Farmers' Experiments*** *(eds. Bertus Haverkort, Johan van der Kamp and Ann Waters-Bayer, available from IT Publications Ltd, 103-105 Southampton Row, London WC1 4HH, UK). In this book, more experiences of PTD are reported. More information about the principles and practices of PTD for LEISA will be published in* ***Farming for the Future*** *(Reijntjes et al, Macmillan, UK, forthcoming).*

Participatory technology development and sustainable agriculture

A group of farmers transplanting their first rice crop. Photo: Michael Loevinsohn.

The application of modern agricultural technologies which depend heavily on the use of external inputs requires a certain minimum rural infrastructure to allow supply and maintenance of external inputs and services, assumes capital investments at farm level and needs a stable environment.

Professionals in agricultural development are gradually realising that modern agricultural science and technology have a certain bias which causes a different impact on development in different areas:

–Use of modern technologies has had quite some impact in industrialized countries in the West and in the irrigated areas in the tropics. The agricultural production in these areas has increased drastically. Yet, the current level of production has overstressed the level of sustainable production.

– The impact of modern high-external-input technology in the rain-fed tropical areas has been very limited. These areas generally have a great diversity in the ecosystem resulting in complex and risk-prone farming systems. Land tenure systems are often insecure and the physical and institutional infrastructure poor. Due to the growth of the population, the low prices for agricultural produce, structural changes in nomadic and sedentary agriculture as well as apparent short-term successes of introductions of modern technologies and its appeal to status, the more traditional agricultural systems no longer seem to satisfy the needs of the people.

Agricultural scientists generally speak of "Low-Resource Areas" for those areas which have low potential for the efficient application of high external-input technologies. As a consequence, the production potential of these areas is regarded as low and as a result, investments made for the development of agriculture in these areas have lagged behind those made for the so called high potential areas.

For these "Low-Resource Areas", where an estimated 1 to 1.5 billion people find their living, a different type of agricultural technology and a different way of technology development is essential. More and more people are concerned about the lack of effectivity of agricultural research, extension and services in these areas. Research, information services and input delivery systems have been mainly concerned with production for export commodities and have been most active in those areas where the production conditions are favourable under the current state of the technology. This has lead to a pressure on the traditional systems as well: traditional methods to preserve sustainability such as use of fallow periods, intercropping and traditional methods of maintaining soil fertility by organic fertilizers and use of trees, in many areas have disappeared partly or completely. Soil degradation and erosion take place on a large scale, but also traditional knowledge and skills as well as indigenous genetic resources are being eroded away.

Production levels in the western part of the world are so high that it leads to worldwide economic problems: low off-farm prices prevail, not only in the West but also in developing countries. Increasingly, governments of developing countries find it difficult to invest in agricultural development by importing agricultural inputs. The terms of trade of external inputs as compared to agricultural produce are becoming increasingly unfavourable.

In the less favourable conditions under which most small farmers have to work, the efficiency of most modern external

inputs is very low and the risks for farmers to use them are great. In view of the ecological deterioration which takes place in many parts of the world, the use of modern inputs is increasingly being questioned. It gradually becomes clear that western agricultural knowledge not only has definite limitations but also has definite negative effects on the development of agriculture in tropical areas.

Production potentials of most tropical areas have been assessed on the basis of western agricultural insights; investments in agricultural development have been based on these assessments and, as a result, locally available resources with which western scientists were unfamiliar have been underutilized. Agricultural research and extension services, institutions for agricultural education and input supply agencies, in general are based on the model of High-External-Input Agriculture and have little experience with Low-External-Input and Sustainable Agriculture.

New experiences

The experiences of farmers and researchers in areas where external inputs are not available, where prices of external inputs are too high to justify their use, or where the ecological effects are too severe have led to a number of practices which are categorized under the heading of Low-External-Input and Sustainabale Agriculture, or briefly, LEISA.

These experiences have shown that decreases in risks, increases in production and sustainble productivity are possible through the application of one or more of the following principles:

- The deliberate use of the diversity in the ecosystem and the exploitation of the linkages and combinations of diverse components in the creation of sustainable and stable systems.
- The use of an integrated approach by taking into account the total effects of the agricultural practices on production as well as on the environment, thus looking upon agriculture as a cyclic process.
- The focus on locally available resources and thus considering unconventional plants, animals and physical resources.
- The recognition of local and indigenous knowledge and the importance attached to the need to strengthen farmer's capacity to develop technology.

This approach is considered as being a modern approach to agricultural development not only for the "low resource areas", but also for the areas considered to have high production potential. Since sustainability and low-external-input agriculture are critical issues in any agricultural strategy, they should not be considered as separate themes or disciplines, but as integral and complementary parts of various research and development programmes.

There is a need for a new practice in technology development and a subsequent need for restructuring of the services, institutions and agencies involved. Existing entities will not easily change their methods and/or their systems. Convincing arguments are needed, successful examples and operational approaches. Only then is there a chance that the entities will develop qualities such as:

- a positive attitude towards existing diversity in agricultural systems
- an eye for productive potentials of indigenous resources and local knowledge systems as well as
- importance attached to participation of the population in technology development.

Sustainable agriculture is far from a reality and will never be a static endgame.

Rather, it requires a continuous process that has to be developed and maintained. Different partners have to play a part and, as the Brundtland report states, it is a long-term process which needs urgent attention.

The ILEIA workshop made an important contribution to the emergence of operational approaches to sustainable agricultural technology development. A great number of cases and descriptions of field experiences has been compiled and assessed, existing networks on participatory technology development have been linked and a number of proposals for further development of field activities have been formulated. ■

Kenyan farmer explaining to researchers the merits of different bean varieties. Photo: Ann Waters-Bayer.

To make the flip: strategies for working with undervalued-resource agriculture

In these remarks, Robert Chambers wants to set our discussions in context, reflect on the new, complementary paradigm, and outline some precepts and priorities for the future.

Robert Chambers

The Context: Three Types of Agriculture

Globally, we can distinguish three types of agriculture (see also WCED 1987 a and b): first, industrial agriculture; second, green revolution agriculture; and third, 'low-resource', or 'undervalued-resource' agriculture.

The first, or industrial, agriculture is found in the rich world in temperate climates and in plantations of the tropics. Its farming systems are relatively simple, often with mechanised monocropping, and its environments tend to have been made uniform. Risks are relatively low. Industrial agriculture is overdeveloped and unsustainable. It uses very high levels of non-renewable external inputs, often supported by heavy state subsidies, and is overproducing and flooding the world with unmanageable surpluses.

The second, or green revolution, agriculture is found in irrigated and high-rainfall areas, mainly in the tropics. These are characterised under present levels of technology as being 'high-potential areas'. They include the irrigated plains and deltas of Asia where the classical green revolution in wheat and rice occurred. Their farming systems tend to be relatively simple and their environments uniform. Production is stable because of good water supplies from irrigation or rainfall. There are quite high levels of external inputs. Some production is unsustainable but further plant breeding and better water management offer a prospect of maintaining or improving present levels of production.

The third type has been described as 'low-resource', but a better term may be 'undervalued-resource' agriculture. It is found in the rainfed, undulating hinterlands of the Third World, including most of sub-Saharan Africa. Perhaps between 1 billion and 1.4 billion people rely on it directly for their livelihoods (see e.g. Wolf 1987). Farming systems are complex, environments diverse, and production risk-prone. Land tenure is often insecure. The potential of this third class of agriculture is normally regarded as low.

World-wide, the priority now is to phase down non-sustainable industrial agriculture, to enhance the sustainability of green revolution agriculture, and above all to realise much more of the potential of the third, undervalued class of agriculture, where so many of the poorer people have to find their livelihoods.

The New, Complementary Paradigm

Normal agricultural research has been simplifying and has relied on high external inputs. The transfer of technology (TOT) from research station to farm has been possible partly because of the opportunities for controlling the farm envi-

Farmers are the carriers of knowledge and innovators on the frontiers of agricultural science. Photo: Kees Manintveld.

ronment and making it like that of the research station. The standard extension message has been a package of practices to be adopted by farmers. This has worked quite well, except for sustainability, especially as industrial and green revolution agriculture are supported by input or output subsidies. In contrast, undervalued-resource agriculture presents a quite different challenge. Instead of simplifying in order to produce more, it entails diversifying and exploiting complexity. It presents many different environments and conditions. As argued elsewhere, (Chambers and Ghildyal 1985; Chambers and Jiggins 1987) it requires a 'flip' or 'reversal' in agricultural research and extension, putting farm families first, and supporting and involving them in the generation of new technology. Instead of a 'package of practices', research and extension have to generate and offer a 'basket of choices'; instead of a message, they need methods. We have here the new paradigm for agricultural research and extension. It has many variants and these have been given several names including farmer-back-to-farmer (Rhoades and Booth), farmer-first-and-last (FFL) (Chambers and Ghildyal), farmer participatory research (FPR) (Farrington and Martin 1987), approach development (AD) (Scheuermeier 1988), and, in this workshop, participative technology development (PTD).

For the future a neutral generic term is still needed which commands more general acceptance. Apart from those listed above, two possibilities are 'farmer-first' (FF) or 'farm-family-first' (FFF). No one wants a plethora of terms, and practitioners will gradually select whatever fits best. For the purposes of these remarks I am going to abbreviate and summarise all these and related approaches under the rubric FF (farmer-back-to-farmer/farmer-first-and-last/farmer-participatory-research, or farm family first, or whimsically, Farmer First Flips). The essence of the FF paradigm, in contrast to TOT, is that farm families are from start to finish the primary actors and points of reference, with their priorities coming first, and with outsiders supporting farm families in their innovations, experiments and trials.

Paradigms and Potentials

The normal paradigm sees potentials in high-external-input simplified agriculture. In contrast, the FF paradigm points to and supports the hypothesis that 'undervalued agriculture' has a much higher sustainable potential compared with its current production levels than either industrial or green revolution agriculture. This potential has been hidden by the TOT approach.

When TOT has not worked, as often with undervalued resource agriculture, the explanation has been first, ignorance and conservatism on the part of farmers, and then second, the low potential and risk-proneness of the environment and farming system. In fact, the reductionism of normal agricultural research hinders it from developing innovations for complex systems. Recent experiences have shown, however, that decreases in risk and increases in production are often possible through exploiting linkages and combinations of diverse elements, for example, crop-livestock systems, agro forestry, rice-fish cultures, earth-shaping of many sorts, water harvesting, soil harvesting, the creation and management of micro-environments, mulching and nutrient recycling, integrated pest management, and the biological and economic diversification of farming systems.

In understanding, managing and exploiting these internal linkages of undervalued-resource farming systems, farm families have a comparative advantage. They are natural experts. They are better placed than scientists to innovate and experiment. In particular, they have the edge in trying out varieties or practices and fitting them to their whole farming system. They may also have a comparative advantage with multiple simultaneous innovation which changes many linked parts of a system at the same time. At the same time, they will always have the opportunities to gain from scientists' expertise and access to other knowledge, material and techniques. It is partly because these linkages and comparative advantages have not been recognised and exploited that the potential of this 'third agriculture' has been undervalued.

Anchors for those at sea

As with all new paradigms, normal agricultural professionals (as normal theologians, astronomers and others in the past) are liable to feel threatened. Some react with hostility, and rejection. Understandably they want to feel safe, with their feet on solid and familiar ground. Instead, we are inviting them to launch out on a largely uncharted sea. The least we can do is provide some anchors, some fixed points to provide some points of reference and security. I would suggest three, covering philosophy, roles and repertoires:

– A philosophy of decentralization, diversity and choice. This emphasises the

The FF paradigm is not an alternative to normal agricultural research, but a complement to it. But FF approaches are so contrary to normal professionalism that for both individuals and institutions they require a 'reversal' or 'flip' and present a personal and professional challenge.

Three types of agriculture summarised

	First	Second	Third
	Industrial	Green Revolution	"Undervalued Resource"
Main Locations	Industrialised countries	Irrigated and high-rainfall, high-potential areas in the Third World	Rainfed tropics, hinterlands, most of sub-Saharan Africa, etc.
Farming system relatively	Simple	Simple	Complex
Environmental diversity relatively	Uniform	Diverse	Diverse
Relative stability	Low risk	Low risk	High risk
Use of external inputs	Very high	High	Low
Agricultural R&D approach	On-station research and transfer of technology (actual)		FF (desirable, see text)
Generating	Package of practices		Basket of choices
Condition	Overdeveloped	Developed	Underdeveloped
Current production as percentage of sustainable production	Far too high	Often near the limit	Low
Priority	Reduce production	Maintain production	Raise production

primacy of what people want and need. It welcomes and embraces diversity. It aims to manage diversity through decentralization and local initiative. It resonates with other changes in development philosophy in the industrialised as well as in the developing countries.

– New roles for outsiders. Instead of the missionary role of those who transfer technology, the new role is that of convener, catalyst, colleague and consultant. The outsider sets up discussions and analyses by farm families and acts as a catalyst, in the strict chemical sense of that term, meaning an agent which speeds up reactions. The outsider is a colleague for farmers in their experiments, and a consultant who can search for and supply ideas and technologies.

– A wider repertoire. The outsider learns and develops approaches and methods for interacting with and supporting poor families, becoming more and more versatile and gaining a wider choice of what to do to perform the new roles. This workshop has shown that a rich range of approaches and methods are already known.

The variety of methods could be intimidating, but should not be. A good cook, a good musician, a good actor all have extensive repertoires and continually add to them. What is needed is not a new fixed model, equivalent in structure to transfer of technology, with rigidly related parts, but rather a fluid process in which each outsider is a performer who improvises and adapts for each audience. As it is with meals, music and plays, so it is with agriculture: farm families are consumers and clients are the arbiters of excellence, valuing variety in presentation and content. Just as diversity of environment and farming system is recognised as positive, so diversity of repertoire in interaction with farm families is seen as needed and good.

These changes of philosophy, role and repertoire require reversals, or flips, seeing things the other way round, and behaving differently. Not everyone can, or should, make these flips personally. Not all will find these anchors adequate. To be good at FF approaches requires openness and empathy, and a capacity to sit down, listen and learn. One danger is that FF methods will be tried by people whose manner and attitudes prevent success and lead them to blame the methods when it is they themselves that have failed. It may be no coincidence that women form the higher proportion of practitioners of participatory approaches, and innovators with these methods than is found in agricultural research generally. Some people can flip more easily than others. The general point is the need to choose themselves not just by formal qualification but also by personal orientation.

Strategic Patterns

Besides its philosophy, roles and repertoire, the FF paradigm also presents patterns of strategy and approach. Many of those who have contributed to its development and articulation have been acting similarly in similar sequences, but with many local and personal variants.

There are common and recurring patterns in, for example, the approaches of
Farmer-back-to-farmer (Rhoades and Booth 1982)
World Neighbors (Bunch 1985, Gubbels 1988)
GRAAP (Groupe de Recherche et d'Appui pour l'Autopromotion Paysanne) (GRAAP 1985)
FSDP/EV (Farming Systems Development Project, Eastern Visayas, Philippines) (Lightfoot et al 1987, Repulda et al 1987).

To varying degrees these approaches share the following:

- sensitive interaction with farm families and communities
- care in the choice of questions and their sequence
- reliance on local knowledge and local analysis
- primacy of farm families' priorities
- support for experiment and adaptation by farm families on their land.

Sequences vary. One is that outlined in the working paper for this workshop, namely:

- Agro-ecosystem analysis
- Establishing linkages with networks of farmers and/or other groups
- Taking stock of existing alternative technologies
- Evolution and adaptation of technologies
- Embedding of new technologies
- Utilisation of newly developed technologies

In practice, iteration and overlaps occur rather than a linear step-wise sequence. Some of the strongest approaches are where analysis by families and communities is encouraged from the start. In his paper Peter Gubbels suggests this sequence, to be pursued in a series of meetings, and not all at one time:

- what changes have taken place here since the time of your grandmother and grandfather?
- what factors have limited production?
- what have you tried to overcome those constraints, and what has your experience been?

In these and other examples, the strategic pattern is one of repeated reversals: starting with people's priorities, not scientists', and proceeding with their analysis, their experimentation and their evaluation. This approach is not, and

Evaluation of Sorghumvarieties by farmers. Photo: Anna Minkiewicz

has never been claimed as, an alternative to on-station and laboratory work, which will always be needed. But it does present a clear and feasible complementary pattern for serving farm families, and especially for exploiting the unrealised potential of undervalued-resource agriculture.

Precepts

In the development and diffusion of methods there are many dangers and many opportunities. Here I wish to suggest some guidelines or precepts:

– Practical categories. There are dangers that top-down classification will proliferate and different schools of practice will emerge. It may be best to concentrate on what works, and on experience with methods, using commonsense categories based on practical applications.

– A bias for action. Experience in the field is worth more than theory in the office. The leaders have been, and will remain, those who innovate and take risks, developing new methods with farm families, and learning by doing. The motto of the Cadbury's executive 'Ready! Fire! Aim!' (Peters and Waterman 1982) has much to commend it.

– Creativity and learning. Risks have to be taken in experimenting with and developing new approaches. Not everything will work, or will work first time. Fostering creativity is not easy and courage is often needed to offset or neutralise the obstacles set by normal professional methods and beliefs. Approaches and methods need to be repeated, adapted and learnt from again and again, with rapid and effective communication of experience between practitioners.

– Lateral not linear. The essence of the learning process is flexibility, avoiding the straight lines and formal procedures of blueprints. FSR has suffered sometimes from routinisation and additive procedures, becoming more long-drawn-out and complicated with each refinement. FF approaches should provide enough options at each stage to avoid the weight of premature fossilisation. The addition of new methods can be lateral, as alternatives, rather than linear as sequential requirements.

Priorities

At this exciting stage we are inclined to make long lists of the actions that should be taken. Such lists will naturally be outputs from this workshop. But lists do not tell us priorities. If we reflect on the 1990s and the 21st century, and if we believe that it is in the interests of those who rely on undervalued agriculture for their livelihoods that FF approaches and methods are developed, improved and diffused rapidly, we have to take a hard look at the choices of what to do. Not everything can or should be done at once. We have to choose those actions where we have a comparative advantage, and where benefits to the poorer people will be highest in relation to the time, energy, finance and other resources we can muster.

My best bet for the priorities for those who follow up on this workshop and who encourage others, are these three:

– Search and network in National Agricultural Research Systems in particular. Search for others who are innovating, and communicate with and encourage them. Start informal and formal networks, concentrating on practical experience, lessons learnt, and what works and does not work under what conditions.

– Make manuals. Short, practical, user-friendly manuals are needed. They should not be like the huge intimidating volumes produced for latter-day FSR/E. Sometimes they may be on two sides of a sheet of paper. Arising directly from this workshop, five needs and opportunities which ILEIA might meet are short manuals on:

- Getting started with families and communities
- Finding and supporting farmers' experiments
- Communicating: farm family and outsider face-to-face
- Learning farmers' agendas and aiding their analysis
- Finding out about agricultural research (for NGOs)

– Invent, learn and train. Invention and development of new methods, learning by doing, and training those who come afresh to FF, will best all occur together, in the field. The normal reflex response towards anything new is to advocate training, as though that will automatically bring benefits. The danger is that this will become too formal, routine and deskbound, entailing the transfer of fixed methods. Much of the best learning will be through collegial apprenticeship, and extended visits to practitioners in the field. Gradually, some training can be formalised and introduced in training institutions, but the very formality and milieu of such training is antithetical to the approach. Most governments and donors may do best to proceed by resolute sequences of steps, starting with training in the field, perhaps taking ICRA as one model. Training, though, faces a chicken-and-egg problem. The best trainers will be the best practitioners, and good practitioners are still few. In the short term it may be best for them to train others in the field in the course of their work. But this need not delay work on new curricula, new textbooks, and new methods in training institutions, especially as these so often take long to prepare and introduce.

Beyond these three thrusts there is much else to do: achieving professional respectability and recognition through publication in hard journals (for example the forthcoming special issue of *Experimental Agriculture*, Summer 1988, edited by John Farrington); analyzing the institutional implications of adoption of FF approaches and methods by NARS; convening workshops and seminars

– in the CGIAR system, in NARS, and among NGOs, and with combinations of these to share experiences and ideas. These should all go ahead. But in my view, the fastest headway will be made by concentrating at this stage on the three thrusts

– search and network, make manuals, and invent, learn and train.

Conclusion

Instant orthodoxy can kill. If FF approaches were quickly and widely accepted and practised, one danger would be doctrinaire dissemination of methods without the basic reorientation needed for them to be effective. But such a rapid spread is not likely. The flips will, for many scientists and practitioners, be difficult and uncongenial. For many years it will be only a minority who wish or are able to change. But FF approaches are not entirely new. They have a long history and are already in use as a minority activity in many places. They promise to prevail more and more in the 1990s and the 21st century. The scale and intensity of their use can be expected to shift sharply. The main innovations and the impetus of the current movement are in rainfed 'undervalued' agriculture in the Third World. We may well see the methods found to be needed and to work there, moving back into green revolution and industrial agriculture, as with reduced subsidies and lower external inputs they move towards new diversification. The changes which have taken place in New Zealand farming with the end of subsidies, and in much of the irrigated agriculture of Southeast Asia with the spread of other crops in the second and third seasons following paddy, probably represent long-term directions for other industrial and green revolution agriculture.

If this is so, then the FF methods which fit diverse, complex and risk-prone agriculture of much of the rainfed Third World, will themselves come to fit and serve the increasingly diverse and complex agricultural systems of the rest of the world. We cannot be sure. But the prospect is exhilarating. It is that the small beginnings found now in parts of Latin America, Africa and Asia will become a permanent and respectable complement to what is now considered normal agricultural research and technology development. It is that the new methods and approaches of a small minority now will become methods and approaches taught in universities and practised in the field all over the world.

This places a special responsibility on all those now involved: to invent, to learn, to analyse, and to communicate, and thereby hasten the process. Thomas Henry Huxley once said that 'It is the customary fate of new truths to begin as heresies and to end as superstitions'

If FF approaches are new truths, then they are passing the stage where they are regarded as heresy. The hope must be that they will be constantly adapted and changed to fit new needs and conditions so that they never become superstitions. For they are different from other approaches and methods. Their basic philosophy of learning from and with farmers, of improvising and inventing, of choosing from a repertoire, and of process rather than blueprint, makes demands on practitioners, but also promises a vitality and diversity to fit the vitality and diversity of the farm families and farming systems they will serve.

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■

Concepts and activities

The aims of this chapter are:
– to contribute to the development of a common language on Participatory Technology Development by the presentation of a number of definitions;
– to identify some essential activities to be carried out in the domain of Participatory Technology Development;
– to give support to the process of making operational descriptions of field experiences by the presentation of format and a checklist.
The concepts and framework for analysis presented in this paper played a role in the workshop in the sense that it provided a common language and structure, but at the same time, have been subject to scrutiny by the workshop participants and other members of our network.

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Some concepts defined

Approach: The strategically chosen combination of methods and techniques.

Operational approach: A combination of methods and techniques, strategically chosen in order to achieve a certain output and which is based on tests and experiences under field conditions. The approach is described and elaborated to such an extent that it can be used and adapted by other persons than those who developed the approach.

Technology: The way knowledge, inputs and services are composed and combined and thus facilitate a certain system to function and survive.

Participatory Technology Development: Activities aimed at, or resulting in a change of the existing technology in a direction considered desirable by the different utilizers of that technology (in our case mainly farmers) and which are carried out by networks in which the utilizers of the technology play an active role. It is the practical process of bringing together the knowledge and research capacity of the local farming communities with that of the commercial and scientific institutions in an interactive way. It involves activities in which local producers and traders work together with external actors in the identification, generation, testing, application and diffusion of new technologies and practices. Participatory Technology Development therefore seeks to strengthen the existing experimental capacity of farmers and will sustain ongoing local management in the processes of innovation.

Network: A number of persons or institutions with functional interactions (communications, resources, actions) concerning a particular domain.

Sustainable Agriculture: Agriculture where production methods are being used which maintain or improve the productive and reproductive resources (such as soil, plants, animals, human labour and skills, socio-economic systems, services and infrastructures) as well as the non-productive natural and cultural resources.

The activities in Participatory Technology Development

For analytical purposes we distinguish five different types of activities in Participatory Technology Development.

Of course, in reality, these activities may not always be found and will probably not maintain the order we suggest.

In our framework we distinguish:
- Five major clusters of field activities.
- More specific descriptions of these activities indicating the concrete activities to be carried out by different persons or networks.

This framework then could be used to describe the operational approaches for one or more categories of actors (farmers, researchers, field development workers or other development professionals). To facilitate the making of the description a format has been elaborated and a checklist has been made for each of the clusters of activities.

Format for descriptions of operational approaches

For our purpose the descriptions of the operational approaches should include practical guidelines for persons who want to apply or adapt the approach and therefore should contain:

1 A label or name.

2 A characterization and description of the purpose of the method, expressed in terms of the desired output.

The degree and type of participation envisaged should be clearly indicated by distinguishing participation in:
- Decision making and choosing of activity
- Implementation and contribution by

way of ideas, manpower, land or finance
- The use of the benefits
- The evaluation.

3 A description of the setting in which the methods have been developed: In which country and agro-ecological, economic and political/administrative environment have the methods been used.

4 A description of the institutional situation of the organization which applied the methods.

5 A description of the procedures to be followed by each of the actors involved (separate for farmers, researchers, development workers etc.). This implies the description of the steps to be taken and the materials required. Where possible these should include illustrations and/or references to existing field guides or training manuals.

6 A description of the skills and means required for each of the actors involved, and indication of the requirements in terms of training.

7 An indication of the costs involved in acquiring the means and time required for the implementation.

8 An elaboration of the limitations and risks of the approach as well as an indication of the potential for improving farmers' capacity of technology development.

9 A list of names and addresses of resource persons who have worked with the approach, including the name of the main author/designer.

10 As appendices the descriptions may include such modules as field instructions, training manuals, evaluation instructions etc., and/or case descriptions of practical applications.

The use of the framework

One of the objectives of the workshop was to collect and assess existing materials and descriptions of operational approaches in Participatory Technology Development. To facilitate that process an analytical framework has been presented and subsequently modified by the participants. This framework distinguishes five clusters of activities which require specific field activities to be carried out by the rural population in concert with development workers, researchers, extension staff, commercial traders and entrepreneurs or other persons engaged in technology development. On the basis of this framework, the workshop participants were invited to participate in the inventory and assessment of existing descriptions of field methods and in indicating the gaps that presently exist in the available methods.

Checklist for the description of operational approaches

A number of questions are formulated below, which may encourage persons with the relevant experience to reflect on the methods used and the way they have been combined. The questions follow the order of the analytical framework.

Related to how to get started

– Who took the initiative to develop this particular technology: the farming community, the development agency, or was it a joint initiative? How did you or your team chose the target categories? Which villages were selected on the basis of which criteria? How was the invitation or selection carried out? Has a specific effort been made to reach the resource-poor farmers, female farmers or to get homogeneous categories, in the sense of farm size, socio-economic position, farming system etc.? If so, how was that done?

– How was the team that carried out the analysis composed and prepared? What was their relationship with the farming communities? Was a specific effort required to build up a relationship of confidence; if so, how was the confidence gained? How much time did the team have/need? How and why was the decision taken to work with a participatory method? How much institutional support/resistance existed for the method? In what sense? Local chief/leader structures? Outside institution building? Which analyses and what information gathering took place before the outsiders linked in with the farmers community?

– How was the goal for the analysis formulated? Specifically, how were the objectives of the different actors identified and merged?

– How did the choice for the domain(s) or subjects for which new technologies were to be developed take place? What was the specific contribution of the farmers, the researchers, extension staff, agricultural service and input supply agents?

– Apart from (participatory) analysis of the agronomic aspects of the area, what efforts have been made to collect information on the socio-economic and ecological situation of the area? Have data related to the way the information system, the input delivery system and the agricultural services in general are functioning been collected? How have the specific sources of information been tapped for this purpose?

– Has the process of participatory analysis as such been made explicit to the farmers and other actors, in such a way that their capacity to replicate the analysis without the interventions of outsiders would increase? If so, how did that take place?

– Which different networks were already in existence before the intervention of the development agency?

– How have the actors established the networks, and how have the development workers or researchers handled/influenced these networks?

Framework of activities to be carried out in Participatory Technology Development in sustainable agriculture

General Terms	1 How to get started	2. Finding things to try	3. Trying out	4. Sharing results	5. Sustaining the process
More specific description of field activities	- Build up relationship of confidence and lay basis for cooperation in analysis - Analyze existing environmental situation, farming systems, problems, networks - Establish relationship with existing networks or form networks for Participatory Technology Development	- Take stock of indigenous technical knowledge and formal knowledge - Screen possible experiments related to varieties, soil/water systems, indigenous processes - Select	- Assess and develop experimenting capacity - Choose subject - Design dynamic operational plan for experiments - Manage the experiment - Assess the results - Analyze and understand the process	- Carry out extension (farmer-to-farmer and otherwise) - Carry out training in use of new technology and in methods of Participatory Technology Development - Produce communications and training materials - Ensure relevant services - Ensure input supply	- Create favourable conditions for peasant organization, local institutions, policy-level support, physical infrastructure - Repeat the process Analyze and document experiences

– Have the members of the networks increased their skills in using networks for reaching their goals; if so, how did that take place?

Related to finding things to try

– How have the different actors been involved in
  * formulating potential solutions,
  * screening potential solutions and
  * defining hypotheses?
– How has the indigenous technical knowledge of the farmers been identified or elicited?
– How has information on existing technology from within the area been merged with existing technology outside the area and with the existing scientific insights?

Related to trying out

– How has the capacity of the farming community to carry out experiments been assessed? How have the responsibilities between the different partners been distributed?
– How has the experiment agenda been chosen by the different actors together?
– How were the experiments designed, what was the role of the farmers, animators, researchers and others in
  * the design of the experiment;
  * the lay out of the trials,
  * the procedures to be followed,
  * the criteria for verification and
  * comparison and the methods for drawing conclusions from the results?
– Who managed the experiments, what were the roles of the farmers the extension staff and of the researchers in this stage?
– Who analysed and interpreted the results? Which methods have been used in quantifying, measuring and comparing the results and interpreting its meaning? Also here, could you distinguish between the roles of the farmers and the roles of the outsiders (researchers, extension workers, etc)?
– Have the farmers, researchers and extension workers themselves drawn conclusions from the methods used and have specific methods been used to help these categories to increase their insight and skills in the different steps of participatory technology transformation.

Related to sharing results

– How do you plan and organize the training for the (selected?) farmers, researchers, extension workers and possibly other development staff in the area? Have you produced any training manuals, curricula, training modules for any of the categories? Who carries out training for whom, and how participatory is the training? Are farmers also used as trainers for development staff, if so how did that work?
– Which activities are planned and implemented to stimulate the communication between the actors on the results of the experiments and the experiment methods? How are different extension methods, seminars, mass communications etc., being used in this respect?
– Has the experiment resulted in the need to modify the services and input supply system? If so how have the actors in these subsectors been informed and motivated to adapt their work?
– Have the different actors (farmers, researchers, extension workers, persons who provide services or inputs to the farmers) increased their capacity to play their role in Participatory Technology Development? What has been done to generalize the experiences and to make the methods used clear and acceptable? This question refers to the problem of "How to design a comprehensive strategy to induce a replicable and self-reinforcing process of Participatory Technology Development".

Related to sustaining the PTD process

– Have farmers' organizations and/or local institutions been formed? If so, how did that take place? How much time did this take?
– How was political support for the introduction and application of the method and for the utilization of the newly developed technologies acquired?
– How was it ensured that the process of Participatory Technology Development could be replicated?
– How were the process, the field methods, extension methods and training methods described, documented and made available for other groups and categories?
– Is it possible to assess the degree to which the newly developed technologies are being utilized by the farmers, and other relevant actors?
– Do the new technologies which have been developed in a participatory way really contribute to a more sustainable agricultural development? If not, what are the reasons, and what could be done to improve the sustainability?
– How is the balance between the change in sustainability, the stability, productivity and the equitability as a result of the process of Participatory Technology Development? What strategies, methods or techniques should be used to bring these four criteria in a good balance?

Finally

The authors were invited to reflect on the following strategic questions:
– Why have the individual methods and techniques been chosen?
– Why have certain steps of the Participatory Technology Development process got more, and other steps less or no attention?
– What do you consider as the necessary steps for an effective process of Participatory Technology Development for your work situation. In other words, could you improve the framework as elaborated by the workshop participants?
– What are your suggestions for a strategic introduction of Participatory Technology Development activities?
– What do you see as the main bottlenecks for Participatory Technology Development? Do you have any ideas on setting priorities to overcome them?

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In monthly group meetings, farmers shared their observations with researchers and other farmers. Photo: David Norman.

Strengthening farmers' capacity for technology development

In most tropical regions farmers are confronted more and more with the urgent need to adapt their farming system to the changing circumstances under which they have to produce. Technological and institutional change is necessary to cope with population growth, decreasing soil fertility, changing climates, markets, prices, demands and needs. Formal Research and Development, based on Transfer-Of-Technology, gives to a certain extent an answer to this need for new technology. Yet, this approach has not been able to formulate adequate answers to the need for the creation of sustainable agricultural systems, and for "low-resource" areas it also has not been able to contribute to a substantial increase in production levels.

Bertus Haverkort, Wim Hiemstra, Coen Reijntjes and Sander Essers

More and more, researchers and development workers are experimenting with approaches to technology development in which farmers play an active role. These approaches range from support for farmers' experimentation to participation of farmers in formal Research and Development programmes.

In April 1988 ILEIA organized an international workshop with the aim to collect, discuss and assess practical experiences on "Participative Technology Development" (PTD). This editorial article reviews the role of farmers and other experts in the development of technology. It assesses the impact of the present processes of Transfer-Of-Technology in different agricultural systems, and argues that there is a need for a new practice in technology development. That practice should integrate the complementary domains of knowledge: Indigenous Knowledge and Formal Knowledge.

The article refers to a great number of experiences with this practice, formulates questions to be answered and indicates a direction on how to continue.

Farmers as developers of technology

Since the earliest stages of agriculture, farmers have been active in developing technologies for the production, processing and storage of food. Farmers discovered, selected and domesticated all of the major food crops and animals. Through their innovative activities many different farming systems emerged, adapted to the local conditions and available resources.

Also at this moment, farmers are still playing a very important role in technology development. This capacity of farmers has never been well acknowledged by agronomists. There are relatively few publications on farmer-originated technologies and systems (Rhoades 1988) and an impression has been formed that farmers are merely agricultural producers who depend on the external agencies such as research, extension and commercial enterprises for innovations.

Johnson Mugarura and a farmer examining Sesbania seedlings intercropped with yam (Colocassia). Sweet potato is in the background. Photo: Michael Loevinsohn.

This impression is proven to be wrong; farmers have remained active in the process of technology development more than being "clients" of "change agents". At the moment, there is a vivid interest in this phenomena. Several publications support this conclusion (Richards 1979, 1985; Rhoades 1982, 1987, 1988; Chambers 1985, 1988; Box 1986; Brokensha et al 1980).

Rhoades (1988) believes that there is evidence that farmer-initiated technological change does not occur by accident, but that there is a farmer-based method for research which, in many ways, is similar to the scientific method. He cites examples of farmer-generated innovations and farmers' adaptations of external innovations. He concludes that farmers, as well as scientists, follow the steps of: formulation of a problem, formulation of a testable hypothesis, testing the hypothesis empirically and validating or invalidating the hypothesis.

Research and Extension as developers of technology

The position of Rhoades is clearly a step away from that of the school of "the Diffusion of Innovations" or "Transfer-Of-Technology". That school is based on optimism about western science and technology and holds the assumption that there is a large stock of sound scientific information and technology ready to be transferred from researchers to farmers. In this view, it is the farmers' characteristics such as class, age, schooling, attitude etc, that determine the rates of adoption, rather than the inherent quality of the technology or the access of the farmers to inputs required. This approach generally has neglected ecological and environmental factors and assumes that the technology introduced to the farmers will be in the same form as the technology ultimately adopted by them.

Up to the present time, methods such as those used in FSR and the Training and Visit System of extension are based on the assumptions of the "Diffusion of Innovations" or "Transfer-Of-Technology".

In the last decade Farming Systems Research (FSR) evolved as a response to the need to identify opportunities for appropriate technology changes amongst poor farmers. FSR is characterized by Farrington and Martin (1987) as: An applied "problem-solving" approach, conducted by multidisciplinary teams, with a degree of farmer participation, where the perspectives of technology change are assessed within a holistic framework. It identifies homogeneous groups of farmers within specific agro-climatic zones as the clients of research. In the FSR approach on-farm trials are carried out and the results of one year's trials generate hypothesis for testing in the next and should influence on-station research priorities.

Although FSR originally was supported with much enthusiasm, latterly more and more criticisms are being heard. Farrington and Martin give an overview of the criticism from which the following is an excerpt:

- The institutional conditions needed to make FSR really work have not been created;
- A major thrust has been the implementation of large expatriate-led FSR programmes; local scientists and local institutional networks have hardly been involved yet;
- Multidisciplinary research proved problematic and the focus on the holistic approach has led to the collection of unwieldy volumes of data;
- FSR is still dominated by the Transfer-Of-Technology approach, does not focus on the problems and potentials of the resource poor farmers nor seeks to find unconventional technological alternatives taking into account the complexity and diversity of prevailing agricultural systems;
- The present researchers have been insufficiently trained to communicate with and learn from farmers, and to cooperate with them.

The impact of Transfer-Of-Technology

The approach of the Transfer-Of-Technology has had quite an impact on the industrial agriculture in western countries and on the green revolution agriculture in developing countries (see table 1). In these areas the conditions are such that relatively uniform practices, requiring high external inputs have been adopted. These adoptions have led to agricultural production which for the industrialized agriculture is far too high and has therefore overstressed the level of sustainable production. In the western agricultural systems there is a clear tendency to reduce the levels of external inputs.

The impact of the Transfer-Of-Technology approach in most of the rainfed tropical areas, the areas generally described as "Low-Resource" areas, has been very limited. These areas are found in the hinterlands of the Third World, including most of sub-Saharan Africa. Probably between 1 and 1.4 billion people rely on them directly for their livelihoods. Farming systems are complex, the environments diverse and the production prone to risks. Land tenure is often insecure. The potential of these agricultural systems is regarded as low by conventional agricultural scientists. Because of the increasing costs of external inputs, the continuing population growth and processes of land degradation, this type of agriculture is becoming more and more important to sustain food production in the Third World countries.

The modern agricultural technology has a definite male and western bias. The technology has been developed in such a way that it responds to the dominant needs and possibilities of the western society and thus technologies have been developed to replace Labour by Capital. In most tropical areas Capital has the greatest relative scarcity, but yet, the technologies offered by development agencies require high capital investments.

Modern agricultural technology requires a certain infrastructure for supply and maintenance of external inputs and services, assumes capital investments at farm level and needs a stable environment. Moreover, little basic or applied research has been carried out to improve the productivity of crops and animals which are unknown in the West. For example, research on water buffaloes or the use of other domesticated or wild animals and research on local food crops as cassava, sweet potatoes, sorghum, millet and most tropical trees and fruits is very limited as compared with their importance in the national agricultural production process, and is only a fraction of the research carried out on "major" crops such as wheat, potatoes, and "major" animals such as dairy cattle.

Concern for sustainability of the green revolution agriculture is expressed by many and recently acknowledged by policy bodies such as the World Commission on Environment and Development in its publication "Our Common Future" (see ILEIA Newsletter Vol.3, No.3) and the Technical Advisory Committee of the Consultative Group for International Agricultural Research (CGIAR) in its report: Sustainable Agricultural Production; Implications for International Agricultural Research (March 1988). Efforts are now being made to reorient the processes of agricultural technology development in such a way that sustainability and stability of the systems receive more priorities.

Production potentials

Recent reassessment of the production potentials of tropical areas on the basis of their locally available resources and local experiment capacity (Haverkort, 1988) suggests that major increments to sustainable output are possible. Therefore, rather than using the term "Low-Resource" or "Low-Potential Agriculture" we advocate using the term "Undervalued Agriculture".

Experiences have shown that decreases in risks, increases in production and sustainable productivity are often possible through exploiting linkages and combinations of diverse elements. Examples are: crop-livestock systems, agro-forestry, rice-fish cultures, multiple cropping, water and soil harvesting, micro-climate management, integrated pest management, nutrient recycling and the economic and biological diversification of farming systems.

In understanding, managing and exploiting these internal linkages of undervalued resource farming systems, farm families have a comparative advantage. They are the natural experts. They gen-

erally are better equipped than external scientists; they have the necessary knowledge for trying out varieties or practices and fitting them into their whole farming system.

This implies that the process of technology development (which includes activities such as research, extension, supply and maintenance of inputs and the establishment of a physical, commercial and educational infrastructure), which has had such an impact in the industrial and green revolution agriculture, needs to be modified substantially in order to uncover the real production potentials and to have a real impact on the rain-fed agricultural systems.

The process of technology development needs to take into account the climatic uncertainties, the diversity of the ecosystems, the complexity of the agricultural processes, needs to cater for an active role by the farming population and should recognise the importance of the indigenous knowledge of the rural population.

The need for a new practice in technology development

The challenge for farmers, researchers, extension workers, traders and industrialists will be to adopt an approach to technology development that overcomes the bottlenecks of sustainability, and that will lead to an increase in productivity.

We have chosen the term Participatory Technology Development (PTD) to describe the process in which different partners work together in the efforts to improve the technology being used. Participatory Technology Development is the practical process for bringing together the knowledge and reseach capacities of the local farming communities with that of the commercial and scientific institutions in an interactive way. It involves activities where local producers and traders work together with external actors in the identification, generation, testing and application of new technologies and practices.

Participatory Technology Development therefore seeks to strengthen the existing experimental capacity of farmers and will sustain on-going local management in the processes of innovation.

Participatory Technology Development should not become a new fashion, and should not be seen as a minor change in the present practices of Farming Systems Research. Participatory Technology Development needs to be complemented by on-station and fundamental research activities.

Participation

One of the key issues in the process of Participatory Technology Development is the way participation will be materialized. McCall (1987) distinguishes three levels of participation:

- As a means to facilitate the implementation of external interventions;
- As a means to mediate in the decision making and policy formulation of external interventions;
- As an end in itself, the empowerment of social groups towards access and control over resources and decision making.

In practice, participation is often only used as a means to legitimize top down approaches.

McCall states that local "participation" in the past 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 and planning of the project. Later "participation" has come to mean that local people also assess their own needs and priorities.

In Participatory Technology Development, "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 to increase their capacity to manage changes in their farming systems.

Obstacles to participation

In promoting participation there are quite some obstacles to 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. Prejudice exists amongst professional agronomists and development workers against the assumption that rural population may have something to contribute.
- The majority of the rural population, women, face special obstacles: heavy labour inputs 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 the villagers are men and most traditional societies have a patriarchal culture, reinforced by the colonial and post-colonial ideologies of the peasant household.
- In most countries, resistance to certain rural minorities exists, based on race, tribe or religion. Thus, participation in local-level development initiatives by rural minorities are 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 towards dealing with risks; risk aversion strategies have to be taken into account.

Professionals engaged in agricultural technology development therefore will need a lot of creativity and endurance to identify and overcome the obstacles. This requires not only agronomic qualifications but also special social skills and anthropological or sociological techniques. There will be no specific guidelines for overcoming these obstacles; the diversity of the phenomena requires 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 physical environment, its (agri-)cultural experience and its socio-economic structures. For people who have not grown up in the local society, it is very difficult to understand the whole livelihood system in all its complexities of physical, socio-economic 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 experiences and directly perceivable evidence (Farrington and 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 belief and confidence needed to counter the fatalism of poverty and leads to some form of self development (McCall 1987).

Indigenous Knowledge 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;
- the monopolization of knowledge by different social and gender groups;
- the economic stratification. Richer people use and generate other knowledge and use other skills than poorer people.

Therefore IK can not 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 experimental work, out of reach of rural peasants. There are also domains of knowledge to a large extent already possessed in IK, which can be added to by "formal scientific" research.

The key to Participatory Technology

Development is the integration of the complementary domains of knowledge.

Experiences with Participatory Technology Development

From the many case studies collected for the IDS workshop: Farmers and Agricultural Research: Complementary Methods, in July 1987 (see ILEIA Newsletter Vol.3, No.2) and the ILEIA workshop in April 1988, it can be concluded that there is already a wide range of approaches to and methods of Participatory Technology Development. There is a 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.

ILEIA has documented some 200 case studies and articles with practical descriptions of field experiences. The descriptions range from scientist-dominated research to support of farmer technology development entirely based on local initiatives and oriented towards the needs and possibilities of the farmers. The experiences have been documented according to five categories of activities in Participatory Technology Development:

- How to get started: How to build up a relationship of confidence aimed at cooperation with local networks of farmers and other actors. How to make a joint analysis of the existing situation, farming systems and problems.
- Looking for things to try: The identification of 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 production systems.
- Trying out: Developing the joint capacity in experimenting; Planning and designing experiments, implementing them and evaluating the results.
- Sharing results with others: Communication of results with other local and scientific networks to scrutinize and interpret them, and to incite others to adapt and test the results for their circumstances.
- Sustaining and consolidating the system of Participatory Technology Development: Creating favourable conditions for farmers' organizations, local institutions and support at policy level. Establishing physical infrastructure and educational facilities to strengthen local experiment capacity and local management of the processes of innovation.

From the list of activities it can be concluded that Participatory Technology Development is more than Research and Development. 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 sequences of the steps taken vary, and rightly so. The sequence suggested by the list of activities mentioned above is an artificial one, only produced in order to compare the many different experiences. In practice, a linear step-wise sequence does not occur; instead, there are iterations, laps and overlaps.

Important questions to be answered

The activities related to Participatory Technology Development are still in the stage of development. There are still many questions which need to be answered as we go further.

- To what extent can PTD make the development of technology more cost effective? Most of the cases reported so far implied a high labour input from outsiders. When the approaches are further developed, the labour input required may become less. However, when PTD is more widely applied, cost effectiveness is very important.
- How can PTD be institutionalized? Most cases reported are project based, and a good deal of them are carried out by non-governmental organizations. How can farmers' groups and organizations be encouraged to form networks for strengthening technology development? How can the official national agricultural research systems be encouraged to apply PTD? What shall be the role of the agricultural extension services? Is the present institutional differentiation of tasks between researchers and extension workers beneficial or detrimental for the application of PTD? How can organizational 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?

Low-External-Input Agriculture as such does not necessarily lead to sustainable agricultural systems. The approach offers some perspectives, but additional conditions have to be formu-

Proud farmer in Ouahigouya, Burkina Faso, showing a good millet crop: the result of improved soil management. Photo: Bertus Haverkort.

lated and additional insights need to be developed.

– 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?

We invite readers to share with us their experiences with respect to these questions.

How to continue

Robert Chambers, in his concluding presentation in the ILEIA workshop, showed optimism about the way and speed with which Participatory Technology Development will be practised in the near future. In order to facilitate the implementation, he mentioned the need for the following:

– A philosophy of decentralization, diversity and choice: This emphasises the primacy of what people need, want and can achieve in their environment. It stresses the importance of diversity and aims to manage diversity through decentralization and local initiatives.

– A new role for outsiders: The outsiders as development workers should abandon the role of missionary who transfers exogenous technology and should rather 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: What is needed is not a new fixed model, equivalent in structure to the Transfer-Of-Technology with rigidly related parts, but rather a fluid process in which the 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.

Priorities

In order to facilitate the further development and operationalisation of Participatory Technology Development, the following priorities were identified:

– Search and network

Search for others who are innovating, especially in National Agricultural Research Systems, communicate with them and encourage them. Start informal and formal networks, concentrate on practical experience, lessons learnt, what works and what does not under specific conditions.

– Make manuals

Short, practical and user-friendly manuals are needed to guide trainers and field workers. They should not be huge and intimidating volumes, suggesting answers to all possible questions, but rather be small and practical, giving orientations for questions to be asked and for ways to find answers. On occasion they could even be on two sides of a sheet of paper.

– Learn and train

Development of new methods, learning by doing, and training those who come fresh to the field, will best all occur together in the field.

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A meeting in which decisions on the priorities are taken together is organized every month. Photo: Hans Levelt.

Sustaining the process. Photo: Wim Hiemstra.

Self-development by peasant farmers in West-Africa

In West Africa, there presently exists a large gap between what agricultural research and extension have to offer, and the needs of the majority of small-scale peasant farmers. There seems to be increasing recognition that, if this gap is ever to be bridged, peasant farmers must participate much more actively in agricultural research and development. Rather than attempting to solve the problems for the peasant farmer, research and extension services and NGOs should re-orient their approach so as to help peasant farmers learn to be more effective in solving their agricultural problems on their own.

Peter Gubbels

While the potential of this idea is large, models for operational approaches to strengthen and institutionalize the peasant farmers' existing capacity to identify, test and adapt new agricultural technologies have yet to be fully developed.

Since 1983, World Neighbors (WN) has been actively involved in developing an operational approach designed to help peasant farmers in West Africa learn to be more effective in improving their own agriculture by undertaking small-scale experimentation. This approach, described in the book *Two Ears of Corn* by Roland Bunch, evolved from WN's 30 years of field experience, particularly in Central America. The question was whether the basic principles of this approach could be applied to West Africa with similar success.

The first WN operational program was established in Bassar, Togo. After a modest degree of success there, WN established new programs in Mali and, more recently, Chad and Burkina Faso. Although the process of adapting the approach to the West African context is not yet completed, the results to date are very encouraging.

Both in Togo and Mali, short-cycle seed varieties, including cowpeas, maize, sorghum and millet, have been the "first wave" technologies that have generated peasant farmer enthusiasm and stimulated continued experimentation of other type of technologies.

Peasant farmer diagnosis of agricultural problems

Peasant farmers already know their agro-ecological area, farming system and socio-economic environment intimately. Their knowledge is superior to what outsiders could realistically hope to gain, even after prolonged study.

Within the framework of agricultural self-development, as promoted by WN, peasant farmers themselves take responsibility for "agro-ecosystem analysis". Study of indigenous agricultural change in West Africa reveals that peasant farmers are dynamic innovators and managers of their local environment (Richards 1985, 1988). They already have a capacity to analyze their agricultural problems and act on this analysis by making appropriate changes to their farming system.

WN's objective is to strengthen and make more effective this existing capacity of peasant farmers. In order to realize this objective in a given program area, WN needs to develop a practical working knowledge of the local farming system. The purpose, however, is not to understand the farming system of the given agro-ecological area in its com-

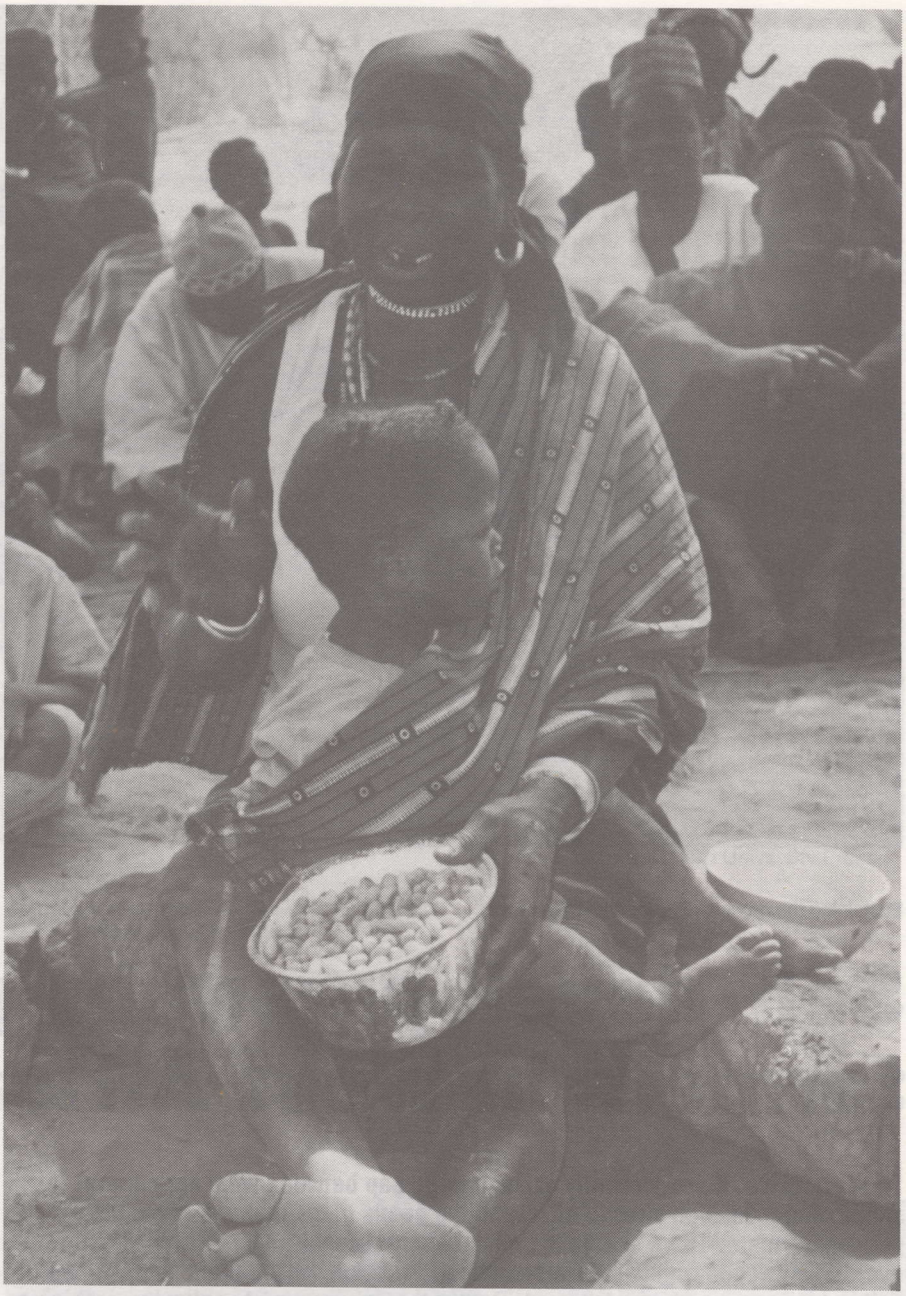
plexity in order to diagnose agricultural constraints for the farmer. Rather, the focus is to learn only what is essential to know in order to effectively guide peasant farmers to undertake their own analysis.

Before actually initiating contact with peasant farmers in the chosen program area, WN contacts the local agricultural research and extension services in order to learn about the area in general, and about the local agriculture in particular, including the major crops, cultural techniques, rotational patterns, division of labour, access to inputs and credit, etc.

WN uses the general information obtained from non-farmer sources to prepare questions of a survey designed to assist peasant farmers in the chosen program area to analyze their agriculture and determine priority problems. This survey is carried out by a team consisting of one or two experienced WN animators and a resource person who speaks the local language.

Typically, a WN program area may include from 20 to 80 villages. The WN team may decide to visit about 10 villages, chosen according to certain criteria set in advance by the WN team in consideration of what has already learned about the area. Before and during these visits, WN makes arrangements to help ensure that an informal gathering of village leaders, family heads and women representing a good cross-section of the local population attend the meeting.

In WN's experience, it is important to structure the informal discussion through the use of questions that stimulate analysis and reflection. Simply asking, "What are your problems?" is likely to provide limited information and a "shopping list" of needs for credit, inputs, and services which the villagers suspect the outsiders might be able to provide them at a later date.



Sharing results. Photo: Wim Hiemstra.

Three fundamental themes

The most useful approach that WN has employed to generate informative and analytical debate has been to ask a series of questions based around three fundamental themes:

- Comparing the agriculture practised in the time of your father and grandfather with the agriculture practised by you today, what are the major changes that have occurred?
- What are the major problems or difficulties that you are facing that limit your agricultural production? Why have these problems occurred? What are their root causes?
- What different ideas or new techniques have you tried in recent years to cope with these problems? How successful have these new ideas been in resolving these problems?

These questions, if artfully asked, generate a sufficient base of quality, analytical information on which to begin the process of helping peasant farmers identify, research and test new techniques which address the identified problems.

WN finds that this approach to helping the participants analyze their situation largely succeeds in identifying priorities that are common to the majority. On occasion, "problems" such as gaining access to bullock traction equipment or fertilizer, which may be of more concern to resource-rich farmers, are mentioned, but at a later stage in the process, when identifying and pre-screening various innovations, WN excludes those which are not likely to assist the majority of the population.

Common problems and local solutions

In Mali, Burkina Faso and Togo, in areas where WN has initiated agricultural programs, there has been a striking similarity of peasant farmer analysis of priority problems. Even though the agro-ecological areas of each program are quite different, the over-riding problems seem to be common:

- Declining rainfall coupled with increasingly irregular pattern of distribution. The irregularity is most pronounced at the beginning and the end of the rainfall season.
- Decreasing soil fertility.

Another similarity observed by WN is that peasant farmers in each of the program areas already have discovered, adapted and applied various innovations of indigenous origin to cope with their agricultural problems. Examples cited by peasant farmers are:

- identification of new local varieties of sorghum and millet which have shorter growing cycles;
- improved use of low-lying marshy areas and valleys where improved water retention makes growing non-drought resistant crops less risky;
- making of earthen bunds or natural

barriers to prevent run-off;
– use of minimum tillage techniques coupled with early sowing to make maximum use of early rains;
– mulching compound fields with vegetative matter brought in from the bush.

While these examples demonstrate that peasant farmers already do informal agricultural research and development on their own, WN has observed that this indigenous process is not systematic or organized. Rather, individual farmers seem to innovate on their own. If they succeed, neighbors see and learn, and a process of informal diffusion occurs. WN learns that the meetings it initiates are the first time that villagers have met together to reflect on agricultural changes that have occurred, and analyze agricultural problems as a group. There is no concerted, organized community effort to determine priorities, analyze problems, seek solutions and take action.

Helping peasant farmers identify potential innovations

Once the main research priorities have been identified by the farmers in the context of a general survey, WN's approach is always to begin on a small-scale, working intensively with 3 to 5 pilot villages (again selected according to certain strategic criteria).

After some time spent to introduce WN, to ensure that the village understands and has interest in testing new agricultural technologies, and that there is common agreement on agricultural research priorities (WN is interested in those innovations which respond to the majority of the resource-poor), WN begins the process of identifying potential appropriate innovations.

However, WN sometimes discovers that the villagers' priorities may not initially be directly related to crop or livestock production. For example, in Bassar, Togo, certain rural communities had a severe problem with guinea worm. Over 40 % of the men and women were suffering from this debilitating water-related disease during the growing season, and were unable to work their fields. In these communities, action to improve water supply and eradicate guinea worm had to be addressed first, before agricultural problems. Often, project and extension workers are locked into helping peasant farmers solve problems within a restricted field, e.g. cash crops or livestock production. WN's experience is that community priorities may not always be related to agriculture and, even when they are, key constraints to production may be more related to factors such as health and water supply. It is often crucial to success that agricultural development programs have sufficient flexibility to allow peasant farmers themselves to set priorities.

While initiating a new program in this way, WN prepares the ground by establishing links with national agricultural research stations and extension services, especially those based near the program area. Also, WN seeks to learn from other NGOs and informal contacts whether peasant farmers in other regions might already have developed innovations to solve problems similar to those faced by peasant farmers in the program area. Finally, during the initial survey and analysis undertaken earlier, WN personnel sometimes succeed in identifying innovative farmers within the program area.

WN seeks to identify potential innovations from all three sources mentioned above, so that villagers will not come to think that research centres are the only source of new technologies.

Pre-screening innovations

Once this initial background work is done, WN "pre-screens" th e identified innovations according to certain key criteria (Bunch 1982). The most important of these are simplicity, accessibility to the resource-poor majority, low risk, and likelihood of generating rapid significant results.

Wherever possible, WN arranges for selected village delegates to make field visits to gain first-hand information about these innovations. Usually, this will be the first time the villagers ever will have visited a research station, or made a trip to a distant region of the country.

The importance of having villagers make such excursions is not primarily for them to gain first-hand information and to be able to listen to those who have concrete experience. Rather, from WN's point of view, the main purpose is to develop the establishment of the farmers' independent links with a much wider network than exists at the village level.

If farmers are encouraged and supported in making direct contact with various potential sources of innovations themselves, rather than depending on WN to perform this role, they are likely in the long term to develop the necessary self-confidence to take up the task of identifying new technologies on their own, with a minimum of outside support. As the process has evolved, the farmers have, with surprising vigor, taken up identification of indigenous innovations, and are exploiting their own network of contacts outside of the area to seek out new ideas.

Finally, with increasing self-confidence, the farmers of the participating villages are relying on their own creativity to think of various ways to improve agricultural techniques. Usually, this creativity is based on experimenting with various planting dates, intercropping techniques, and plant populations of new short-cycle seed varieties which have already been tested and accepted by the community.

Testing new technology

In the WN Sanando Program near Segou, Mali, peasant farmers experienced severe drought in 1984 and 1985. Their own local varieties of millet and sorghum had failed to mature before the end of the rains. Also, villagers suffered during the difficult "hungry season" in July and August, because their stock of grain from the previous year's harvest was depleted before their local long-cycle varieties matured and became available for consumption. When asked what solutions they had already tried to address these problems, the farmers replied that they had identified a local variety of millet called "souna" which had a short-growing cycle of only three months. However, while "souna" helped them cope with shorter growing seasons, the farmers said that it was of inferior quality and palatability. They would be very interested if WN could help obtain other varieties of short-cycle seeds.

This information supported prior WN experience that peasant farmers innovate on their own to cope with agricultural problems. The "best bet" intervention that an outside agency such as WN could make is to move in the same direction as the farmers themselves, by improving, reinforcing or adding to the type of indigenous innovations already being tested and adopted by peasant farmers.

Thus, WN identified a range of new short-cycle varieties of millet, sorghum, and cowpeas. Some of these varieties were recommended by a Research station. Others, of local origin, were identified by individual farmers, with the encouragement of WN staff. WN organized meetings in 4 carefully chosen villages in the Sanando District, at which both men and women were present. Every individual was given a small handful of each new seed variety, a few grains only, and was asked to study the seed carefully. The animator asked the group what type of seed it was, whether they had ever seen this particular variety before, and how in appearance it compared to their local varieties.

Without exception, these questions stimulated lively discussion and interest, more so when the WN animator said that these seeds were reputed to produce a harvest in only 3 months. The farmers asked many penetrating questions about what type of soil was required, what spacing, what the plant looked like, etc.

The animator replied that, following their wishes, he had been able to identify short-cycle seed from other regions of Mali but knew little else. The farmers determined that these seeds had never been grown before in their village, and so even the limited information available on how to grow this seed under their local conditions might not be relevant.

"So, what do you think should be done?" Some farmers were enthusiastic and proposed planting a whole field with the new varieties. Wiser, more prudent farmers responded that it would be risky

to grow such a large area of completely unknown seed. Thus, the community itself (not WN) suggested the idea of testing the seeds on a limited scale.

Basic Steps

"So, how should we test these new varieties?" Again, the animator did not impose a set of pre-determined experimental procedures preferred by WN. Rather, he asked the farmers a set of carefully prepared questions (modules of conscientisation) designed to learn what farmers themselves thought about how to undertake an agricultural experiment, and to stimulate them to elaborate the basic steps of the process on their own:

- Should every farm family in the village try out the new seeds or just a few?
- If a few, by what criteria should these individuals be chosen?
- Should all the trials be put together in one big field, or should they be on the land of each selected farmer?
- Is one single test enough for each variety of seed? Why or why not? If not, how many test plots of each seed variety should be made in the village in order to be more confident of the results?
- How can the production of these new seeds best be compared to our local varieties?
- Should the test plot be on a special field or in the regular field in which the farmer was planning to grow his local variety of the same type of crop?

In this way, using dialogue, guided discussion and problem-posing techniques, WN stimulated the peasant farmers, within the context of the community, to make the basic decisions on how to undertake the trials, and to feel that experimenting with new varieties was in their immediate interests and their, not WN's, program.

In each of the 4 villages, farmers came to quite similar conclusions about how to conduct the experiments. Each community decided to choose a certain number of individuals (pilot farmers) who would undertake the trials on their own land. The villagers opted for smaller trial plots, varying from 10 "steps" by 10 steps to 30 by 30 depending on the experiment and crop.

To be more confident of conclusions drawn from the results, the community assembly decided that each trial should be replicated at least 5 to 10 times in their village. Part of their reasoning was that the trial should be undertaken in all the major variant conditions prevailing in the village (i.e. fertile/poor, high/low, planting date, etc.)

Farmers also quickly grasped the utility of having "control plots" using their own local variety next to the trial plots with the new seed in order to compare results under exactly the same conditions (date of sowing, land preparation, weeding, spacing, etc).

Immediately before the growing season, WN staff invited all the "pilot farmers" of all 4 villages to a short training course on basic principles of conducting a field trial. WN made clear that each farmer was to manage his or her trial plot and set the production variables according to their best judgement and traditional practice. Whatever the plots produced would be theirs after harvest, but the information generated would be reported and shared with the entire community. WN reviewed and reinforced the principle that trial and control plot should be treated exactly the same, with the seed variety to be the only differing "factor of production". To this end, each pilot farmer received training on how to accurately stake out the trial plots, and what field observations to make.

During the growing season, WN staff regularly visited each of 20 or more pilot farmers in the 4 participating villages. Additional important data that farmers could not yet record or measure for themselves was collected by the project for subsequent project-level interpretation and analysis.

Evaluating the results

Some months after harvest, WN facilitated village-level evaluation meetings. Each pilot farmer gave a complete report to the assembly. Interpretation of the results covered a wide range of criteria, mostly set by the farmers themselves, including yield, taste, drought and pest resistance, conservability, marketability etc. By asking "why did farmer A have much better yields than farmer B?" and "how do you account for all the differences that occurred between the replications", the farmers' intimate knowledge of their agriculture was brought into play, and a wealth of data, information and understanding was generated.

Thereafter, WN organized a inter-village session bringing together delegates from all 4 villages to compare results and discuss conclusions. This 3-day session, held in one of the villages, brought considerable new insights. The delegates examined each innovation tested in turn and decided to either

- reject it entirely,
- test the innovation again with more replications and under different conditions or
- recommend the innovation for widespread extension.

Not only did the assembly of farmers demonstrate their superior capability to assess the results, but for innovations selected for extension, they were able to recommend an impressive list of cultural techniques (date of sowing, type of soil, plant density etc). for achieving the optimal "fit" of the new seed variety into the local agro-ecological system.

Although these recommendations were not derived from scientifically rigorous experimental data, they did proceed from the farmers' experience, keen sense of observation, and intimate knowledge of local conditions. Their validity became dramatically clear during the next two years, when farmers acted on their own conclusions, and the adapted innovations spread rapidly to 10 new villages through a village-managed extension effort.

Women farmers were very clear on their criteria for technology assessment. Photo: David Norman.

Institutionalizing the process

After initiating the agricultural self-development process described above, WN works to consolidate, improve, extend, and make it self-sustaining. A network of "Paysans Essayeurs", recruited by their communities throughout the project area, receive additional training in how to undertake small-scale experimentation. They learn how to design simple experiments, not only in how to conduct variety trials but, in time, how to test intercropping, plant spacing, rotation, tillage, fertility, soil and water conservation, and pest management techniques.

Since almost all peasant farmers are illiterate in the areas reached by WN programs, a functional literacy component has been added to the training to enable these volunteer farmers to accurately measure and record additional relevant data, such as rainfall, planting dates, plant stands, etc.

If peasant farmers can successfully learn to organize and direct their own agricultural on-farm research, WN has found that a village-managed extension program, based on volunteer peasant farmer trainers, can easily be organized. Such an approach can be very cost-effective in comparison to traditional extension methods because

– the innovations have already been tested and adapted to local conditions by the farmers themselves, and
– it is not necessary to provide transport and hire paid staff.

In each of its programs, WN seeks to "institutionalize" this process both at the village and inter-village level, so that peasant farmers will continue meeting to analyze problems, identify and test innovations, evaluate results, and extend the proven technologies on their own, after WN phases out its support.

The agro-ecological problems faced by the resource-poor peasant farmers in West Africa are staggering. Development agencies and governments urgently need a dramatically more effective methodology to agricultural research and extension in order to make more efficient use of scarce resources.

To be effective, this methodology must be: inexpensive, robust, fast, flexible and easily replicable by training of field workers. It must be based on learning by doing within a process of action-evaluation-action. Finally, it must build on peasant farmers' capabilities and knowledge and develop their social technology required to continue the process with minimum outside support.

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A Philippine case on PTD

Clive Lightfoot and Francisco Ocado

This paper describes the different stages of a participatory method of the Farming Systems Development Project-Eastern Visayas to identify farmers' priority problems, diagnose farming systems, elaborate farmers' hypotheses and implement farmer-led experiments.

Participatory methods were developed in response to a lack of progress and farmer adoption using conventional transfer of technology methods. Before participatory methods started, several conventional socio-economic surveys were conducted. Also, cropping pattern trials had been going on for two seasons. This work had been done by a site research team comprising two economists, one livestock specialist, one agronomist and one extensionist as team leader. The team was supported by senior staff from the Department of Agriculture and the Visayas State College of Agriculture.

Stage One "How to Get Started"

First step: Farmers Identify an Appropriate Problem

Farmer group meetings elicited information on current topics of conversation. Attenders of the first meeting came because either they were interested or they were co-operators in previous cropping pattern trials. Asking farmers what their current topics of conversation were stimulated much more dialogue and proved a better entry point for finding problems than asking for problems directly. A key point was to get as many topics as possible to build an atmosphere of free exchange. From the many topics discussed, farmers selected declining soil productivity as the topic they would like to elaborate further by visits to their farms.

Farmers asked us to visit their fields so that they could show us what they were talking about. In these brief one-on-one discussions the complex web of whats and whys involved in the seemingly straightforward subject of soil productivity was appreciated. Group meetings of all concerned were used to obtain consensus on a priority problem. A key point for such meetings is that if consensus is not attained interest and co-operation will soon wane – waning interest is a useful check for researcher error. From the complex of problems mentioned, consensus began to form on issues pertaining to the cultivation of infertile, marginal cogonal uplands, areas infested with Imperata grass *(Imperata cylindrica).*

Second Step: Diagnosing Farming Systems

During the process of identifying farmers' priority problems, researchers gained sufficient knowledge to itemize key points for further study. These points were discussed and elaborated into guide topics with key informants. Guide topics included farm typology (resource base of farm size, family size, livestock held, etc.) some description of processes (area selection, cultivation procedures, and cropping sequences), and reasons surrounding the problem's existence (why Imperata is present, why farmers must cultivate these areas, what constraints are faced). This draft set of guide topics was pretested with a handful of 'typical' farmers prior to conducting the survey.

An informal survey was conducted of some twenty-four randomly selected

households from a total of one hundred and fifty in three upland villages. Survey topics were informally discussed in any order over several sessions. This was particularly the case when farmers requested us to visit specific parts of their lands to enable them better to explain a point. Estimates of percentage vegetative composition of Imperata areas, labour and draft power used in opening such areas were also gathered.

Informal survey responses provided information on the bio-physical causes and socio-economic constraints surrounding the problem. Why is Imperata around? Why are these areas cultivated? Each reason given was ascribed a box on the blackboard with arrows leading to the centrally placed problem box. A small group of 'key informants' then explained the relationships between boxes and between the boxes and the problem. Finally, the boxes were redrawn into concentric rings around the problem, with each box forming one segment of a circular systems diagram. The size of each segment was determined by the proportion of farmers who responded to that point against all points in that ring. A systems diagram provides a picture of the complex of issues and interactions farmers perceive to surround their problem.

Finally, a group meeting of all respondents was called to obtain agreement that the systems diagram represented what was happening on their farms. By working through this diagnostic procedure several times it is probable that farmers will develop the capacity to use the diagramming technique on their own.

Stage Two "Looking for Things to Try"

First step: Search for Potential Solutions

In order to let the farmers' priorities and ideas come first, their experiments, ideas, or knowledge were elicited. Most farmers knew that Imperata neither grew in shaded areas nor germinated in shaded or covered soil. More than this, several key informants had observed that Imperata was shaded out or suffocated by vigorously vining plants. In group meetings attended by farmers, site researchers and station-based researchers, the farmers' observations were supported by formal research findings. Farmers also expressed other ideas for controlling Imperata. Plowing and planting cassava or sugarcane were two examples. Supplementing this list, researchers advanced the idea of using herbicides.

Second Step: Screening Potential Solutions

At technology screening meetings, key informants and researchers presented to this farmer group various options, with the 'pros' and 'cons' openly debated. The systems diagram was used to focus the debates as 'pros' became potential benefits vis-a-vis bio-physical causes and 'cons' became potential conflicts vis-a-vis socio-economic constraints. For example, farmers judged that plowing would required too much labour and draft power, already in short supply, and herbicides would cost too much. Money and labour constraints did not, however, appear to conflict with a potential solution in shading out Imperata by planting trees or vining plants like Pueraria. Although several farmers wanted to try Pueraria, others wanted to see it growing before they would make any decisions on testing. A field trip was arranged for them to see Leuceana trees, Pueraria and Centrosema growing at a research station and on farms. One key point here is that, if strong consensus cannot be reached on a well-defined test, it is better to go back a few stages rather than push forward an unpopular experiment.

Stage Three "Trying Out"

First step: Defining Test Hypotheses

Farmers decided through group meetings to test vining legumes for the rehabilitation of Imperata-infested land. They had a hunch that legumes may shade out Imperata grass and also directly improve soil fertility. Furthermore, farmers thought that ground covered by a flat bed of legume would be less laborious to cultivate than that of tall grasses and shrubs. But would it or how well would it do all these things? Neither researchers nor farmers knew but they both wanted to find out.

Second Step: Designing Farmer-Led Experiments

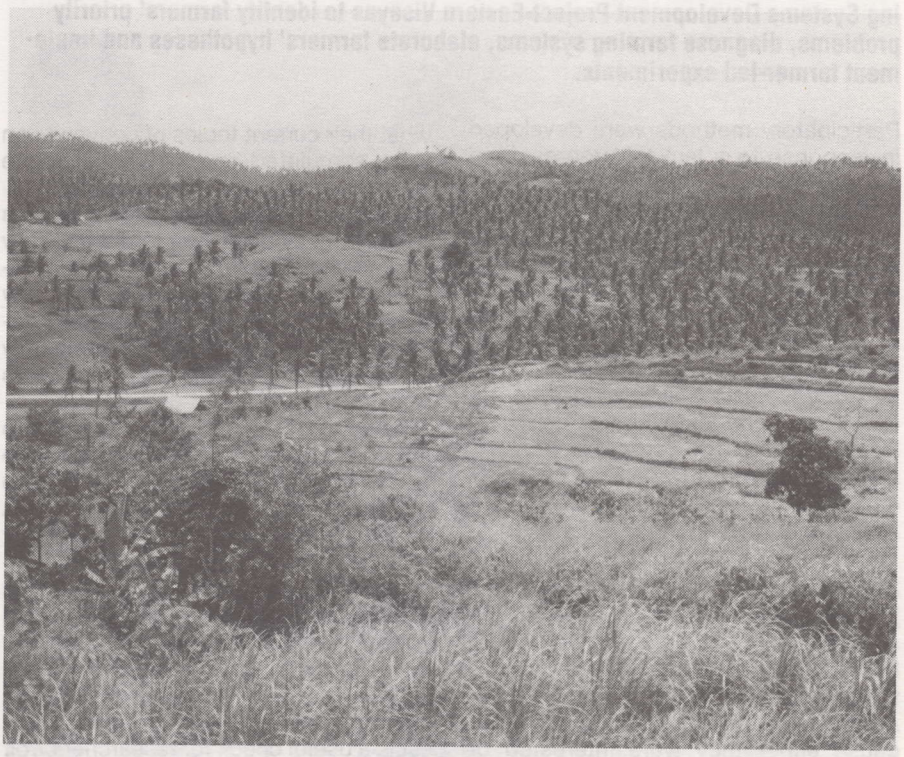
Most decisions pertaining to experimental design were made by farmers during visits to individual farms. Farmers chose plot locations and plot sizes from a researcher defined range of 500 to 1,000 sqm. The number of replicates or farms was, however, set within an acceptable range by researchers. Treatments were limited by availability of legume seed. Farmers developed their own methods for establishing the legumes. Finally, what parameters to measure was decided by what farmers did not know and wanted to find out. Measurements taken by researchers included farmers' assessments and standard biological measurements.

Third Step: Conduct Farmer-Led Experiment

Following a schedule of farm visits, farmers and researchers demarcated the plot, farmers prepared the land and planted the legumes. Researchers provided the legume seed and recorded Imperata stand densities, took soil samples and noted labour requirements. Periodically, farmers and researchers visited the plot to note progress and take biological measurements. Where damage by drought or fire occurred, researchers encouraged farmers to reseed. All experimental plots were demarcated and planted to the legumes Pueraria and Centrosema. Nurseries of *Desmodium ovalifolium* were also started. Even though prolonged drought after establishment slowed legume growth, interest remained high. After six months legumes covered only 25% of the ground, partly because of drought and partly because of accidental burning. Most plots are now ready for planting to a second legume *Desmodium ovalifolium.*

Fourth Step: Analysis of Experiment

Farmers continually analyzed the exper-



Typical landscape of Eastern Visayas, Philippines. Photo: Ly Tung

iment. However, final results must await the testing of all hypotheses. So far, researchers have done the labour data analysis for establishing legumes. They have also monitored the percentage cover of legume and Imperata. These data and analysis, along with farmer responses, were discussed in regular farmer group meetings.

Discussion

The method described encourages farmer participation. It also encourages the use of systems logic in identifying systems problems, analysing systems, and elaborating experiments. Consequently, these experiments are very different from typical cropping pattern trials which place priority on maximizing crop grain yield per hectare and high cash inputs. Upland subsistence farmers are uninterested in immediate increases in crop yield and cash input; instead, their priority lies in the long-term rehabilitation of cogonal land and in saving labour.

A more holistic systems logic also leads to differences compared to conventional cropping pattern trials. Cropping pattern trials usually focus on one or two crops and assume they will be grown every year. A wider view of upland farming systems reveals that upland farmers do not only cultivate many agro-ecological zones, but they do so on a crop-fallow rotation. Thus, farmers are interested in the management of cogonal fallow land and not just the cropped areas. On this occasion, more participation and a wider systems view than in conventional cropping pattern research undoubtedly produced important differences in both research topic and orientation of intervention. More important from a methodological standpoint is the fact that, on other occasions, this method has led to unusual experiments. Legume-enriched fallows are being tested to enhance soil fertility recovery and reduce labour costs in coconut-fallow rotation systems.

Participatory methods that use farmer knowledge and systems are now solving problems that conventional cropping pattern research was incapable of addressing. Participating farmers have increased their capacity or skills and willingness to work together as a result of working on this experiment and they are able to increase their part in this trial process when addressing another problem. Furthermore, if and when the time comes for farmer-to-farmer training, they are prepared to be trainers.

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Participatory analysis of an Indian village agroecosystem

Some degree of local participation is relatively easy to achieve in the information-gathering stages of rural development planning. The local inhabitants are able to participate as information providers and, if an informal interviewing approach is used (i.e. without a fixed questionnaire), the respondents can also help determine what topics are investigated - i.e. the ones which they feel are most important. But how can they play a more active role as information gatherers and what about the analysis and presentation of the information - what mechanisms are there to incorporate their participation during these stages, too? It is in these later stages that the important decisions are made about the appropriate development activities/innovations for the area, so participation by the inhabitants of the area is most vital here.

Jennifer A. McCracken

These issues were considered and several participatory mechanisms tested in recent Rapid Rural Appraisal (RRA) work in Gujarat. This article will describe how the analysis and presentation, as well as information collection, was contributed to by the villagers, and will briefly outline some of the issues which arose concerning the participatory objectives.

The primary objective of the work, undertaken by staff of the Aga Khan Rural Support Programme (India) and the author, was to develop a framework for participatory village-level planning for the agency. Two villages were investigated for about one week each, by a multi-disciplinary team of 5 or 6. Before starting either of the RRAs we (the RRA team) paid an informal visit to each village. We consulted the Sarpanch (village headman) and asked his permission to conduct the RRA. We also met with leaders of each of the main communities in the village to explain the purpose of the RRA and to gauge the level of receptiveness towards our work. The RRA began with visits to the village, simply wandering around and introducing ourselves to the villagers, to make our presence known and to try and avoid any misunderstandings or suspicions about our intentions in the village.

Villagers join the RRA team

As we talked about our work during these first visits, we were also able to make contact with three or four villagers who were interested and available to join us for the early information-gathering stages. Also on the first day, we studied the secondary data (village census records, map etc.) with some villagers, to verify the figures and check for any changes which had occurred since the data were produced (encroachment of village grazing land, expansion of the housing area etc.) We used the map for discussions to find out more information such as the ownership, productivity and problems of the different areas within the village.

We also used the map to help choose a representative transect line through the village – that is, a route along which we would pass through all the main zones within the village agroecosystem. We then walked this general route during the next several days, and noted down the characteristics and conditions of each zone. Again, the villagers were actively involved at this stage of information gathering. A group of two or three villagers joined us as we walked the transect. Their knowledge of the different zones was an essential supplement to our own observations and, during interviews with other villagers encountered along the transect walk, this group also joined in the discussions. Where possible we tried to work with this same core group of villagers for several days; as they became familiar

Mrs. Saroja Reddy sharing her experiences in ecological farming with her colleagues. Photo: Erik v.d. Werf

with the kinds of issues we were interested in, we benefitted more and more from their approach. Indeed, as the mystique of our work was removed, this group of farmers in turn could tell other villagers of what was going on. As well as these benefits of participation by some of the villagers, we obtained an extra bonus in one of the villages, where one of the villagers accompanying us, a member of an untouchable caste, turned out to have a postgraduate training in sociology – a discipline which our team had been lacking!

After a couple more days of interviewing (using a checklist of issues which we had drawn up previously), we withdrew from the village as we reached our 'optimal ignorance' level, i.e. when we felt we had gathered enough information and detail to get a reasonable picture of the village.

Diagrams for two-way communication

As we discussed among ourselves the new information we had collected, we began to firm up our ideas as to the key problems and opportunities in the village and possible initiatives to help alleviate the problems and/or make use of the opportunities. While we wanted to hear the villagers' views as to whether they felt these were the real issues, and what activities they felt could help the situation, we were unsure of how to go about this. As a first step we drew a set of diagrams to illustrate our findings.

In addition to the map and transect these diagrams were mainly seasonal calendars showing the availability of the village's main resources. Problem periods were highlighted and opportunities were also marked. We then drew these diagrams on large sheets of card and tried to make them as understandable as possible by minimizing the amount of text (Gujarati) and using colour-coding wherever possible. The seasonal calendars, for example, were simplified, by changing the axis of individual months to 3 blocks of different colours, each representing a season. We were still not sure of how easy it would be to communicate our findings and ideas with these diagrams to the villagers, so as a trial we invited the leaders of each of the main communities to a small group meeting, outside the village. The actual identification of these people was quite straightforward. We simply asked members of each community for the name of their respected leader, and then visited that person to invite him to the meeting. We also made it clear that it was very important for some women to attend, and tried to find those women who would be most comfortable in speaking out at such a meeting. It proved difficult to convince the men of the value of this, and to convince the women that they had something to contribute, but in each of the two RRAs, the women who attended did speak up, especially when issues such as fuelwood were being discussed. As we presented each of the diagrams to the group, they helped us to amend any incorrect diagrams (for example, by showing on the map where areas marked as village grazing land were in fact government revenue land) and to fill in information on incomplete diagrams (for example, adding an extra crop to the cropping calendar, or adding another problem to one part of the transect). We also began at this stage to discuss with the group the issues represented in the diagrams and to get their ideas of the many opportunities.

Analysis and discussion in the open

After this meeting, we felt ready to go to the rest of the villagers with our findings. But in each village the leaders suggested it would be better if they themselves showed the diagrams to the other villagers: "You will not be able to make these issues clear enough. Let us make the presentations, and we will use these charts to explain what you are trying to say." We welcomed these suggestions wholeheartedly and accompanied the leaders to a general meeting in the village, where they presented the

findings. In the first village in which we tried this approach, we expected about 60 or 70 villagers to attend, but in the event 500 or 600 turned up! The leaders stood up on a platform and held up and described each diagram in turn, and the issues being represented. The first diagram shown was the sketch map and the team watched as the elderly Brahmin who was presenting it hesitated each time he was showing a feature on the map. Then, realizing the problem, he turned the map upside down and continued more confidently with the presentation. Obviously the team's north-oriented map was not how he envisaged his village!

The village meeting went on for some two hours. After sorting out the map, the Brahmin leader held up a transect diagram – a pictorial cross-section through the different areas of village land with notes on the conditions found there and special emphasis on the specific problems in each area. As he read out the notes, the other villagers began to shout out mistakes in the diagram: "You have left out an important problem in the grazing land; many people are mining the soil and that is why there is so little grass left. And in the housing area: none of those handpumps are working now." Other leaders held up calendars showing when the water scarcity limits crop production, when it is that many of the villagers must buy fuel and fodder from outside the village, and when the landless labourers have to borrow money to see them through the slack period.

As well as enabling the team to correct their findings, each of the diagrams also provided a focus for discussion of the particular issue which it represented. Indeed they turned out to be a valuable means of ensuring that each key issue was discussed. At one point the Sarpanch, who was helping with the presentations, tried to show the fuel calendar very fleetingly and without commenting on it and was ready to move on to the next diagram which he obviously considered more interesting or important. But one of the villagers shouted out "Just a moment, Chief! It's clear that getting enough fuel is not a problem for you. In fact, neither is it a problem for me. But it is a problem for many of the people in our village. So put up that diagram again, and let's talk about it!"

The fuel calendar was one of the diagrams which gave the women a chance to join in the discussions, as it dealt with a topic very relevant to their daily work. They were quick to point out mistakes. "That calendar shows that we collect wood from around the village; that's not true. There are virtually no trees left here to cut and we have to buy all our fuel from outside at that time."

After all the diagrams had been presented, the discussion turned to ideas for dealing with some of the problems. A checkdam was the most popular option for many of the wealthier farmers with large landholdings near the river. But their wives argued that a bridge was more important. At present they have to wade across the river or make a long detour to the nearest crossing point, to bring food from their homes to their families working in the fields. We began to respond to the ideas which were being shouted out, sometimes throwing back questions for the villagers to consider: "That checkdam site will bring most benefit to farmers on an area of disputed land; that will cause problems for getting government approval for funding." We also began to discuss with the villagers some of our own ideas such as biogas plants to help the fuel problem and an animal husbandry programme to provide income for both the land-owning and landless members of the village. The discussions continued and the meeting finally ended with the villagers deciding to form a Village Organisation to look into these various ideas with AKRSP (India).

Unanswered questions

During this work we came up against the following issues and questions on participation:

– For real participation by the villagers, time needs to be set aside, especially at the beginning of the work, to make clear what we are doing and to seek their help and involvement.

– We need to be especially careful if the expectations of the villagers are not to be raised inappropriately. I feel there is more danger of this in the case where villagers themselves are involved in the RRA, as they have invested their own time in the work. Yet if the team talks frankly with the villagers about the possible follow-up (and possible non follow-up) of the RRA, this risk should be minimised.

– How can the diagrams be improved as a means of (1) communicating the findings to the villagers, (2) filling in gaps in their information and analysis of their village, (3) positively reinforcing the information they already know and the tests and experiments they have already tried?

– Can we further increase the level of participation, for example, by involving the villagers in compiling the checklist of issues to be investigated and in drawing the diagrams?

– What is the best form for the village meeting? Should a smaller meeting be held later to discuss each innovation/suggestion in more detail?

– How much should the village meeting discussions be limited to projects which are within the scope of the agency, and how much should the agency staff stress their normal 'menu' of projects?

These and other questions have no doubt arisen before in other participatory analysis work, and the author would welcome comments and ideas on how others have tackled them.

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An agropastoral woman in Nigeria keeping an eye on her sheep, which graze fallow land between cropped fields. Photo: Ann Waters-Bayer.

Farmer participatory research in the IPM extensions and women project

Women are responsible for choosing and buying pesticides during their trips to the markets. Working with a "bottom-up" approach and involving local school teachers resulted in a decrease of insecticide sprays in upland-rice from 4-6 to 0-2. Boys are trained as 'IPM Scouts' to assist the farmers in consolidating the gains.

Candida B. Adalla and Melanda M. Hoque

Pesticide use in Southeast Asia has been increasing since the early 1960's and is expected to increase further in the future if alternative controls are not able to show remarkable progress (Oka 1988). In the Philippines, rice production accounts for 54 percent of the total insecticide sold in the market (Magallona 1980). It is therefore not surprising that most of the pesticide-related poisoning of users was reported among rice farmers (Loevinsohn 1988, Castaneda 1988). In addition, the psychological impact created by previous government programs which advocated massive pesticide use in its desperate efforts to be self-sufficient in rice is a reality we have to contend with. It is within this framework that the IDRC-funded IPM (Integrated Pest Management) Extension and Women Project was conceptualized. Its primary objective is to create awareness and subsequently facilitate adoption of IPM in the target village. It also aims to highlight the role of women (farmers' wives) in the farming community and assist them in the performance of such roles through an appropriate technology, if any, or develop one with their active participation.

The project started in June 1986, and was initially supported by the FAO Intercountry Program. By a happy coincidence, it was conceived and managed by an interdisciplinary team of researchers, all women. One represents the field of entomology and handles the technical aspects of IPM; one is a vertebrate biologist who handles the rodent pest problems in rice and later on the subproject on vegetable pests management (a concern that was expressed to us a year after the problem in rice was addressed to) and an economist who looks into the socio-economic aspects of the project. In addition, the project is ably supported by a development communication expert and a rural sociologist, who provide the appropriate communication and extension perspectives.

Being a location-specific technology, the first phase of the project concentrated on the generation of location specific information aimed at improving the adaptability of the existing technology to the target villages. In addition, the project emphasized the partnership between the various participant levels, namely: the researchers, the farming household, the local extension agents of the Department of Agriculture and other sectors of the village having a part in this community-wide project. It may be important to mention that we did not initially plan for a specific women's component. Whatever women's activities we have, and are incorporating into the project, evolved out of the perceived needs of the farmers' wives with whom we have been working.

How did we get started?

The foremost consideration in selecting the site was accessibility to the University where all five project leaders are based. Secondly, the sites were selected on the basis of existing linkage with the community (as one of my research aids was from the place) and, of course, the fact that the village does provide the lowland rice environment and appropriate rice-upland crop farming system in which we are interested.

The conventional protocol was followed. We held meetings with the local staff of the Department of Agriculture, who kindly provided us with the list of possible co-operators. Selection of co-operators was based on pre-set criteria after conducting a Rapid Rural Appraisal (RRA) of the place, its people and situation. After this, a benchmark survey was conducted.

The benchmark survey documented relevant demographic information and current knowledge, attitude and practices related to IPM in particular, and rice and vegetable production in general. It may be worth mentioning here that we tapped the services of the local school teachers to conduct the survey, as we felt after the initial RRA that the farmers were more at ease answering questions and relating experiences with the school teachers in the locality.

Finding things to try

While the project had pre-set objectives and treatments to start with, the information gathered from the RRA and benchmark survey were used to modify the approaches and incorporate additional treatments. True to our initial assumption, the target farmers are dependent on synthetic pesticides for their pest control. In addition, their perception of a pest situation is rather loose (seeing one to two moths flying around, when damage is apparent ... and so on) and they practically lack the knowledge of natural enemies and natural control. Concerning women, we realized that they have a significant role to play. Seventy-five percent of those who responded to the question of what role they perform in rice farming claim they were the ones who purchased the farm inputs (fertilizer and pesticides) and they do this during their regular trips to the town market where they purchase household and food items. However, when it comes to selecting brands or kinds of pesticides, the women follow their husband's orders, consider experiences of friends and neighbouring farmers and sales talk of the pesticide dealers as a basis for buying a specific brand or kind of pesticides.

The project was aware of this information and lined up activities addressed to the expressed problems. Regular visits and casual talks to each co-operating husband and wife brought new ideas and revealed additional problems. So far, the $2^1/_2$ years of interaction with them has been truly challenging and very rewarding. Ifn fact, we realized that there were more problems than we expected and that we were spending more time and resources than was initially planned.

Trying out and sharing the experiences

The project believes in a "bottom-up" approach in problem identification and subsequent course of action. With the active participation of the farmers and their households, especially their wives, we were able to identify and resolve issues and approaches on how to link them. We approach the problem of promoting awareness and ultimate adoption of the technology by showing the promise or advantages of IPM vis-a-vis the traditional practice. The plot of each co-operator was divided into 2, where on one part his traditional pest control practice was carried out while the other

half was IPM. Except for spot control and nitrogen rates, all other management practices and field operations for both farms were the farmer's decision. For the IPM he was under the supervision of the project staff, and he could not spray nor add additional nitrogen without the approval of the IPM staff. Furthermore, the technical basis for deciding whether he needed to spray or not is painstakingly taught to him using his own field as his laboratory. In other words, training on how to recognize pests and natural enemies, appropriate methods of sampling and ultimate decision making were done on a "one-to-one" basis right in the farm of each co-operator. This is considered the most important aspect of the project as it also seems to be the most difficult and time-consuming part. But we found that this was the very aspect that truly enabled our farmers to appreciate our approach – and expressed that they did learn and appreciate better the pictures, slides and ideas put forth during regular monthly meetings.

Finally, results of the economic and agronomic performance of the trials are given back to them after each cropping season. A specific meeting is held solely to present the seasons' data and each co-operator is given the basic comparative information on expenses, harvest and profit. In addition, we try to call their attention to some practices which we thought would need appropriate discussion, i.e. their massive use of synthetic nitrogen fertilizer and spraying even if there was no need for it. These season-ender meetings are usually capped by a picnic where each contributes his modest share to make the affair a truly entertaining social interaction.

Sustaining the gains

While the project staff feel that it's too early to conduct an impact assessment of the project, some activities automatically generate this information. For example, we are happy to note that some women would consult our project staff (who reside in the village) prior to their decision of what pesticide to buy. Some would request a staff member to go with her and assess her pest problem when she wanted a spraying done. One co-operator (an elementary school teacher) requested a seminar on IPM for his Agriculture class and encouraged his pupils to collect the golden apple snails during weekends in support of the community-wide effort to control the pest. On top of this, we are happy to note an apparent attitudinal change among co-operators regarding their use of pesticides. Our data show that the average insecticide spray among rice farmers has decreased from 4-6 (pre-project data as per benchmark survey) to as low as 0 to 2 after two and half years we spent in the village.

In the context of pesticide use, we are confident we have made an edge in reducing their dependences on pesticide and creating the awareness on the existence of natural controls, i.e. the presence of good levels of natural enemy population right in their paddies. However, from the technical point of view, it is clear that their basis of reducing pesticide use is rather loose. They learn to just follow what is being done in the IPM plots. We are not confident that they now have the expertise to make an intelligent decision, because their basis of decision-making needs improvement. When farmers were asked why they are not able to do the pest-monitoring scheme the way they were taught to, some expressed the difficulty of looking for and counting these tiny insects. Others do not feel comfortable carrying a pencil and a piece of paper to record what they see in the process. Still others claim that they can assess visually without really counting/sampling for pests (which may really be true).

Since the project is terminating by December 1989, we have made the following contingency plan to sustain whatever little gains we have made. On the difficulty of the farmer to monitor pests/natural enemies due to poor eyesight, we have trained IPM scouts for hire. These are young boys, 10 to 13 years old, who are sons of farmers themselves. The idea is to make their services available in case farmers would need them. In addition, they can do the services for their own parents. On the other hand, plans for a Phase II of the project are addressed to the farmers' way of assessing pest levels/damage versus the actual situation, and to evaluate its efficiency and predictive reliability. Finally, efforts are also being made to make sure that the farmers will sustain their newly learned technology by requesting the technical staff of the local office of the Department of Agriculture to provide the necessary technical expertise in addition to our individual commitment to come back (although on a less frequent schedule) and still provide the moral and technical back-up until they become confident in their decision-making for a truly need-base use of pesticides, until finally weaning them from pesticide dependence.

Conclusion

We realize that Integrated Pest Management is a rather complex technology, because it involves decision making on the part of the farmer and that the decision should be based on sound and accurate assessment of pest problems, which in itself would require some skills. This participatory research approach is believed to lessen the lead time for introducing the technology to its subsequent learning and ultimate adoption. In addition, it makes the client feel involved in the process and also gives him the option to decide whether it will benefit him or not, based on his actual experiences.

We accept the inherent limitation of the approach and we hope to ultimately fine-tune our methodology in due time. For the moment, our experiences indicate that, like the experiences at PROPELMAS (Vel et al 1989), most farmers are used to working together for certain types of activities (in our case, the IPM concerns) and that the possibility of benefitting only a particular group (those with leadership potentials and aggressive ones) is real. On the other hand, we also feel that our approach seems to be working just as well, if not better, than the usual "shot-gun" training and demonstration method where technologies are given in a "top to bottom" manner as perceived by government technocrats.

Finally, we recognize the technical shortcomings of IPM for the moment and we hope to work out these limitations, given the necessary logistic support by appropriate agencies.

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Farmers experiment with a new crop

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.

John Connell

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.

Stimulation

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.

Farmers' 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 crystalized, farmers are still evaluating and modifying them. In one village, for example, farmers have used 6 harrowing methods, giving different seed cover and seed depth.

Limits

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 to/ha in irrigated areas and 0.8-1.5 to/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 pre-season 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

Scientists, extension workers and farmer getting together in the field to discuss problems, and modifications the farmer has made. Photo: John Connell.

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'.

Why a "minimalist" approach to PTD?

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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Beyond the PTD approach

Having gone through the October 1988 issue of ILEIA on Participatory Technology Development and some of the references mentioned in it, one should be very pleased to find that farmers' participation in rural development is receiving more and more attention, even from mainstream scientists. Every development worker with his or her heart in the right place should applaud these bottom-up strategies.

Jacqueline Vel, Laurens van Veldhuizen and Bruce Petch

Undoubtedly Participatory Technology Development will contribute to the refinement of sustainable agricultural systems. Yet we feel there is something lacking in the PTD approach, or Farmers Participatory Research (FPR; Farrington and Martin 1987).

To understand our concerns it may be relevant to explain that we have been working for the last four-and-a-half 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.

Is development of technology enough?

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-side 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 thus formed provide a good basis for further organization.

From the evaluation of this activity many technical problems became apparent. Yields of the new crop are quite low. Farmers cultivate green gram on steep hillsides and they 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 their labour is found to be the most constraining factor during the season in which green gram is grown, as farmers are obligated 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 on ly consider the factors of production and indigenous technical knowledge or would they also take into account the social background of the labour constraint?

Indigenous knowledge

This example illustrates the importance of analyzing 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 ITK (Indigenous Technical Knowledge)?

Within Propelmas we do explicit research on indigenous ways of farmers' cooperation and organization 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 orientated. But even then, there is more to indigenous knowledge than ITK suggests.

The necessity of conscientization

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 critically analyze their situation 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 organization

In the articles of Volume 4 No. 3 of ILEIA, little attention is paid to the need of small farmers' organization. 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 organizational 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 rational of group formation or the building of local organizations (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 organize 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 to 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, conscientization, and discussion on possible actions take place between NGO field staff 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 nearly five years. The project area of the Propelmas Rural Development Project is, by Indonesian standards, very sparsely populated, only 30 inhabitants per square kilometer. 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 organization follows strict hierarchical, feudal lines. Strong dependency relationships 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 is different than the PTD approach. Nevertheless, for purposes of comparison, we have attempted to describe our approach using the PTD's five-step model (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 twelve 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

Building of awareness and self-confidence among small farmers is a prime prerequisite. Photo: Bertus Haverkort

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.

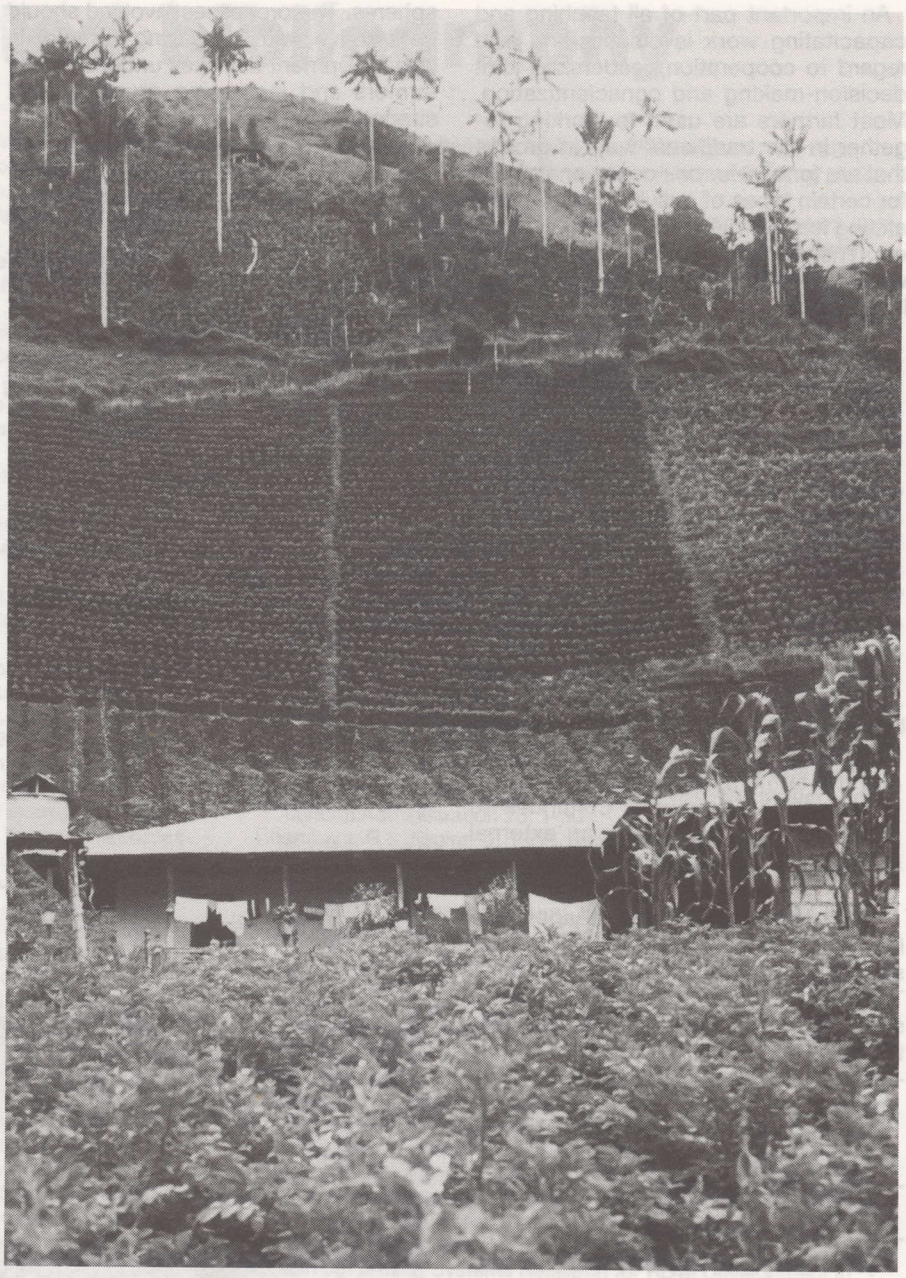
From the result of the survey we decide whether there is scope for a fruitful working relationship with the village or group and try to choose people who seem to be promising as key persons for activities. These key persons can be characterized as people who are able to coordinate a group of farmers, 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 to 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 organize 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 organized small working groups. At the end of this meeting and based on the information available at that point, the farmers and the project will 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 interest of the farmers with more resources;
- the activity should provide a first step to farmer organization;
- carrying out the activity should not require many inputs or knowledge from outside, and should be relatively simple;
- the activity has to bring a quick result to its participants;
- it has to produce good possibilities for follow up activities.

In our project area growing green gram has proved to be a good entry-point activity.



Analyzing the farming system is a proces of cooperation between the farmers and project staff.
Photo: Bertus Haverkort.

Trying out

While carrying out this activity we learn a great deal about the participants, their organization, 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 organization of farmers. The process of conscientization 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 farmers 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 discussions with regard to cooperation, leadership, joint decision-making and conscientization. Most farmers are used to working together in the traditional way, in groups that are formed for one occasion only, or for certain types of activities, while benefitting leaders more than ordinary farmers. The road to a farmers' organization which functions in a democratic way is long and difficult.

Sustaining

In the Propelmas approach the most important part of this step is evaluation and organization. Activities as well as functioning of organizations 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' organizations are further formalized. In this process of increasing institutionalization of farmers' groups, Propelmas at first assists and actively intervenes when there are problems. Eventually Propelmas withdraws and the farmers' organization becomes independent. Propelmas continues to provide assistance, but as an external advisor and facilitator only.

Trying to fit the Propelmas approach into the 5-step model of the PTD 1 obscures some of its major elements. Therefore it is appropriate to give a summary of the approach in our own terms:

- Propelmas' assistance is requested, staff visits the village, (first informal contact with individual(s) requesting the assistance).
- Gathering of information, survey and discussions, analysis.
- First assessment both within the project as well as together with farmers in a formal meeting.
- Entry-point activity.
- Evaluation of entry-point activity.
- Follow-up activities, increasing complexity and scope; each activity evaluated.
- While expanding activities, a process of organizational strengthening takes place, resulting in formalization of farmers' organization.
- Propelmas withdraws from participation actively in the organization.

Conclusion

The complex strategy that is necessary for effective rural development will vary according to local conditions, but should combine technology development with conscientization and community organization. Farmers should eventually 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 organizational 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, field workers, 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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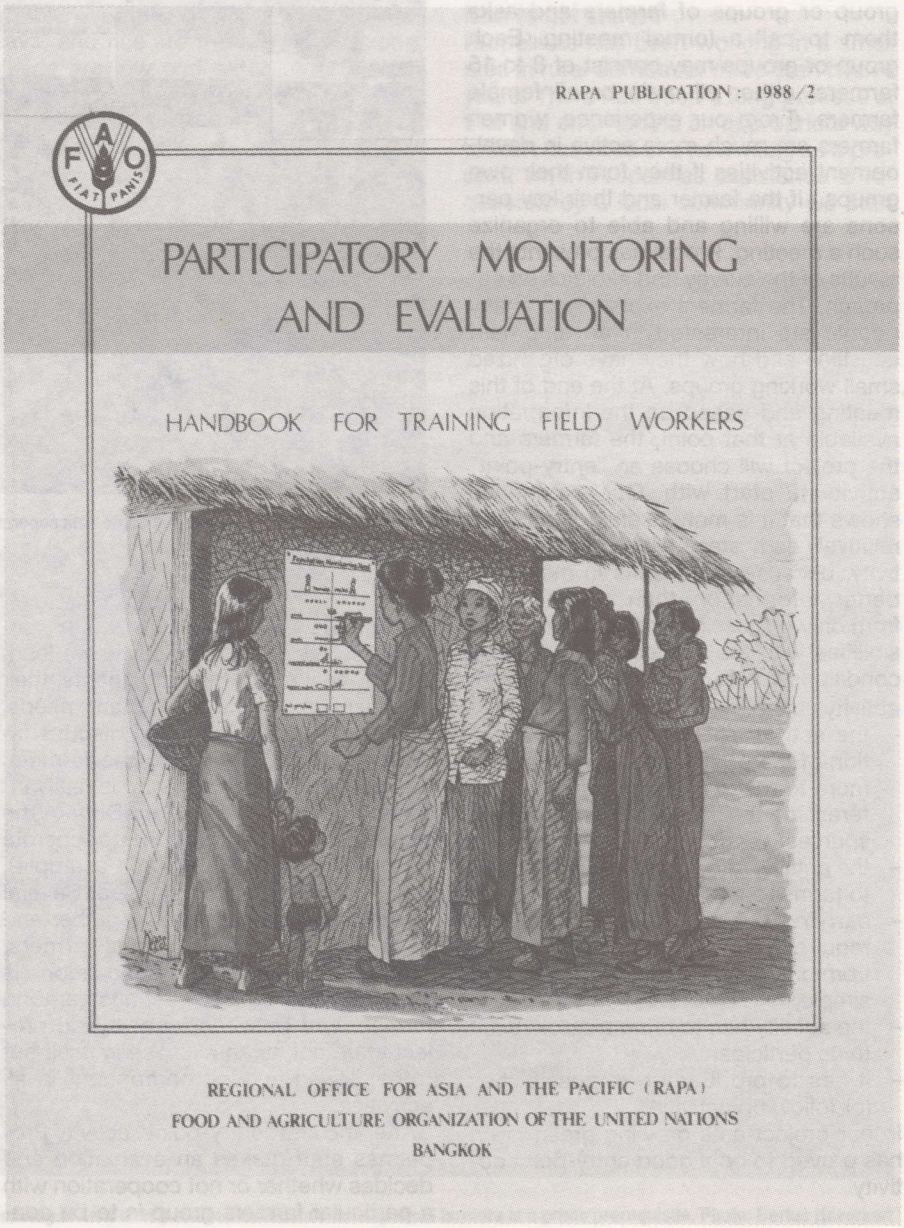

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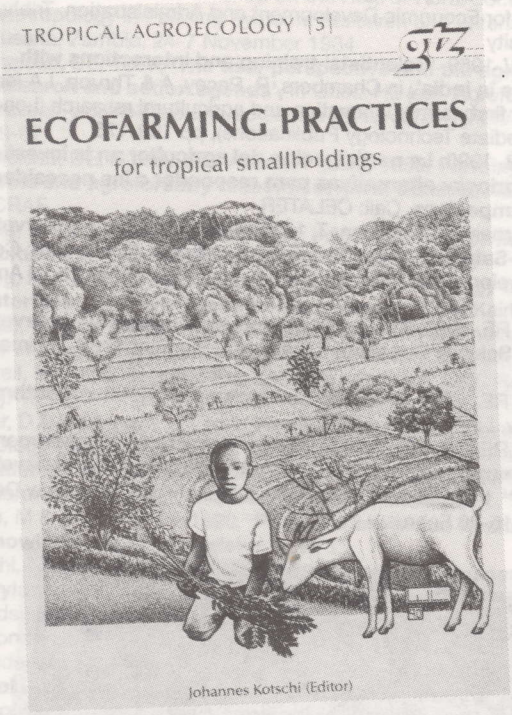

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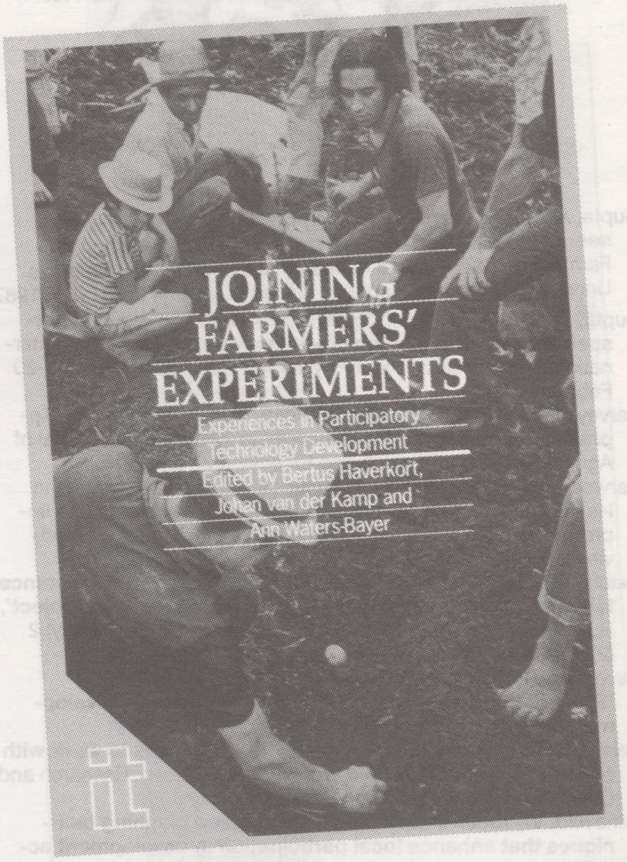

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