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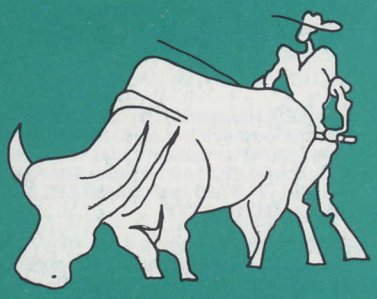

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Discussion on Sustaining Agriculture

Colophon

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Cover photo: "Small-scale farming could well be dubbed 'the world largest research laboratory'. The vast majority of knowledge applied by farmers comes from agriculture". Picture taken in Peru by Hans Carlier.

Dear Readers,

This issue of the ILEIA Newsletter does not have a special theme. We return to themes of earlier issues, particularly technology development by farmers. Several other articles are included on for example participatory rural development, livestock and water management.

In their article 'Beyond the PTD Approach', Jacqueline Vel et al rightly pose the question: Is development of technology enough? Should not the central problem be how to improve the effectiveness of outsiders' efforts to improve the living conditions of resource-poor farmers?
The Propelmas project in Indonesia, of which Jacqueline Vel et al are staff members, gained valuable experiences with their community development approach.
Technology development/research may never be an aim in itself, it has to serve and fit the struggle of farmers to sustain or improve their livelihood. This is best ensured when the efforts of outsiders concentrate on the direct needs of farmers and on mobilizing and strengthening farmers' own initiatives to improve their living conditions. Technology development to sustain agriculture has to fit in this overall approach.

In her article on participatory analysis of the village agroecosystem, Jennifer McCracken shows us the vivid interest of Indian farmers in analyzing the village problems and ideas of dealing with these problems.

That farmers are creative innovators, adapters and communicators of agricultural technology is demonstrated in the article 'Farmer experimentation and communication' by Coen Reijntjes and Wim Hiemstra. From the discussion on PTD we got the impression that farmer experimentation and communication is only seen as "something" which may give scientists clues to improve their own (participatory) Research and Development. In our opinion, formal scientists' on-station and on-farm trials, farmers' on-farm and participatory trials and informal farmers' trials are complementary and all have their own role to play.
Especially in low-external input agriculture, enlarging the capacity of farmers to experiment and communicate seems to be a very effective way to stimulate agricultural change. Apart from that, formal research and extension may gain effectiveness by studying farmer experimentation and diffusion and by improving communication between farmers and scientists.

The contribution of Leonard Peries on Sustainable Agriculture and the activities of the National Rural Conference in Sri Lanka shows the importance of local NGOs in taking initiatives to sustain agriculture/the livelihood of small farmers and society as a whole. Leonard Peries poses the question who is leading/dictating 'development' fertilizer and pesticide multinationals, the government or the people/farmers? The National Rural Conference is pursuing a vigorous opposition against the senseless use of chemical inputs and inappropriate technologies pushed by multinationals, the government and the media and is developing alternatives based on organic, native agriculture. In the opinion of Leonard Peries, 'Sustainable Agriculture should be a deliverance from consumer thinking, a return to sanity and self-reliance....'.

It is clear to us that Sustainable Agriculture, as an approach, should be concerned with setting ethic/political values on how people want to and have to live together in balance with their economic, social, cultural, political and ecological environment.

The article of Pieter Vereijken 'Research on Alternative Agricultural Systems in the Netherlands' shows that sustaining agriculture is a hot item not only in the tropics. He concludes that 'drastic reduction of the usage of fertilizers and pesticides by means of integrated farm management is attractive from the environmental point of view. The resulting cost reductions may also offer sufficient compensation for lower yields and may even bring a higher profit. In further research of alternative agriculture farmers should play an important role in testing the prototype-system in order to attain technically and economically feasible farming scenarios'.

We hope that this issue may provoke some reactions from our readers to continue the discussion on sustainable agriculture and technology development by farmers.

The Editors

Farmer Experimentation and Communication

Coen Reijntjes and Wim Hiemstra

Innovation and adaptation of technologies to sustain agriculture have always been implicit activities of farmers. Sustaining the production capacity of the land, to secure the continuity of livelihood during the life-time of the farmer but also to ensure that children may find a living on the family land, has been and will always be an important aspect of the struggle for survival of small farmers. It can even be seen as the driving force behind agricultural change, in any case for farmers who do not have other alternatives to make a living.

The continuing process of innovation and adaptation by farmers has led to long-time sustained farming systems fine-tuned to the ecological, economical, social and political environment of the farmer. However, it has also led to recent changes in farming systems to improve short-term productivity, which now turn out to be environmentally unsustainable. The capacity of farmers to innovate, adapt and diffuse technologies will be, now more than ever, of crucial importance for them to find a new balance between productivity and environmental soundness of their farming systems. In this article we will look at what some authors have written on farmer experimentation and communication and on their being complementary to formal research and extension.

Experimenting farmers, the norm and not the exception

Richards (1988) has written on this subject: 'Older literature readily admitted that agricultural practices were well adapted to environmental conditions in pre-industrial societies. But these practices were often thought of as 'traditional' and static - as if arrived at by happy accident at some early point in the evolutionary sequence, and then copied without further thought, generation after generation. These earlier perceptions are now thoroughly outmoded, for two reasons. First, the facts of agrarian history frequently imply a greater dynamism than the older conventional wisdom was prepared to allow (Boserup, 1965; Rhoades, 1987). How else, as Bunch (1987) notes, was it possible for two New World crops, maize and cassava, to establish themselves as major staples throughout tropical Africa in the 450 years since first introduced by the Portuguese? Second, there has been a crucial shift in the way the concept 'traditional' is regarded by historians and social scientists. It is now common to stress that tradition need not to be timeless or static. Some traditions are quite clearly recent inventions. In other cases even to maintain the appearance of tradition in a changing world requires ceaseless invention and adaptation. Some of these newer perspectives have rubbed off on agriculturalists, and it no longer causes surprise to find that traditional cultivators are tirelessly inventive. In recent literature the experimenting, innovative, adaptive peasant farmer is now accepted as the norm not the exception (Altieri, 1987; Biggs & Clay, 1981; Budelman, 1983; Lightfoot, 1987; Millington, 1987; Reij, Turner & Kuhlman, 1986; Richards, 1986)'

McCorkle et al, 1988: 'Indeed, African people have been farming for thousands of years, necessarily readjusting their cropping and herding techniques to innumerable social, economic and environmental changes. In sum, using their own ethno-scientific methodologies and the means at their disposal, African farmers have been responsible for significant agricultural innovations'.

Technology needs to be renewed continuously

Bunch (1987) states that no innovation, or an extremely limited number, is ever going to be permanent. 'A productive agriculture requires a constantly changing mix of techniques and inputs. Seeds degenerate, insect pests spread and develop resistance, market prices fluctuate, new inputs appear and old ones become expensive, agricultural and economic laws change, and temporarily successful technologies become less profitable as their spread forces market prices downward. Small farmers on all continents have proven themselves perfectly capable of developing many kinds of technology on their own. Of course, traditional agriculture itself can be seen as a combination of technologies developed by villagers and/or spread by villagers'.

Some examples in a short survey

In their case-study on 'Farmer Innovations and Communication' in Niger, in two weeks time McCorkle et al (1988) found, in a small area, many examples of farmers' experiments, communication and local practices unknown by the team. Some of them are given below:

– A farmer in Wazeye has been experimenting with a short-cycle millet, which he discovered during a trip to Filingue. A market woman of Filingue was selling this variety. He liked the looks of it, and she gave him a handful of the millet, to try it in his fields back home.
For two years now, he has been cultivating a small plot (7-8m2) of the new variety, and has been very pleased with its performance. He finds that 'it gives many kernels and it does very well without fertilizer'. Hence he plans to continue and increase his cultivation of this hardy, short-cycle millet.

– Another farmer in Wazeye has always been looking for new varieties of all sorts of species. In fact, he is something of an ethno-botanist. He keeps a garden of exotic, medicinal, and/or almost forgotten trees, cacti, shrubs, and other plants near his home.
Recently, he travelled to 'Hausa country' in Nigeria, to attend the funeral of a family member of one of his

"So long as farmers' own research efforts and their wealth of communication resources are ignored, much of the donor investment in Research and Extension institutions and projects will be lost". (Photo: Wim Hiemstra)

relatives. During this visit, this relative introduced a new variety of short-cycle millet to him, unknown in Wazeye, plus a new type of fonio. The farmer looks forward to trying both of these fresh acquisitions this year, to see if they might prove a useful addition to his already large collection of species.

– The same farmer also uses a traditional technique for killing rodents that gnaw at the young trees he nurtures in his botanical garden. He prepares a poisoned bait from a certain cactus which he also raised, and then places the bait at the foot of the seedlings. As reported, any rodents that eat this tasty morsel are instantly paralyzed.

– A man in Goube is trying out a new idea he learned from a marabout (holy Moslem leader). Before the first rains, he digs seed pockets, places manure directly into them, then re-fills them with earth. Termites help break down the manure, and with time any 'burning' effects the manure could have on seeds are dissipated. After the first rain, the sand on top of the prepared pockets is discoloured, making them easy to locate. The farmer reopens the pockets and plants dressed seed. The dressing wards off the termites. This man believes his manuring technique is nearly as effective as chemical fertilizers, and certainly much less expensive.

– When Wazeye farmers plant their millet, they may also throw some sesame seeds into the pocket to protect against it Striga. This parasitic plant entwines itself so tightly around the millet's roots that 'When you dig it up, it looks like a potato. But when the sesame grows up alongside the millet,' informants say, 'this does not happen'.

Farmers claim that the Striga wraps itself around the root of the sesame, thus leaving the millet free.'

Farmers echo the view that formal R and D has little to offer

Based on these findings, McCorckle et al conclude:

* 'Nigerian farmers are clearly open to, actively seek out and apply new ideas in their plant and animal agriculture.

* Moreover, they plan, implement, and evaluate their own informal on-farm research trials.

* In the process, they demonstrate a sophisticated understanding of the complex interactions among numerous variables with which they must contend.

* Sahelian farmers manifest an indisputable demand for fresh agricultural information and ideas (and their associated technologies, tools, management practices, etc.), no matter what the source of origin, as farm families struggle to wrest a living from an ever-more-difficult physical and human ecology.

* Farmers are largely self-directed in their endeavor to get access to such information through a multiplicity of networks and communication channels, both informal and formal. But they rely more heavily on informal resources in evaluating information and formulating decisions, since formal sources do not (and cannot by themselves) fully meet the farmers' need for credible and workable information.

* Sahelian farmers design and conduct their own applied and adaptive research using empirical, ethno-scientific methods. Much of this experimentation is explicitly impelled by what producers perceive as the inappropriateness of technology currently offered by formal systems of RD&E.

* A rich body of local technical knowledge exists in agriculture, elements of which - with increased cross-regional communication and in some cases validation and refinement by formal research - could almost certainly be of use to farmers throughout the Sahel.

** So long as farmers' own research efforts and their weather of communication resources are ignored, much of the donor investment in R and E institutions and projects will be lost. Like it or not, both R and E depend for their success on farmers' own, informal systems of technology validation and transfer.*

Farmers themselves echo the view that formal R&D has little to offer them. To give just one simple example - but one of paramount concern to Sahelian producers - there is little point in generating new miracle crops that require massive inputs of commercial fertilizer unless a number of other problems are solved (see AED 1988 and USAID/Niger 1986:30-38), for example generation of cash or credit for purchase of such inputs and, in relation to this, stable and profitable markets for the crops thus produced; related issues of adequate supply, transport, and distribution networks for both fertilizers and crops; and even relatively simple questions like translation of recommended fertilizer applications into local systems of land and volume measurements.'

Adversity stimulates experimentation

'Recent research (in both Africa and India) concerning the adaptive responses to drought and famine tends to suggest that the poor farmer's faith in the value of experimentation is strengthened rather than undermined by adversity (Juma, 1987; Vaughan, 1987). De Schlippé (1956), percipient as usual, was one of the first to provide evidence on this point, recording that experiments by Azande cultivators tended to increase in number and complexity after a poor harvest. Of the examples he documents, some of the most ingenious were undertaken by women' (Richards, 1988).

Taking initiatives may be lamed

This however, does not mean that all farmers are innovative and are able to cope with changing circumstances. Many farmer problems can not be solved by technology. Social, political, cultural or economic constraints are frequently more limiting than technological constraints. 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 though their own action may be limited (Vel, J., 1989; Ros, T., 1988). Fatalism due to alienation of one's cultural roots, poverty or enduring crisis (oppression, war, droughts, etc.) is laming the initiatives of people to change their situation.
Change may also lead to unsustainability when short-term productivity or high profits force farmers to forget about the importance of the farming system being in balance with the environment.

'The young farmers in Peru are crying to stop the 'turns' and plant year after year in the same fields. It is foolish, they say, to let the land lie fallow so long when we can make so much more money by selling our produce in the Lima market. They say don't worry about the old ways. Today we have fertilizers and pesticides. And it is true, ingeniero, we can produce many tons more'. Highland villages have survived across the millennia, while nations, governments and even cities have faded from the human scene. But today there is an erosion in the mountains which cuts silently and unseen. Like the erosion of the precious soil, this erosion is equally irreversible and just as costly. I am referring to the exodus from the mountains and the demise of traditional insights and practices' (Rhoades, 1988b).

The potential for innovation is large

Bunch (1987) reports many examples of experiments that have been observed in the areas where agricultural development programmes have consciously stimulated villager-initiated and villager-managed research. Some examples are given here.

'In the World Neighbors Programme in Guinope, Honduras, one farmer already using contour ditches for erosion control decided that he would give the compost another use: by building the compost in a meter-wide swath just above the new contour ditch, it worked as a dead contour barrier for four months, increasing the soil caught while his grass barriers were still growing and unable to hold much soil.

In the WN Cebu Programme in the Philippines, farmers who had been taught to plant Leucaena as a contour barrier found that planting Napier grass along the barrier after the Leucaena had grown a meter high provided a more solid barrier and a faster growing one than Leucaena alone.

In the WN/Oxfam San Martin Programme in Guatemala, farmers just learning how to grow groundnuts tried interplanting them with the traditional beans. As a result, the beans, which matured more quickly, were harvested before the groundnuts needed all the space; production increased 50% over separate plantings.

Again in San Martin, Guatemala, wild rabbits were wiping out soybeans introduced by the programme. One day a local farmer smelled a horrible odour as he was walking by a drugstore. It was iodine. He bought a pound, mixed it with water, and sprinkled the solution around the borders of his soybean field. The rabbit problem was eliminated. One of his neighbors discovered that burning sulfur at the edges of his fields provided the same happy results.

In a WN/COMBASE Programme area in Chapare, Bolivia, where farmers were using the traditional jungle slash-and-burn agriculture, most of them were losing half their rice to an insect pest. Programme extension workers were recommending the farmers to use various insecticides, all of which were expensive, highly toxic, and only occasionally available. Nevertheless, one day the extension workers came across one farmer whose rice was very surprisingly totally undamaged. For three straight years, this farmer had kept his fields free of the insect by a) clearing the jungle in such a way that the wind could circulate well; b) burning the host weeds thoroughly, and c) planting on a certain date.
This control system obviously incurred no expense and no toxic residues.

In the WN/ACORDE/ Recursos Naturales El Rosario Programme in Honduras, farmers found that a local legume (velvet bean, *Mucuna pruriens*) being pushed by the programme as an intercropped green manure, could be used as a mulch also, with significant attendant advantages. The small loss in soil fertility caused by mulching the green manure rather than burying it was more than compensated by the weed control effects (two weeding operations in the subsequent maize crop were completely eliminated), maintenance of extra moisture in the soil (particularly important in this drought-prone area), use of the beans in human nutrition (which had been precluded by the turning under of the velvet bean while still immature), and the comparative ease of merely cutting down the green manure rather than burying it.

Farmers in a Christian Reformed World Relief Programme (CRWRC) in Chiapas, Mexico, found velvet beans growing wild in the nearby jungle, and noticed that they shaded out all other weeds. They planted it together with their corn, and in traditional jungle conditions, together with the proper use of chemical fertilizer, were harvesting 4 tons/ha in the same fields year after year without the benefits of either a crop rotation, periods of fallow, or migratory agriculture.'

These experiences of World Neighbors, but also of many other organizations like Propelmas (Vel, 1989), Grupo Yanapai (Fernandez, 1988), FASE (Proposta No. 36, Jan. 1988) show how important and effective it can be, in terms of technology development, to help farmers to analyze their situation, to strengthen their self-confidence, and to make them aware of and strengthen their communal capacity to experiment and manage change.

Farmer experimentation and the exchange of results and local practices should be promoted to spead up the process of generating technology to adapt and sustain agriculture. Further development of methodologies and a creation of non-governmental as well as governmental training capacities to strengthen farmer experimentation and communication is necessary (see also page 28, Call for Experiences) and should therefore receive high priority in development cooperation.
In the Proceedings of the ILEIA Workshop on 'Participatory Technology Development for sustainable agriculture' (ILEIA, 1989) more information can be found on 'Sharing the results' and 'Sustaining the PTD process'.

Complementarity between farmers' and scientists' trials

Small-scale farming could well be called the 'world's largest research laboratory'. The vast majority of the knowledge applied by farmers comes from agriculture itself and is passed on within agriculture. Research and extension services cannot and must not replace this process. Their task should rather be to improve the transferability of external knowledge to agriculture and to give farmers incentives to solve their own problems (Thimm, 1989).

Formal research can be made more effective by improving communication and collaboration with experimenting farmers, as Stoop and Bingen point out (1988, ISNAR, unpublished).

'The structure of local agriculture and the macro-economic conditions of many developing countries dictate, to a large extent, low external input technologies as being most adapted to the prevailing agricultural production constraints. Yet much of the on-going agricultural research focusses on 'modern' technologies mostly based on sole crops of improved varieties to be grown with chemical fertilizers and pesticides.

Often national research staff are reluctant or unaware how to explore alternatives to the 'modern' package. These alternatives, however, might be more economic in terms of local price ratios, the availability of seasonal labour or climatic risks and yield security. By including some of these aspects, a more diverse research programme would evolve, yielding probably a more realistic range of low costs recommendations.

A common lack of awareness exists about methods and approaches towards research of this type. Much of the knowledge and information required is not found in textbooks, but needs to be identified in the field and in discussions with farmers and through participatory research activities. However, once identified, these technologies can be transferred relatively easy to other nearby communities. It can also be integrated into a research programme (on-station) to be combined with other technological inputs thus contributing eventually to improve adaptation of proposed technologies, thereby increasing their acceptability to farmers.'

There is a clear complementarity between farmers' trials and scientists' trials. As McCorkle et al (1988) put it: 'It is not to say that one approach should be ignored at the expense of the other. But to focus on top-down technology design alone is scientifically indefensible. Important data available from the targeted end-users of such technology will be overlooked. Scientific and ethno-scientific information represent two kinds of knowledge systems and expertise which must be synergistically combined for progress in agricultural development to occur.

Combining these two kinds of agricultural intelligence can enhance the quality of research - whether by farmers or researchers. Agricultural scientists tend to focus on only a few pieces of 'the realities in our village' which lie within their disciplinary

ELCI Workshop 'Food for the Future'. Field visit to a women's group experimenting with bio-intensive gardening. ''NGOs can help set up information networks that facilitate the sharing of experiences, develop the concept of participatory research and serve as an extension tool''. One of the recommendations of the workshop. (Photo: Coen Reijntjes)

boundaries - and even then, from an often rarified perspective. Producers themselves necessarily view farming more holistic and practical'.

Recognizing this complementarity between farmers' trials and scientists' trails and improving the communication and cooperation between farmer and scientists could be an important step to improve the effectiveness of both ways of technology development.

Which technology is to be developed?

An interesting viewpoint on complementarity of technology generation is given by Susan George (Transnational Institute). The pace of scientific discovery is accelerating in the North. Micro-processing, super-conductivity and a host of other technological advances are creating a new industrial revolution. In agriculture, this accounts probably for biotechnology.

'Most Third World countries are, however, in no postition to participate in this revolution, have much less control on its outcome, and can be expected to lag even further behind. What advantages will the South be able to command?
The South should not try to imitate the technology generated in the North, but it should develop its own technological basis and make a jump forward to sustainable, clean and labour intensive technology. This is what's needed in the North very soon too, but the North is not at all prepared for it. In the South, sustainable agricultural systems are still operational; the traditional knowledge is still available, but disappearing in a very rapid pace. This traditional knowledge has to be collected and assessed scientifically. A 'marriage' between traditional knowledge and scientific knowledge may be the best step forward' (Susan George, 1989).

The present environmental problems in the North, affecting the whole planet, might very well prove that her point is right and give a comparative lead to the South in the next century.

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Participatory Analysis of the Village Agroecosystem

Jennifer A. McCracken

A case study from India

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.

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. Once the RRA began 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 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!

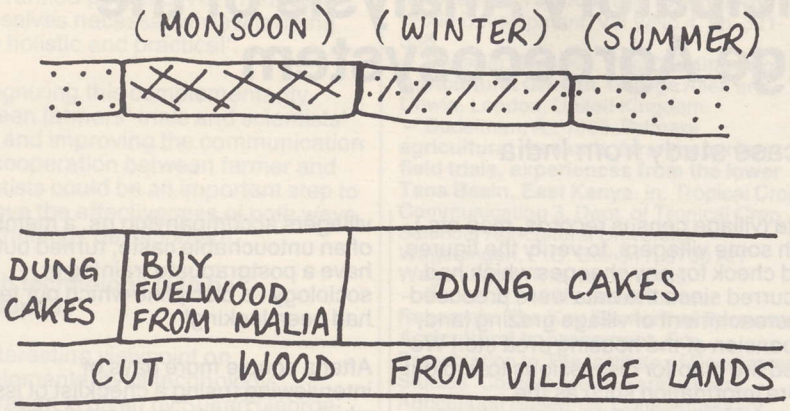
After a couple more days of interviewing (using a checklist of issues which we had drawn up previously), we withdrew from the village as we reached our 'optimal ignorance' level i.e. when we felt we had gathered enough information and detail to get a reasonable picture of the village.

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.

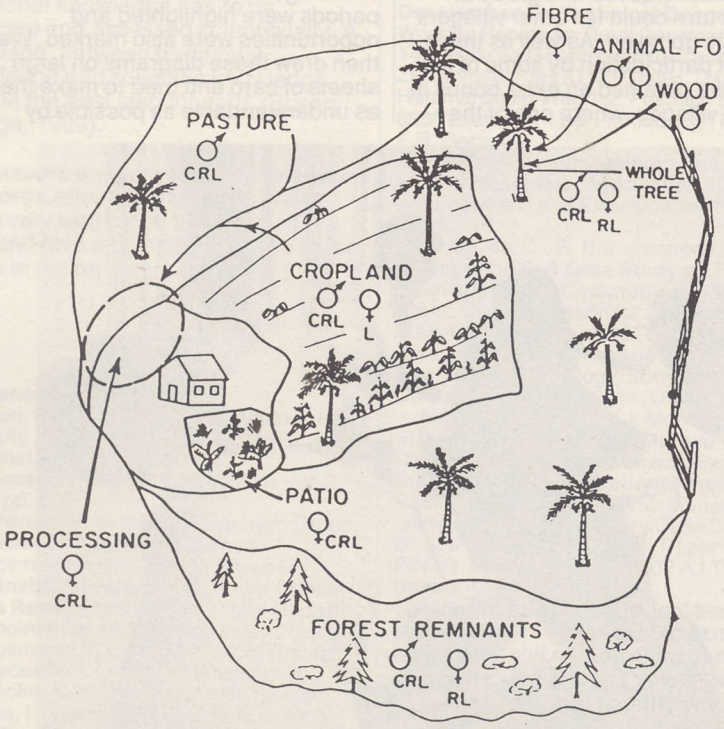
In addition to the map and transect these diagrams were mainly seasonal calendars showing the availability of the village's main resources. Problem periods were highlighted and opportunities were also marked. We then drew these diagrams on large sheets of card and tried to make them as understandable as possible by

The village headman uses a diagram to make a point, during a preliminary analysis session. (Photo: Jennifer McCracken).



The women spoke out against this representation of their fuel problem

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 diagram 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.



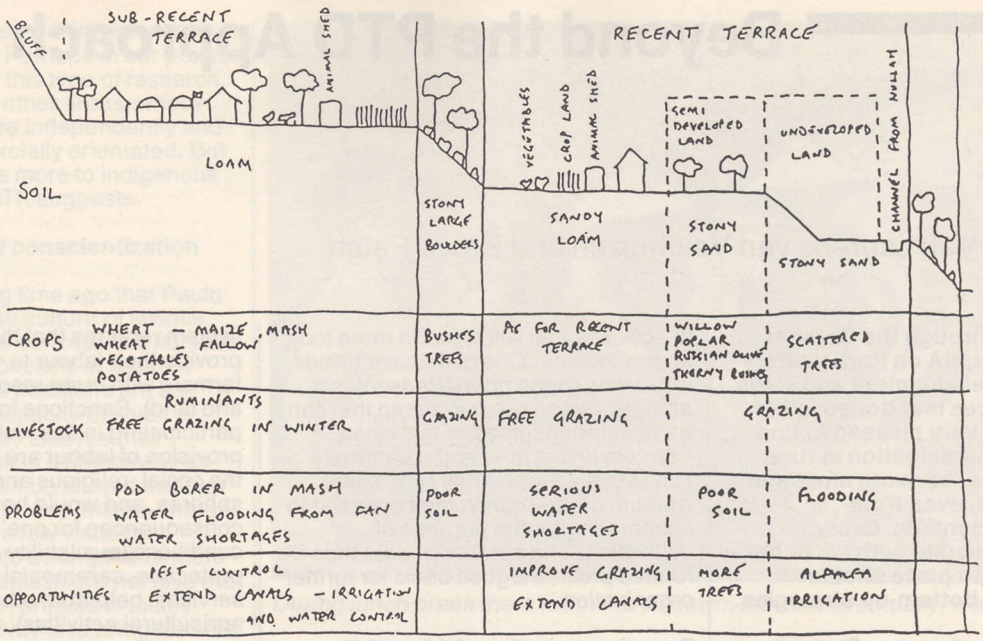
Example of a map of the Pananao Sierra, Dominican Republic. Key: R = responsibility to provide a product to the household; L = labour input for establishment, maintenance of harvest; C = control of resource or process. (Poats, 1988).

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! Its 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 (shown above) was one of the diagrams which gave the women a chance to join in the



Example of a transect, a village in Northern Pakistan (Conway, 1987).

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 the staf of the Aga Khan Rural Support Programme.

Unanswered questions

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

1. 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.
2. 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 talk frankly with the villagers about the possible follow-up (and possible non follow-up) of the RRA, this risk should be minimised.
3. 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?
4. 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?
5. What is the best form for the village meeting? Should a smaller meeting be held later to discuss each innovation/suggestion in more detail?
6. 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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Beyond the PTD Approach

Jacqueline Vel, Laurens van Veldhuizen and Bruce Petch

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.

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 constrains are frequently more limiting than technological constrains.

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 hill sides 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.

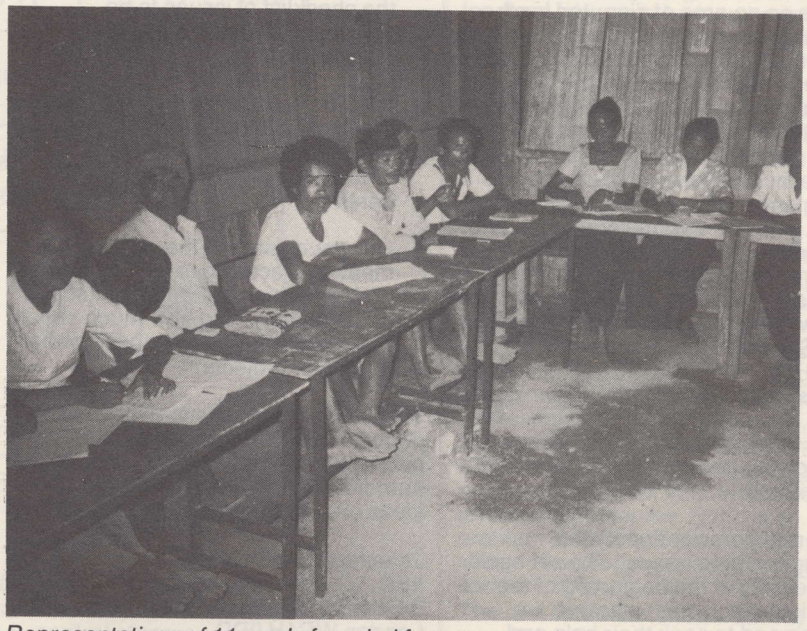
Further inquiry shows that there is another advantage for the farmers in cultivating green gram on these seemingly unsuitable sites. The crop grows on these sites with hardly any soil preparation, giving the farmers adequate results with very little labour input. This is very important as their labour 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 only 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



Representatives of 11 newly founded farmers organizations meat for the first time to discuss their common problems (Photo's: authors)

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 NGO's, 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 the recent issue 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:

a. they enable effective communication between our project's very limited staff and a relatively large number of farmers;
b. 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;
c. 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
d. they help to build up negotiating power on behalf of the farmers in dealing with traders and the local government.

During lunch break there is time to sit down, talk and eventually, make new plans

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 NGO's. 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 NGO's 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 NGO's by participating in field visits and farmers's discussions. But the area reached by the NGO's 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.

a. 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 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'.

b. 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 points':

(i) 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;
(ii) the activity should provide a first step to farmers organization;
(iii) carrying out the activity should not require many inputs or knowledge from outside, and should be relatively simple;
(iv) the activity has to bring a quick result to its participants;
(v) 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.

c. 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 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.

d. 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 only 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.

e. 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 obscures some of its major elements. Therefore it is appropriate to give a summary of the approach in our own terms:

1. Propelmas' assistance is requested, staff visits the village, (first informal contact with individual(s) requesting the assistance).
2. Gathering of information, survey and discussions, analysis.
3. First assessment both within the project as well as together with farmers in a formal meeting.
4. Entry point activity.
5. Evaluation of entry point activity.
6. Follow up activities, increasing complexity and scope; each activity evaluated.
7. While expanding activities, a process of organizational strengthening takes place resulting in formalization of farmers' organization.
8. 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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Research on integrated and organic farming in the Netherlands

Pieter Vereijken

As doubt about the perspectives of current agriculture is growing, interest in alternative systems of production is increasing. As a result, many new research activities have been started. Currently, most initiatives are taken in the field of plant production. In Europe, a Working Group of the International Organization for Biological Control (IOBC) is trying to develop integrated arable farming systems inspired by the aims and methods of Integrated Pest Management (IPM). The two oldest projects are the Lautenbach experimental farm near Stuttgart (West-Germany) and the Nagele experimental farm of the Ministry of Agriculture in the Netherlands.

On the latter farm integrated arable farming and organic mixed farming are being developed and compared with a conventional reference farm. Crop rotation, fertilization and crop protection on the 3 farming systems are described. Results of farming and research during the 1985-1987 period are summarized. Finally the perspectives of both alternative systems are discussed.

Objectives and significance of integrated and organic farming

The intensification of agriculture, based mainly on increasing inputs of fertilizers and pesticides, is considered as the major cause of a crisis. On the one hand, it is causing pollution of the environment, flattening of landscapes and decline of flora and fauna. On the other hand, it is leading to increasing agricultural surpluses which are forcing policy-makers to switch from a protective to a more market-oriented agricultural policy. Consequently, farmers all over the world have to face the snowball effect of falling prices, decreasing incomes and threatening unemployment. Integrated farming seems to be the only realistic strategy to control the still aggravating crisis, since it takes into account both ecological and socio-economical considerations. Briefly, its objectives at farm level are as follows:

1. A shift in emphasis from greater production to cost reduction and improvement of quality of both products and production ways, through substituting expensive and polluting inputs, especially fertilizers and pesticides, by both agricultural and ecological knowledge, (brain) labour and non-chemical husbandry techniques.
2. Encouragement and conservation of flora and fauna in and around fields to stabilize the agro-ecosystem as a major preventive measure against outbreaks of pests, weeds and diseases.

As main social effects of this integrated farming strategy can be expected:

a. Less pressure on profits of the agricultural holdings at increasing cost of production means and decreasing prices of products.
b. Less pollution of the environment.
c. More safety for public health.

Biological or organic farming may be considered as the most radical approach of these integrated objectives. On the long term it may also appear the most successful approach, provided the necessary technical and economic improvements can be made.

The experimental farm in Nagele

This national experimental farm for the development and comparison of alternative agricultural systems started in 1979. It is situated near the village of Nagele in the North East polder, 3 to 4 meters below sea level on heavy sandy marine clay (24% lutum). The size of the farm is 72 hectares. Three farming systems have been studied: Organic, Integrated and Conventional. The systems are run on a commercial basis by 1 manager and 4 co-workers. The organic farm is managed according to the biodynamic method, which is one of the organic systems practiced most in Western Europe today. It is a mixed farm of 22 hectares, with 20 dairy cows and a 10-year rotation including 50% fodder crops. Its main objective is to be self-supporting in fertilizers and fodder. No pesticides are allowed. The conventional farm which serves as a reference has as its main aim a maximum of financial return. The integrated farm should produce a satisfactory financial return but it also aims at a minimal input of fertilizers, pesticides and machinery, to avoid pollution of the environment and save non-renewable resources, so it may be characterized as an intermediate system.

The research on the farms has three objectives:

- development of the organic mixed farm and the integrated arable farm in theory and practice;
- evaluation of the results of the systems with respect to their specific aims
- comparison of the results of the systems with those of the conventional reference system.

Farming methods and techniques

Crop rotation

Appropriate crop rotation can be very effective to control pests, diseases and weeds and maintain soil fertility. In conventional agriculture, the chances

Dutch farming system experiment in Nagele. (Photo: Pieter Vereijken).

The organic farm: red clover/grass mowing pasture and white clover/grass grazing pasture with the Dutch-Frisian cows in the background. (Photo: Pieter Vereijken.)

for a good rotation have been strongly reduced, since most farmholdings in the Netherlands are small and farmers have to grow high yielding crops in an intensive way, facing increasing production costs and decreasing returns for their products.

For this reason the integrated system had the same crop rotation as the conventional system: potato - variable crop - sugar beet - winter wheat. The choice of crop for the variable year/field depended on the market situation. Since 1985, peas have been grown on one half of the field and onions and carrots on a quarter each. A longer rotation would have offered a better barrier against soilborne pests and diseases, but it would also have been less profitable than the current 4-year rotation.

As a contrast, the mixed character of the organic system offers excellent opportunities for a diversified and sound rotation. Perennial pastures with grass and clover suppress weeds, restore the soil structure and increase the organic matter and nitrogen content of the soil. Moreover, a high proportion of grassland in the rotation reduces the cropping frequencies of the marketable crops such as potatoes and cereals. As a result, the pressure of soilborne pests and diseases is kept to a minimum. At the moment the rotation is: potato - winter wheat - half carrot, half fodder beet - pea - 2-year mowing pasture (alfalfa, red clover, English rye grass) - onion - winter wheat - 3-year pasture (white clover/grass mixture). This crop sequence was specifically based on alternating positive and negative influences on the structure and the nitrogen reserves of the soil.

Fertilization
As is usual in Dutch arable farming, on the conventional farm fertilization was mainly of a mineral nature. Organic manure, preferably solid chicken manure was applied only to the wheat stubble land to supply organic matter. On the integrated farm, fertilization was mainly organic and mineral fertilizers were only used in a complementary way. In this system crops were moderately supplied with N in order to avoid abundant leaf development and - as a result - high disease susceptibility. Liquid chicken manure was applied right before the sowing of sugar beet and the planting of potatoes, and immediately ploughed under in order to achieve a maximum N-effect. In conventional agriculture, green manure is applied to improve soil structure. On the integrated and organic farms, green manure crops were also grown to fix the nitrate which had been left behind by the main crop or which has mineralized after harvest. Thus, green manure crops served as a means of prevention of nitrate leaching. On the organic farm, only organic manure from our own farm was used. Clover was the main source of N in the farm cycle. After being consumed as protein by the dairy cattle, N was collected in the loose-housing as stable manure. Together with the other nutrients, N was distributed over the various crops, as required. Because products were sold, soil reserves of P and K were gradually depleted. This was compensated for by purchasing straw and roughage and some concentrates.

Crop protection
In conventional agriculture, crop protection is chiefly of a chemical nature. Whereas on the integrated farm, pesticides were used only as a last resort. Chemicals that are known to be highly toxic, persistent or mobile were avoided. Weeds, diseases and pests were controlled mainly by means of resistant varieties, lowering of the N-dressing, mechanical weed control, use of appropriate sowing times and sowing distances, etc. On the organic farm ample rotation was indispensable for the prevention of weeds, pests and diseases, because chemical control was prohibited. In both experimental systems, some loss in yield caused by weeds, pests and diseases was accepted.

Results of farming and research

Economics and environment represent the two main criteria for the social acceptability of the three production systems. The inputs of fertilizers and pesticides were important indicators of the environmental impact. The economic viability was especially indicated by net surplus and labour returns. Because of considerable changes in the management of the systems since 1984, only the latest results are presented (1985-1987).

Total returns of the organic farm appear to be considerably higher, as a consequence of high premiums on standard product prices. Marketable organic crops clearly have higher returns than grassland and fodder crops. However, the total production cost was much higher than on the conventional and integrated arable farms, especially in labour, buildings and cattle/fodder, which renders by far the lowest net surplus. In spite of this, labour returns on the organic farm were highest, although insufficient compared to labour returns outside the agricultural sector. The integrated farm hardly differed from the conventional system in total returns and total operation costs (labour, contract work, machines). However, the integrated farm gave considerable savings of expenses in fertilizers and pesticides. As a result, the integrated farm achieved a 500 guilders (ca. U.S. $250.-)/ha higher net surplus. The three farms hardly differed in intensity of soil use (Standard Holding Units/ha). Labour productivity of the organic farm however, was less than half of that of the two other farms (Standard Holding Units/Labour Unit).

On the integrated farm, an important shift has taken place from mineral to organic fertilization (Table 1). Compared to the inputs on the conventional farm, total inputs of K and N were less and the total input of P was the same. On the organic farm, a very large quantity of K was brought into circulation by fodder crops and cows. However, P and N fertilization was by far the lowest here. N-availability was clearly the main limiting factor for production on the organic farm, as appears from yield comparison between experimental plots in the pastures with and without clovers. From the results, it has been concluded that biological N-fixation was the main source of N-input in the organic system.

On the organic farm, relatively little nitrate is leached, as appears from analysis of the average drain water contents (Table 1). Nitrate leaching on the integrated farm remained equal to the conventional farm, notwithstanding its principally organic form of N-supply. Apparently, the resulting higher degree of N-mineralization after harvest was

recovered successfully by green manure crops. In fact, the drainwater of the organic farm was so clean that it could also meet the requirements of the European Community-guidelines for the maximum admissible nitrate content of drinking water (5,6mg NO3-N/1 = 25mg NO3/l).

On the conventional farm 9.2 pesticide treatments per field were applied and on the integrated farm only 3.5 per field. If the use of chemical means per year is expressed in kg per ha active ingredient, the difference is still greater: 10.4 versus 4.6 and even 53.1 versus 4.6, if routine fumigation of the soil against potato cyst eelworm on the conventional farm is included.

Experimental introduction of integrated agriculture

From the experimental results the conclusion may be drawn that drastic reduction of the usage of fertilizers and pesticides by means of integrated farm management is attractive from an environmental point of view. The resulting cost reductions may also offer sufficient compensation for lower yields and may even bring a higher profit. As increasing costs of production and especially decreasing prices of agricultural products put profits under pressure, it becomes attractive to convert to integrated management. Considering the saturation of markets and the growing amount of restrictions through environmental legislation, research on integrated farming should be extended, through experimental introduction of the system into practice. This would imply the testing of the prototype-system developed in Nagele by experienced and commercial arable farmers, in order to attain technically and economically feasible farming scenarios. Undoubtedly this will also lead to the improvement and broadening of the current integrated cropping programmes, promoted by the great variety of practices in attitude and skill of farmers, nature and size of holdings, soil types, crop rotations etc. Two other experimental farms for the development of integrated arable farming started in 1986 and 1989 in the peaty sand and light sand districts respectively.

Perspectives on organic farming

The net output of the organic mixed farm has increased steadily since 1985, when low profit fodder crops were replaced by high profit vegetables and milk production was raised to a higher level through supplementary purchase of concentrates. Consequently, an acceptable income can be expected in the next few years. This can be achieved on the condition that, a 25% (milk, meat) to 100% (grain, vegetables) higher price level be obtained for the organic products compared to the conventional market, in order to make up for the higher investments in capital and labour. This need of high premiums however, appears to be too high a threshold for the majority of farmers and consumers up till now. This does not mean that organic farming is doomed to play a marginal role. In areas with sensitive ecological characteristics and also in water collection areas, organic farming may play an important role because of its minimal introduction of nutrients and its rejection of chemical pest control. Therefore, organic farming in these areas deserves financial support from public funds. Finally, an increasing demand for organic products is occurring on the European market, inspired by growing concerns for man and his environment and for the well-being of animals. Sooner or later this may lead to a break-through of organic farming into the conventional practices of farm production, trade and consumption.

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Photo's: Pieter Vereijken

	Conventional	Integrated	Organic
K as fertilizer	75	20	-
K in organic manure	70	95	155
Total	145	115	155
P as fertilizer	15	-	
P in organic manure	40	55	20
Total	55	55	20
N as fertilizer	140	60	-
N in organic manure	75	125	115
Total	215	185	115
NO3-N in drainwater	12,4	12,2	5,0

Table 1. Fertilization (kg ha-1) and nitrate-nitrogen content of the drainage water (NO3-N in mg l-1) in the 3 systems averaged for 1984-1986.

	Conventional	Integrated
Results per ha in Dutch guilders		
1. Total returns	6190	6250
2. Labour cost*	2310	2280
3. Contract work	1020	1020
4. Equipment and machinery	1560	1630
5. Total operation cost (2. to 4.)	4890	4930
6. Land and buildings	1290	1290
7. Fertilizers	450	290
8. Seeds	690	790
9. Pesticides	690	260
10. Other costs	610	610
11. Total cost (5. to 10.)	8620	8170
12. Net surplus (1. minus 11.)	-2430	-1920
13. Labour returns (12. plus 2.)	- 120	360
Technical and economic data		
14. Cultivated land (ha)	17	17
15. Number of labour units	0.7	0.7
16. Standard holding units (S.H.U.) per ha	105	105
17. S.H.U. per labour unit	149	152

* 27 guilders/hour was the norm gross reward for the farmer's own labour in Dutch agriculture during 1985-1987.

Table 2. Average economic results of the integrated and conventional farming systems during 1985-1987 (US$ 1.00 = Dutch guilders 2.00).

Towards a structural change in agriculture

Leonard Peries

Alternatives to chemical inputs

The National Rural Conference, a local NGO in Sri Lanka, began working on alternatives to chemical inputs in agriculture way back in 1973. At that time the government had established several large youth farms chiefly to meet the problems of youth employment. The NRC had also 15 youth farms in different parts of the country. These youth farms were intended, inter alia, to propose new approaches to development planning in a 65-70% rural set up that is Sri Lanka.

The main strategies of these farms were:

- to assist the national food drive.
- to involve rural youth, boys and girls, mainly drop outs from school, in gainful employment as they worked, earned and learned at the grass roots: within each farm the young people were to develop their own curriculum to devise a way of life and a system of continuous learning.
- to revive native agriculture, which meant that only organic inputs were to be used and in the process to counter the alienation which the technologically overloaded Green Revolution proposed in the name of increasing food production.
- to propose a system of land reform where those who worked the land owned the land.

The country was going through very severe growing pains; by 1976 it was debating whether to go the slow agricultural way or opt for rapid industrial growth and open the country to technological determination by foreign interests. This debate had serious effect on the state sponsored farms and our farms too suffered a loss of personnel.

In the general elections of 1977 the country opted for industrial growth; export trade was preferred to a programme of agricultural growth in which the majority of the people of the country could participate and preserve the nation's sovereignty. Emphasis was placed on Free Trade Zones where cheap labour is offered to foreign and local industrial efforts.

The decision of the country to go industrial made all youth farms anomalous; The National Rural Conference too was compelled to adapt itself to the new political climate without compromising its search for new dimensions of growth.

Grass-roots research

Accordingly The National Rural Conference organized a 12 acre farm to do grass roots research and to try to keep alive the fundamentals of agricultural development, namely, land reform, indigenous technology, organic methods of agriculture, making use of composting, companion planting, herbal prophylactics, weed control etc.

A study group at the experimental farm (Photo: Leonard Peries)

Within the farm, where seven boys and girls from the farms we closed down had agreed to come together, we had poultry, cattle and bees. We also devised methods of collecting cattle urine in which very little interest was shown as a rich source of natural urea. We found cattle urine effective against fungus in certain vegetables; cattle urine mixed with cattle dung and allowed to settle for a time (slurry) proved an effective and cheap organic fertilizer for coconut and leafy vegetables like spinach, lettuce, cabbage etc; cattle urine has also been found effective against the black beetle that attack coconut palms.

We worked at companion planting and identified local plants to keep away insects and disease. Special leguminous plants to refurbish the soil and eliminate rotation of crops have helped us reduce costs and maximise land use.

We have also identified and are using herbal preparations both as prophylactics to prevent infection and disease and as a cure against leaf curl in capsicum and worm infection in the egg plant, etc. Herbal prophylactics can create a disease free and infection free environment for plants whose seeds too can become resistant to disease.

We are in a position to produce these prophylactics in quantities large enough to meet the present demand to a great extent. We are studying how to increase production but we would not want to make it a commercial exercise.

We are trying out the prophylactics on paddy to prevent insects and bugs attacking the paddy. We are also developing methods of preserving fruits for long periods so as to meet problems of scarcity.

Small networks of remote farmers

In all these activities we are in consultation with the remote farmer who has much information to offer in the way of organic pest control, storage, etc. He feels that he is being exploited by chemical companies but lacks the courage to say no to chemicals.

So we are working on small networks of farms and we have also organized five large villages for which we are trying to invest great efforts to make them models of sustainable agriculture where the people at the base can produce safe, low cost food, and organize their own outlets of scale to offset the activities of the middle man.

Sustainable Agriculture, call for a get together

Agriculture is in a crisis in many countries; if the crisis is not immediately showing in your country, it should show soon. The chances of averting the crisis in our country are not too good, but we should take strong measures to try to avert it because the crisis is not only agricultural, it is social and political too.

The average farmer and peasant cultivator in our country as elsewhere has to contend with serious issues like the increasing cost of seed, of chemical inputs, marketing hazards, low returns for their produce, increasing dependence on inappropriate technologies and, more seriously, the possibility of a loss of identity and of being displaced as the community breaks up for agribusiness to take over.

The main cause of the crisis is the senseless use of chemical inputs and inappropriate technologies which multinationals and their agents are allowed to advertise and sell with gay aband on to simple people.
Items like tractors and chemical inputs which are produced mostly abroad, are primarily serving to maintain the level of employment in the rich countries and their extravagant lifestyle. Intrinsically this action of the multinationals is a violation of human rights. It is time that people everywhere take note of this violation and of the damage that certain forms of advertising do to the mind of man and to the entire human situation. Serious actions should be taken against this crisis which agriculture and every form of life faces.

Since the Green Revolution, there has been evidence that agriculture has been brought under an industrial discipline in which native agriculture and native skills have been presented as serious anomalies. But because of environmental destruction, the threat to all forms of life and the cost factor involved in the use of alien inputs, there is a growing reaction against the use of such inputs. But it is feared that multinationals will try to contain this reaction within the very thesis that goes by the name of Sustainable Agriculture and build it into a monopoly in which the people and their rights will be submerged.

In the face of the growing crisis of agriculture, there are many initiatives that go by the name of Sustainable Agriculture. But if Sustainable Agriculture does not have the objective of making the traditional farmers and peasant cultivators realistic, resourceful and free persons, the attempts at developing alternative systems of agriculture, will serve very little to alter the precipitous course of events.

To the average farmer and peasant cultivator Sustainable Agriculture should be a deliverance from consumer thinking, a return to sanity and self reliance, which marked him everywhere in the past as the backbone of his country's economy and her pride. Today he has lost both his pride and his position. Sustainable Agriculture should have the object of restoring him to his rightful place in building a strong and independent nation.

Today many people in our country and elsewhere are discovering effective, cheap and safe alternatives to these expensive and damaging inputs. Others are continuing to experiment on effective organic methods by which the farmer can produce both cheap and safe food. These people are already growing rice, vegetables, fruits, nuts without chemical inputs and without the use of heavy machinery. This will save our country from different kinds of disaster and help engender a more viable, independent and enduring programme of development, initiated by the people.

People involved in agricultural change towards sustainability should get together to explore more fully what we might do jointly to counter domination by multinationals and consumer thinking, starting with getting farmers engaged to think out their own problems and abstain from using damaging and dangerous inputs. Our research has brought us to a point of assurance that poor countries can by-pass the 'artificial pests' and produce plenty of safe food.

We are envisaging a structural change by helping peasantry to see the need to organize themselves to resist the overtures of the multinationals who appear to have little sympathy with the people, their culture and survival.

A new polarization of the agricultural sector is called for so that it will not be dictated by the industrialists but be able, from a position of strength, to bargain with them and together evolve a new thesis of development in which the independence of both sectors and their interdependence can create the discipline for overcoming both power and poverty.

A beginning should be possible by more intense research into organic potentialities.

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A sustainable agricultural village unit (Photo: Leonard Peries)

What can be learned from traditional, small-scale irrigation?

N.A. Gworgwor

Shadoof irrigation in Nigerian farming systems

For the most part, Northern Nigeria is situated in the geographical region of the West African Savanna. It is characterized by an open grassland with few scattered trees and a lot of shrubs. The rainfall pattern is seasonal with a wet season varying from 5-6 months in its lower part to about 2-3 months in the upper north where it borders the Sahara. The dry season is usually longer than the wet season. The agricultural production is subject to rainfed conditions with mostly sorghum, millet, groundnut, cowpea and cotton as the dominant crops.

During the dry season in the low land areas and river banks called fadama, wheat, barley and vegetables are traditionally grown by farmers under irrigation. The water in the rivers, or water dug up from wells can be lifted using the shadoof irrigation system. This irrigation system is still practiced widely by small scale farmers all over the northern part of Nigeria. A random sample interview with farmers in Erhabor, northern Nigeria (1982) reported that out of the 125 farmers interviewed, 114 used the shadoof lift system and only 11 used motor driven pumps. Forty-two farmers operated two shadoofs on their farms but only one farmer operated two pumps. All the other farmers irrigated with only one lifting device.

The Shadoof System

This is the traditional system of water lifting by small-scale farmers from its source to a higher level for the purpose of irrigating their crops during the long dry season. It is considered to be a primitive lifting device which originated along the Nile and was first recorded in tomb drawings at Thebes dating from 1250 B.C. It is one of the simplest and oldest devices for raising water from streams, shallow wells and ponds by human power. It is easy to construct, simple to maintain and can be replaced inexpensively with locally available material. Generally, the lift range of the shadoof is between one and three meters. When the lift from stream to fields exceeds this range it becomes necessary to use two or more of the devices in series (Erhabor, 1982). The device is laborious to operate and lifts a limited amount of water per day. Hence it is generally for irrigating small plots of land. The technical specifications of shadoofs operated by most farmers consist of a frame, pole, rod, counterweight, calabash, rope and wooden inlet (Fig. 1). By pulling the rod down, the operator lowers the calabash into the stream or well where it is filled with water. When the rod is released the counterweight lifts the calabash up from the water source to the level of the operator where he pours the water into a wooden inlet from which it flows onto the field (Erhabor, 1982; Isrealsen and Hansen, 1962).

Operation of Shadoof

A typical operation of the shadoof system involves two operators. One person lifts water with the shadoof to a height of about 2.4 m and the other person distributes the water in the field by opening and closing the channels between rows. Each farm is irrigated at least twice a week with each operation lasting about four hours. The amount of water lifted depends on the height, the size of calabash, and the number of men working. An earlier study conducted in the Zaria area of Nigeria reported that an average of 10 buckets or calabashes were lifted per minute (Erhabor, 1982). Since the average calabash size is two gallons, this means 20 gallons per minute or 1200 gallons per hour (4,542 liters/hour).

Type of Crops Irrigated

Most farmers using the shadoof irrigation system grow between two and eight crops on their farms while three crops is most common. The crops mainly grown are onions, peppers, garden eggs and tomatoes, with wheat, okra, spinach and tobacco in smaller quantities. The field sizes under shadoof range from 0,029 to 0,614 hectares with 0,158 hectares as the average field size. The output of these crops are generally sold directly from harvest to the public either in the immediate environment or - in most cases - purchased and transported to urban centres. The farmer thus earns a lot of money with this system and has enough to feed his family. The money they collect from these sales provides capital for other business, clothes for their family, pays school fees and provides medical care.

Lessons from the System

This system though laborious and consuming a bit of time in operating is of course in the traditional system of farming efficient enough for the small-scale food producer, considering the fact that it is all made out of local resources. It is cheap, easy to construct and maintain. It has also demonstrated the farmer's ability to evolve in time a system that is ecologically sound for his sustenance. However, some of the farmers who have saved some money over time are now changing this system for a motor driven pump. This pump was introduced in the late 1970's by agricultural instructors and friends of the farmers to increase their operational efficiency and area of cultivation. However, the motor driven pump is not likely to stand the test of time due to frequent break-downs of the machines and high cost of maintenance. Therefore, it is important to improve the shadoof system of irrigation, its water lifting capacity and the possibility of increasing the area of production should be looked into, preferably still using local materials, which the farmers can easily construct and maintain by themselves.

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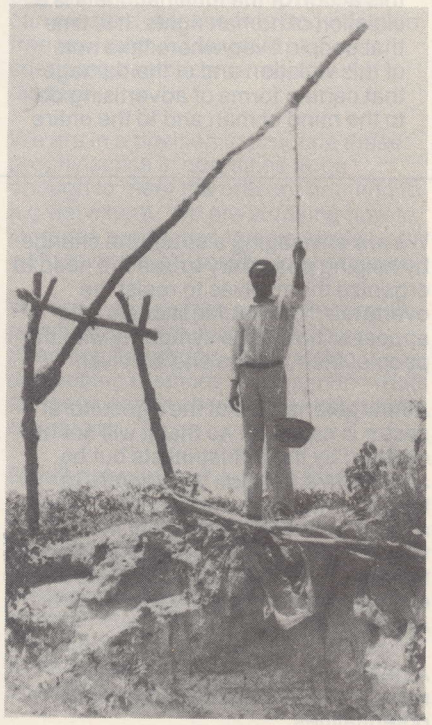

A traditional shadoof irrigation device in Nigeria (Photo: N.A. Gworgwor)

Comments on Water Harvesting

A.S. Widanapathirana

The article 'Water Harvesting for plant production in Sub-Saharan Africa', which appeared in ILEIA Newsletter Vol.4,No.4 is interesting and touches on most of the important points concerning the subject. However, there are several issues which the article does not discuss. The objective of this note is to surface some of these issues and present their actual state of art.

Benefits

On the side of the benefits, there are several further advantages underlying the system of Water Harvesting (WH) in arid areas. The first advantage is related to the ability of WH to operate independently from the local rainfall distribution. In arid areas the main barrier for crop production is not the precipitation itself but its distribution. There has often been enough rainfall but crop production failed nevertheless because the distribution of rainfall has been so poor that most of it came in 1 or 2 storms. Hence, the traditional system based on rainfall could not produce the required level of yields. Therefore, in situations of a poor distribution of rainfall, WH has a unique advantage over traditional rainfed agriculture.

Secondly, with the WH system, when used in 'Wadi' valleys with deep and fertile soils (as is often the case in Sudan where WH is extensively applied), it is possible to produce highly valued crops such as vegetable and fruit crops that can not be produced when traditional systems of crop production are applied. Moreover, the productivity of the land is also much higher than under normal conditions. This is definitely an advantage for low income families in that it helps to produce relatively more on the same limited piece of land. The cultivation of vegetables also improves family nutrition.

A third advantage is that WH helps to lengthen the period during which crops can be produced. This is basically related to the fact that WH ensures storage of water within the soil, some of which can be tapped for crop production with the help of residual moisture farming. In Sudan, the period for crop production based on run off farming is from June till October. The residual moisture farming commences in November and continues through April/May in the following year. With this method, the labour use profile and the period of earning income may be extended. These are definitely advantages in an arid area where income generating opportunities are very low.

Problems

The efficient utilization of land and water resources in the WH system is debarred by several problems. A problem the article did not mention is the absence (and NOT lack of) of relevant information on agronomic and hydraulic aspects. Because of this absence of knowledge, people build large constructions which are really not required under the given conditions. Other problems are the development of salinity in 'water harvesters', soil cracking and a high rate of siltation. The farmers take certain measures to reduce the intensity of the problems. Unfortunately, by doing so, they do not realize the disadvantages.

Nor does the article outline some socio-economic problems. Among these problems are the land tenure aspects, disparity in income distribution as a result of the high level of income for some farmers, a tendency to concentrate on non-food crops such as tobacco and the resultant deficit in food crops in areas where WH is used, increased training needs of farmers since WH based crop farming is not very familiar to them, etc. All these problems should receive attention when WH is introduced to meet today's food needs.

Other Components

When WH is introduced, there are several other issues which should be carefully planned. Among them are protection of the scheme against wind erosion (reduce the intensity of farming in more fragile areas, encourage people to plant trees in order to stop encroachment of WH areas by dunes, etc.). Tree planting along WH schemes should be taken up as a matter of very high priority which should start before the preliminary measures concerning the development of WH are undertaken, otherwise it may be too late to think of protecting the area. This is very important since it is nature of mankind 'to destroy a good ecosystem without realizing the harmful effects of doing so'. The environmental issues have already started to raise the 'ugly head' in several WH schemes in Sudan because protective measures where not planned in the beginning.

Miscellaneous

It might also be mentioned that the traditional schemes which were developed by farmers themselves cost very little. In fact, the cost of real traditional schemes may be much lower than the cost of schemes altered by interventions. Soil fertility is not a problem in Sudan because of two reasons. To begin with, in the type of WH system we use, a lot of fertile soil from elsewhere in the form of silt is deposited in the fields. The replenishment of soil fertility by silt is much higher than the crop requirements. Secondly, the area available for expansion of WH schemes is very much larger than that which is already exploited. Additionally, because of design/engineering problems, crop production may not be practiced in the same scheme every year, leaving the area fallow. Hence, depletion of soil fertility is not a problem at present.

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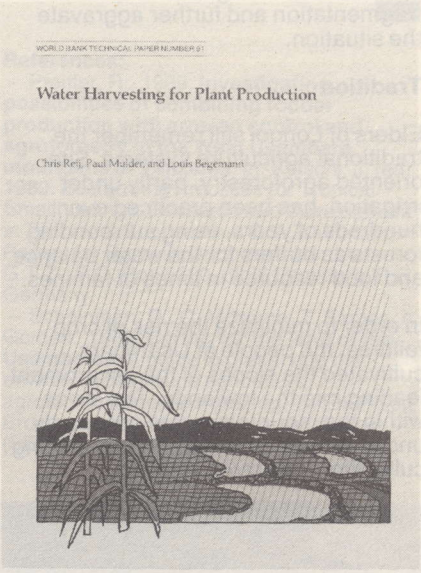

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Agroforestry and integrated land-use in Tanzania

C. Mersman and G. Taube

Untunzaji Ardhi: Another try for the better

Shengereza Kimweri is a farmer of Longoi, Usambara Mountains. Like many villagers he is looking for alternatives in agriculture, since farming has become quite a risky exercise, far from producing a satisfactory farm income. Currently applied cropping patterns on his 2.5 ha farm date back to colonial times, when crop prices made farmers change their traditional production patterns of a variety of staple foods towards maize and beans as major crops planted in monoculture.

Moreover, due to population pressure more and more land has been deforestated and unsuitable land (hilltops, steep slopes, etc.) has been taken under cultivation. Heritage customs lead to high land fragmentation and further aggravate the situation.

Tradition

Elders of Longoi still remember the traditional agriculture systems. Site-oriented agroforestry, partly under irrigation, has been practiced over hundreds of years, using surrounding forests as buffers for the water balance and food resource in times of famines.

In order to minimize the risk of crop failures, the people of Usambara cultivated the slopes of the escarpment leading into the lowlands. The areas within the mountains were only partly under permanent cropping and shifting cultivation was rarely applied.

Soil erosion on a typical slope in the West Usambaras. On the adjacent plots the farmer has started to plant macro-contourlines (mcl) (photo: Lars Johanson)

Even nowadays knowledge of trees and their integration into agriculture, green manuring and fallow plants as well as ways of intercropping has not been lost. Some farmers still continue to cultivate their fields in a modified traditional way, including now cash crops such as coffee.

But they are few. Shengereza Kimweri has never been one of them. He has seen the environmental change leading to continuously lower harvests but he sticks to a cropping system which seems to guarantee at least partly his basic needs in staple food production in the short run.

Potentials

The Usambara Mountains are a non-volcanic range with relatively steep slopes and narrow valley bottoms of about 274,000 ha arable land at present and have a population of approx. 400,000 people, increasing yearly by 3.6-4%. At altitudes between 1,200 and 2,200 m temperate, per-humid and semi-arid climates can be found.

Subsistence production is the chosen system to secure short-term needs for families. Virtually all farmers grow maize and beans, although both crops can be produced considerably cheaper in the lowlands surrounding Usambara. Only a comparatively small number of farmers specialize in vegetable production, contributing thus to the supply of urban markets like Tanga and Dar es Salaam.

The natural potential is presently unused, since farmers do not dare to invest in alternatives. Transport and marketing facilities might not be available, as it is already true for pears at the moment. They were introduced by the British and are now rotting away by hundreds of tons without a chance of marketing.

Regarding agroforestry people are eager to plant trees and integrate them into their fields, not only for firewood but also for fruits other than pears.

The natural potential of Usambara and the knowledge of the people about their environment are decreasing at an alarming rate, the former being due to soil erosion and inappropriate land-use practices.

An alternative: SECAP's technical package

Both the knowledge of the people and the natural potential have formed the basis for SECAP's concept of agroforestry and sectoral integration in the attempt to make full use of the participation of villagers to implement a sustainable land-use system. During five years of a pilot phase (1979-84) a sectoral package was developed, consisting of the following elements:
- basic soil erosion control measures and zero grazing
- alternative ways of crop production, livestock keeping and related activities
- catchment afforestation and range rehabilitation

Basic soil erosion control
The macro-contourline (mcl) was initially introduced to meet the urgent needs of fodder under the zero-grazing system. Grasses, creepers and leguminous fodder bushes at the same time form a quite effective erosion control but take approx. 15-20% of the arable land out of the crop production. However, this can easily be compensated both by an increase of productivity of the remaining land due to manure application and by the production of fodder, leading to higher milk yields. The manure becomes available from keeping the animals under the zero-grazing system. Suitable agroforestry trees planted adjacent beneath the mcl are to strengthen the effect of soil erosion control and to produce firewood, timber and fruits. Additionally these trees have positive micro-climatic effects and produce litter as organic matter.

But not only grasses, creepers and bushes are demanded by farmers. Alternatives have to be offered and many farmers have started to plant sugarcane, pineapples and bananas into the mcl as cash crops.

The establishment of the mcl is assisted by the Project by providing grass splits and seeds initially but by now, most villages participating (30 at present) are self-reliant.

Trees are being raised in the communally run village nurseries. Contrary to the original Project recommendations to use trees also for afforestation purposes, farmers have increasingly demanded to plant the 'village trees' exclusively into their fields for agroforestry. A small calculation: 60 trees planted per year at a survival rate of 60% will enable a family to satisfy its demand for firewood and timber, if the trees are harvested after 8-10 years. 3000 m of mcl means an erosion control of about 2.5 ha, planted at a spacing of ca. 8 m between the lines and trees at a spacing of 10 m.

Alternative activities
Alternative activities range from using draught animals for transport to intensifying dairy production by

exotic/local cross breeds, from intensified crop production (manure application, green manuring and intercropping) to fruit-tree planting. All alternatives are fully or partly chosen by the farmers themselves according to their specific needs. Furthermore, a village bull is kept by one farmer on behalf of the village. All components, however, should be part of the system, integrated into the individual land-use concept and interlinked with the other productions.

Catchment afforestation and range rehabilitation
Catchment afforestation and range rehabilitation with mainly indigenous tree and fodder bush species is an assistance of the Project to interested villages, meant as an infrastructural support to save or restore water balances and lands. Planning and executing is done in close cooperation with concerned villages and with casual laborers from those villages. Organization and management of the afforested or rehabilitated areas are the tasks of the villages themselves, the Project only gives advice and assistance. The harvesting of tree crops is then entirely the business of the village.

Mapping and demarcating cause major confrontations with those farmers who have to give up fields. However, by involving Village and District Authorities fully, it has so far always been possible to achieve a compromise.

Economic viability and acceptance

All technical recommendations and measures of the Project have to be both ecologically sound and economically viable. Survey results show that this is the case if the basic erosion control measures and additional activities are applied together. The recommendations enable farmers to meet their urgent demand for staple crops in the short run and at the same time give them the chance of a long-term investment in measures that will lead to the highly needed sustainability of land use.

Moreover, farmers are strongly involved in continuously adapting the technical recommendations to their needs and to changing socio-economic conditions.

Participation and Extension

In Tanzania extension staff is mainly trained to deal with farmers in a 'top-down' approach, the common way of extension implies a teacher-pupil situation. SECAP on the contrary tries to ensure the participation of all people by emphasizing a two-way communication, implying that extensionists and farmers can learn from each other.

SECAP's communal approach tries to involve all villagers in activities such as village tree nurseries, grass multiplication plots, seed orchards and village bull centres. All farmers are advised in the application of basic erosion control measures, while those farmers taking up additional activities are regarded and dealt with as interest groups.

The communication between farmers, extension staff and Village Authorities is often hampered by differing interests, which people try to overcome by intermediates like the SECAP Village Committee, existing in all participating villages. These committees consist of 5 villagers, who are elected during general village meetings. During these general assemblies farmers have the opportunity to express expectations and problems, while the extension staff learn that extension means participation of people, who know a lot about their environment and who know best how new ideas can be integrated into existing land-use systems. Like these, all other extension instruments - field days, group meetings, seminars, special campaigns - are based on the principle of information exchange.

Still a chance for Usambara?

SECAP's village approach towards erosion control and sustainable land-use aims at the same time to improve the planning, organization and management capabilities on village level and to make farmers and villages self-reliant in all aspects related to land-use. Shingereza Kimweri and his fellow farmers in Longoi have already taken up many of the Projects's recommendations and have found alternatives in agriculture, which are both sustainable and profitable for them.

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Agroforestry and zero-grazing on Shengereza Kimweri's farm (photo: Lars Johanson)

The Guinea Pig as meat producer

Johan H. Koeslag

The guinea pig (*Cavia porcellus*) is called cuy, cobayo or curi in Spanish. This animal is, just like the llama and alpaca, a pre-Colombian domestic animal kept in the Andean region. Even today, its distribution coincides with the area of influence of the ancient Inca Empire. Besides being an important source of protein-rich meat, in traditional regions it is also used by local 'witches' in curing human illnesses.

In Peru there are about 21 million guinea pigs. Annually 65 million animals are slaughtered, which produce 16.500 tons of meat, which is about 6.5% of the total meat production. This meat is mainly consumed by the rural population and for these people it is an important source of animal protein. Also in other Andean countries, like Ecuador, Bolivia and Colombia, the guinea pig is important. In Colombia, half a million guinea pigs are almost exclusively found in the Andean part of the Department of Narino, which is located near the border with Ecuador. This article pays special attention to the production of guinea pigs in Narino.

Traditional keeping of guinea pigs

About 90% of all families in the rural areas of the *Narino* highlands (1500 - 3000 m.a.s.l.) keep guinea pigs. Most of these families live on small farms, with less than 5 ha of land. They grow potatoes, maize, beans, traditional Andean crops and vegetables. In general, their houses have only one room with an earthen floor and the guinea pigs are kept inside the house. These guinea pigs are fed with kitchen wastes and agricultural by-products and although feeding is adequate, their productivity is low. This is due to the mixing of animals of different sexes and ages, which results in a high incidence of contagious diseases, breeding at an age too young and a high degree of inbreeding.

Most animals produced in such a way are consumed by the family, especially during feasts. A wedding or a village festivity without the serving of guinea pig meat is not considered complete. But nowadays, more people are living in the cities and they too like to eat guinea pigs, at home as well as in restaurants. Because most guinea pigs are consumed by the producers, they are hardly offered on the market and as a consequence, prices are high.

Considerations for improved guinea pig production

In 1974 a Dutch bilateral project was started in *Narino*. It was focussed especially on dairy production. Quite soon people came to realize that on small farms, the production of milk alone would not provide enough income. Furthermore, it was considered necessary that the position of women should be strengthened. For those reasons, the project investigated the technical and economical feasibility of other types of agricultural production. Vegetables and fruit showed good prospects. In the animal production sector, pigs, poultry and guinea pigs were compared (Table 1). The table shows that although the initial investment in guinea pigs is fairly large, rentability is by far the highest. The main reason for this is that pigs and poultry need concentrates, which are expensive, while guinea pigs can be fed with roughage.

Problems and solutions

In 1975, the Dutch project, together with Colombian organizations, started a programme to stimulate improved guinea pig production. The main problems of the programme and their solutions are discussed below.

In Colombia, guinea pigs are only important in the Department of Narino, and there, especially for a marginal group: women on smallholdings. As a consequence, the National Ministry of Agriculture was not much interested in guinea pigs. Other agricultural activities, especially cash crops, milk and beef, had a much higher priority on a national level. The initiative to start up the guinea pig programme was taken by the Regional University and the Dutch project, without much national support.

Hardly any knowledge about improved guinea pig production was available in Colombia. Furthermore, the animals present were of low quality, grew slowly and inefficiently and suffered from a high degree of inbreeding. Technicians from Peru were invited to give a course on guinea pigs and they also advised us about required adaptive research. The research was carried out by the University and the Dutch project. Colombian and Dutch agricultural students carried out many of the practical investigations. To increase the genetic potential of the local guinea pig population, improved Peruvian animals were imported.

Members of the target group, women who often do not have a certificate of ownership of the land, had difficulties in getting loans from commercial banks. Quite some initial investment is required for improved guinea pig production although this can be paid back in a relatively short time due to the high profits. Because banks were hesitant, the Dutch project, UNICEF and other organizations provided loans to several groups of women. When these loans had a very positive effect and were paid back, the banks also became more inclined to provide loans. When the women started commercial guinea pig production, they were very happy with it because they made good profits. Women have always been taking care of these animals but in the improved production system, work load increased considerably (see box). As long as the women got the benefits of their extra work, this was not a real problem because part of the money earned could be spent to alleviate their domestic tasks. However, guinea pig production is so profitable that men became interested too and in some cases they wanted to take over the marketing and keep the money, letting the women do the work! To prevent this as much as possible, an Association of Guinea pig producers (Asocuy) was founded. Asocuy is directed by women and takes care of the marketing of guinea pigs.

Housing of guinea pigs

Guinea pigs should be housed in different pens according to their sex and age. The following module is recommended in which pen 1 measures 1,5m2 and all the others 1m²:

Pen 1 With 10-12 breeding females plus their unweaned young and one breeding male.

Pen 2 For up to 15 recently weaned

Type of animal	Pigs		Broilers	Guinea pigs
Number of animals	3 growing	1.3 sow	800	85 females
Income/animal $	5860	16825	149	245
Costs/animal $	6350	16450	140,5	60
Labour income/animal $	- 490	375	8,5	185
Farm income $	-10400	- 6265	26330	58410
Labour income $	- 3555	565	41930	99360
Investment $	17930	11820	214400	92715
Rentability %				
Farm income/investment	- 58	- 53	16	63
Labour income/investm.	- 20	5	26	107

Table 1: Economic comparison between pigs, broilers and guinea pigs in Narino. Prices are in Colombian pesos ($).

females from 12 days up till 2 months of age.

Pen 3 Up to 15 recently weaned males.

Pen 4 Up to 12 females from 2 to 4 months of age. At the age of 4 months, the animals weigh about 1 kg and can be used for breeding or sold for consumption.

Pen 5 Up to 12 males from 2 to 4 months of age. These animals are sold for consumption.

Pens can be constructed on the floor of the house, in a special building or in cages which can be placed outdoors, like rabbit cages. Guinea pigs don't suffer much from cold, but cannot withstand drought. Floors of pens can be made of wire mash, wooden slats or be solid and covered with bedding materials.

Start of an improved unit

If somebody has guinea pigs and wants to improve its stock, the best female guinea pigs are selected and mated with an improved male bought from the University farm or a neighbour. Good animals have short, fine and light-coloured hair and grow quickly. Females should be replaced by the best offspring of this crossing. Breeding females should be culled at an age of 18 months when prolificacy starts to decline.

Reproduction

Guinea pigs may become sexually active at an age of 1 month. Under improved conditions, the animals are used for breeding at an age of 3 months when they have a weight of at least 600g. One male is sufficient for a group of 12 females. Pregnancy lasts about 68 days and after that 1 to 4 young ones are born. Within half an hour after having given birth, the female comes in heat and can be served again. In this way a female can produce about 5 litters with in total 10 to 15 young pigs per year. The young are well developed when they are born. They will start eating grass within 3 to 4 days and can be weaned at an age of 7 days. In Narino weaning is normally done at an age of 12 days, when the animals have doubled their birth weight of 90-125g.

Feeding

Although guinea pigs grow quicker when fed concentrates, for economical reasons they often only get roughage, like improved grasses, maize plants, alfalfa or carrots. However, when they are exclusively fed with the local kikuyu grass (*Pennisetum clandestinum*), the animals will lose weight and eventually die. In Narino the best and cheapest feed is ryegrass (*Lolium sp.*). An adult guinea pig consumes about 300 to 400g pre-wilted ryegrass per day. The grass should be available day and night. Starving and after that overfeeding or the provision of wet, spoiled or molded feed may cause bloat and result in the death of the animals.

Maria participates in a women group that got an UNICEF loan. She keeps 12 breeding female pigs and produces about 100 marketable guinea pigs per year. She has sown 400 m2 of improved ryegrass. For cutting and transporting the grass she needs about one our a day. She bought a scythe to make grass cutting easier. When asked about the guinea pigs, she told us that she really prefers the Peruvian type because it grows better and is less nervous. She also says that at present she eats less guinea pigs than before because she can get such a good price for them. She sells guinea pigs to be able to buy plantains, cassava and pastes or when the children have to buy books or a uniform for school. However, in a few months time her daughter will have her first Holy Communion and on that occasion guinea pigs will have to be served for relatives and friends. About half a guinea pig per person will be necessary. For this purpose she now also keeps guinea pigs in the traditional way in the house. The extensionist is not happy about this because he is afraid diseases will be transferred from those animals to the improved unit.

Hygiene

Changing the bedding material at least once a week is recommended. As bedding material, straw is preferred to wood shavings because the latter often has been treated with wood preservers which may affect the guinea pigs. Grass should be produced on a plot which is not grazed by other animals to avoid transfer of parasites. To reduce soiling of grass and to diminish the risk of bloat, grass should be fed in a rack. External and internal parasites can be controlled by drugs. Guinea pigs are notorious for their susceptibility to many diseases. So even with adequate hygiene and proper housing, animals may become ill and die. Investigations are carried out in *Narino* to improve prevention and treatment of diseases.

Summary and conclusions

Guinea pig production in Narino is very profitable. On the market, a guinea pig of 3 to 4 months old with a weight of 1 kg costs twice as much as 1 kg beef. Production costs of a guinea pig for consumption are about 20-25% of the selling price so even if the price goes down due to a greater supply, the producers still can get a good income. The main advantages of guinea pig production in *Narino* are:

- people are familiar with this type of animal and like to eat it
- improved animals are available
- housing requires a fair initial investment but all materials are locally available
- after the sowing of pastures, no inputs from outside the Department (like concentrates) are required. Seeds of improved pastures are locally available.

Two main problems remain, which are only partly solved:

- the high risks of animal diseases
- to assure that guinea pig production does not put too heavy a labour demand on women and that they benefit the most from this type of production

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Guinea pig production is attractive on small farms in the Andean region. (Photo: Johan Koeslag)

Plant Protection

Alternatives for chemical pest control

The Patriotic and People-oriented Science and Technology (PPST) Foundation is a voluntary organisation devoted to evolving self-reliant indigenous alternatives in Science and Technology. One of their activities is to evolve alternatives for chemical pest control. To that purpose, a Southern Regional Seminar on Biological Methods of Pest Control was held in Madras, November 1988.

The purpose of the seminar was to bring together scientists, farmers, policy makers and extension workers for exchange of useful information. There were four technical sessions:
1. Integrated Pest management (IPM), which stressed a.o. that beneficial organisms (lady-bird beetles, hunting spiders, and praying mantids) take care of about 40% of the crop pests.
2. Bio-control in practice, which stressed a.o. the control of the red hairy caterpillar in e.g. Jowar (sorghum): children of the community were encouraged to collect egg-laden leaves and from near the roots of the plants; light traps to attract moths and the use of ducks which could eat the caterpillars.
3. Traditional Agriculture, outlined a.o. little known details about India's Pre-British agricultural traditions and practices, e.g. rotation of crops, use of the drill plough and sophisticated animal husbandry practices. Several proverbs were mentioned which encapsule information about weather, movements of insects and birds, the ecological condition of the soil with respect to astrological correlation, etc. Also lessons from traditional Sri Lankan Agriculture were presented: to prevent crop failure and damage by pests, timely cultivation, mixed cropping, minimum tillage and indigenous crop protective measures are important.
4. Bio-control with specific agents, revealed the use of birds as control agents of pests. Also the great potential of reptiles (rat snakes, sand boas, pythons, monitor lizards, bat owls and domestic cats) for rodent control (20-25% loss in food grains, FAO) was mentioned, if the initial fear has been overcome.
In the open session, the participants shared their experiences with various alternative farming methods. A farmer from Chingleput shared her experiences with multi-cultural farming, agroforestry, and biological pest control.
At the conclusion session, the following suggestions were made: there should be comprehensive documentation of traditional biological pest control techniques; the outcome of research should be made more accessible to farmers, and effective pest control without chemical pesticides is not consistent with modern chemical-based farm technology. Alternatives in the form of natural and organic farming should be developed and popularized to make large-scale biological pest control possible.

The enthusiasm and response from several farmers and voluntary organizations has been quite overwhelming. PPST hopes to start a resource centre on biological methods of pest control.
If more people and organizations are interested, they can contact:
Dr. K. Vijayalakshmi, PPST Foundation, 5, Second Cross Street, Karpagam Gardens, Adyar, Madras 600 020, India.

ILEIA Newsletter hopes to publish more material from this workshop in the Plant Protection issue of 1989 (Autumn).

Plant-Derived Pesticides in Developing Countries, Possibilities and Research Needs, Gerrits, R. and van Latum, E., 1989.

In November 1988 the Dutch Ministry of Housing, Physical Planning and Environment released the study mentioned in the title. The use of plants with toxic or repellant action against pests is a common crop protection practice in traditional agriculture systems in developing countries. The study provides an overview of the most important literature on the subject of plant-derived pesticides in developing countries and aims at raising international awareness of the potentials of plant-derived pesticides. It also indicates criteria for establishing a safer use of plant-derived pesticides internationally. Pesticides from the neem tree (*Azadirachta indica*) are taken as an example. The authors come to the conclusion that the pesticides from the neem tree have a great potential but so far they are used on a small scale only. The study also highlights problems concerning the registration process of plant-derived pesticides in Europe and the U.S.A. After completion of the registration process of a promising substance like neem in a developed country, introduction in a developing country would only need a little additional research. The report also contains an interview with Prof. Dr. H. Schmutterer, neem expert of the Giessen University, F.R. Germany. Addresses are given of persons and institutions active in the field of plant-derived pesticides. The study is written in English.

Edwin van Latum

The study can be ordered at:
Foundation for Ecological Development Alternatives, P.O. Box 11190, Amsterdam or P.O. Box 151 Hoofddorp, the Netherlands. US$ 9.00

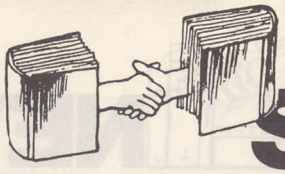
PEAP's International Information Links Program, Pesticide Education and Action Project (PEAP), P.O. Box 610, San Fransisco, CA 94101, USA.

The three major objectives are:
1. To catalog, computerize and systemize PEAP's International Pesticide Information Collection, containing 600 publications, dealing with pesticides, alternatives and development-related issues.
2. To increase international access to information to information resources needed by NGOs around the world.
3. To facilitate international exchange of contacts, strategies and experiences among NGOs.

PEAP is the North American Regional Center for Pesticide Action Network (PAN) International.
Regional offices are in Africa: ELC, P.O. Box 72461, Nairobi, Kenya; Francophone Africa: ENDA-TM, B.P. 3370, Dakar, Senegal; Asia/Pacific: IOCU, P.O. Box 1945, Penang, Malaysia; Europe: Oxfam, 274 Banbury Road, Oxford OX2 7DZ, England; Latin America: Fundacion Natura, Casilla 234, Quito, Ecuador.

Pesticides News, first issue June 1988. Pesticides Trust, 20 Compton Terrace, London N1 2UN, England. Quarterly, Subscription 10 for individuals, 25 for others.

Pesticide News is published by the Pesticides Trust which has recently been formed. It aims at creating awareness among those who make decisions over the use of pesticides and regulation of pesticides, and among workers and consumers of the problems associated with pesticides, and to promote alternatives to the present pesticide policies in both developed and developing countries. Regular features will include: abstracts of research papers, book reviews, conferences, etc.. Articles will cover: health and safety, toxic waste and pollution, industry, wildlife and conservation, biotechnology, Third World issues, integrated pest management.



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People's Participation in Social Forestry Projects. Berenschot, L.M. (Ed.), 1988, 101 pp., Bos-document 7, Price US$ 10.- Foundation Bos, P.O. Box 23, 6700 AA Wageningen, The Netherlands.
This document contains the proceedings of a workshop which aimed at an analysis of various dimensions of participation in social forestry projects; an exchange of experiences on participation in field projects and an identification of major factors influencing participation in social forestry.

People's participation in Development in Black Africa. A.-C. Mondjanaghi, 1984, Editions Karthala, 22-24 Boulevard Arago, 75013 Paris, France, 456 pp, 160 FF.
70 senior staff members of various origins working on various disciplines at the Panafrican Institute for Development held a seminar to examine the realities and limits of people's participation in their own development. The broad issues discussed in this publication are: general reflections; cooperatives, community development and participation; training and participation. Case studies are presented from different African countries and an annotated bibliography completes the book.

Philippine Upland Research and Extension Training Workshop Proceedings, June 19-24, 1988. FARMI, Baybay, Leyte. Information: Farmi, 8 Lourdes Street, Pasay City 3129, Philippines.
The objectives of this training-workshop was to bring together FSR/E practioners and research administrators from different regions to: exchange experiences in participatory methods; identify problems related to the use of participatory methods; determine ways to increase effectiveness and efficiency of farmer participation; examine implications for roles of research and extension staff; publish operational descriptions of participatory methods. Seven participating projects are described according to the following steps: 1. How to get started; 2. Looking for things to try; 3. On-farm tests; 4. Farmer-to-Farmer Training; 5. Sustaining.

Proceedings of the ILEIA Workshop on 'Operational Approaches for Participatory Technology Development in Sustainable Agriculture'. 1989, 65 pp.; Prices: First World: US$ 7.50; Third World: free of charge. ILEIA, P.O. Box 64, 3830 AB Leusden, The Netherlands.
A limited number of copies are available of the proceedings of the ILEIA Workshop on PTD. Contents: PTD and Sustainable Agriculture; Concepts and Activities in PTD; Inventory and Assessment of Existing Experiences (How to get Started, Finding things to try, Trying out, Sharing results, Sustaining the process); Strategies for Participatory Research and Development of Technology; Conclusions and Recommendations; Abstracts of Workshop Papers and References.

Voices of Rural Practioners, Self-analysis of local rural development initiatives worldwide. 1987, Edited by Institute of Cultural Affairs, IERD Series, Vol.2, K.G. Saur Verlag KG, Heilmannstr. 17, D-8000 Munchen 17, Fed. Rep. of Germany. ISBN 3-598-21047-7. Price: US$ 135.-
Even positive results of projects eliminating hunger, ignorance and disease are often surrounded by an atmosphere of pessimism. Therefore, the emphasis of the International Exposition of Rural Development (IERD) by ICA has chosen to focus during a process of 3 years in 50 countries on the successes of rural development. It also tries to make means available by which proven successes, methods and approaches, based on local initiatives are to be maintained. This book is part of a series and contains: 1. Voices of Rural Practioners (a.o. agriculture, health, women, economy, education, housing); 2. Project descriptions; and 3. Presentations held during the exposition in New Delhi, India, 1985.

Growing Together
Women, Feminism and Popular Education. ISIS Book series 1988/1, ISBN 88-85840-02-7, ISIS, Via San Saba 5, 00153 Rome, Italy.
Increasingly, people's movements everywhere are finding that education is a crucial part of their attempts to empower disenfranchised groups in the political, economic, social and cultural arenas. Such efforts may term themselves popular education and they have in common that they are starting from the experiences of the participants. In the 1980s, feminists and women's groups in many places have begun to carry the struggle for women's empowerment into the popular education movement. They are working to combine the strengths of feminism and popular education. The experiences are particularly rich in Latin America, and it is encouraging to see that they are brought together in this book, thus made available to other grassroots groups, women's groups and educators. Experiences from Brazil, Chile, Ecuador, Mexico, Peru, Domincan Republic and Venezuela are listed.

Viewpoints on Agroforestry. 1988, Wiersum, K.F. (Ed), 256 pp, Centraal Magazijn Wageningen Agricultural University, De Dreyen 4, 6703 BC Wageningen, The Netherlands. Order number: 06 03 7707.
In 1981 this reader was published for the first time. Both ecological, agricultural, technological and socio-economic aspects of agroforestry developments were treated. Since 1981, scientific understanding has advanced markedly and consequently, this reader has been renewed and extended. New reviews have been included, while data in remaining chapters were updated.

Cultivo en Hilleras, una Opcion Estable a la Agricultura Nomada (Alley Cropping -A Stable Alternative to Shifting Cultivation), IITA, 1989, available from: Rodale Institute, 222 Main Street, Emmaus, PA 18049, USA.
The spanish edition of the Alley Cropping booklet is now available.
Advantages of Alley Cropping are seen: the biological recycling of nutrients, soil conservation, surpression of weeds and rapid production of by-products such as stakes and firewood.
Research at IITA has led to the development of the following alley cropping systems:
1. Leuceana/Gliricidia maize-cowpea
2. Leuceana-maize-yam
3. Alley farming, integrating Leuceana and Gliricidia alley cropping with livestock.

Agroforestry Abstracts.
CAB International in association with ICRAF. CAB, Wallingford Oxon OX10 8DE, England. ISBN 0952-1453, 1989 subscription: US$ 92.00 Americas £48.00 Elsewhere.
This new quarterly journal (June 1988) provides abstracts (1,000 per year) and reviews of the world's research and technical literature covering the field of agroforestry. Abstracts are grouped under the following topics: Agroforestry (AF) in general; AF systems; trees and shrubs for AF; horticultural and plantation crops for AF; pasture and field crops for AF; animals for AF; AF products; Environmental and service aspects; sociological, cultural and economic aspects; research and development.

Agricultural Extension. 1988, van den Ban, A.W. and Hawkins, H.S. 344 pages, ISBN 0 582 02883 3, Price £4.95, Longman Group, Longman House, Burnt Mill, Harlow, Essex CM20 2JE, England.
Unlike the 'how-to-do-it' manuals, which constitute much of the literature on the principles and practices of extension, this book examines the social and psychological principles underlying extension activities.

Compostage dans le cadre de l'Agriculture Tropicale. 1979, Dalzell, H.W., Gray, K.G. and Biddlestone, A.J., 60 pp. Available from: Nature et Progres - 680, rue Pierre Montet, 69400 Villefrance-sur-Saone, France.
This practical guide which has been translated into French describes the basic process of composting for fertilization and proven methods of heap construction. The conclusions are that composting entails low costs, has little risk of failure, increases crop production is a simple technology, uses the available labour force and gives less dependancy on imports.

The Gatekeeper Series, Sustainable Agriculture Programme, IIED, 3 Endsleigh Street, London WC1H ODD, England. (£1.50 each inc. p and p).
The Gatekeeper Series is produced by the International Institute for Environment and Development (IIED) to highlight key topics in the field of sustainable agriculture. Each paper reviews a selected issue of contemporary importance and draws preliminary conclusions of relevance to development activities. References are provided to important sources and background material.
The Series is aimed at field staff, researchers and decision makers.

Gatekeeper papers produced to date:
1. Pesticide Hazards in the Third World: New Evidence from the Philippines. Sept.87
2. Cash Crops, Food Crops and Agricultural Sustainability. Sept.87
3. Trees as Savings and Security for the Rural Poor. Jan.88
4. Cancer Risk and Nitrogen Fertilizers: Evidence from Developing Countries.Jul.88
5. The Blue-Baby Syndrome and Nitrogen Fertilizers: A High Risk in the Tropics? Jul.88
6. Glossary of Selected Terms in Sustainable Agriculture. Aug.88
7. Glossary of Selected Terms in Sustainable Economic Development. Aug.88
8. Internal Resources for Sustainable Agriculture. Sept.88
9. Wildlife Working for Sustainable Development. Sept.88
10. Indigenous Knowledge for Sustainable Agriculture and Rural Development. Nov.88
11. Agriculture as a Global Polluter. Jan.89

TOP 5 NEW

Our interests at ICRISAT -- the International Crops Research Institute for the Semi-Arid Tropics are to serve as a world centre for improving yield and quality of sorghum, millet, chickpea, pigeon pea and groundnut crops; and to act as a world repository for genetic resources of these crops. The centre also helps develop improved farming methods that will help introduction of sustainable production systems through more effective use of land, water, human and economic resources in the seasonally dry semi-arid tropics. The focus of institute's work is the rainfed dryland agriculture in Asia, Africa, and Latin America. Traditional rainfed agriculture in these areas has failed to provide adequate food for its growing populations, deforestation and soil erosion are rampant, and ecological balance is precarious. Drought is a regular feature and crop failures occur at frequent intervals leading to severe rural poverty. India suffered the worst drought of this century in 1987. She experienced a shortfall in agricultural production and drinking water availability was a serious problem. I have therefor commented on five recent publications dealing with the subject of agricultural droughts and their management as these are of current interest.

1. **Science Age**, a monthly science periodical devoted its November 1987 issue to the question of Drought and Food Security in the developing countries. Subjects like role of research, meteorological forecasting, soil degradation, food drought and rural urban migration are discussed. The papers by M.S. Swaminathan on drought and food security, and role of research by N.C. Brady deserve special mention. (Science Age, Vol.5, No. 11, Nov. 1987, 72 pp. Copies are available at: Science Age, Nehru Centre, 11th Floor, Annie Besant Road, Bombay 400 018, India. Cost $ 0.4 per copy).

2. ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). 1988. **Drought Research Priorities for the Dryland Tropics** (Bidinger, F.R. and Johansen, C. Eds.), Patancheru, A.P. 502324, India. 219 pp. This book is the product of a consultants' meeting held at ICRISAT in Nov. 1986, which brought together specialists from a number of disciplines to discuss priorities for applied research on improving crop production with a high degree of promise for the short to medium term in the drought prone environments. It deals with the issue of the application of currently available knowledge and technologies to the problems of the dry tropics.

3. **Technical Report 1985-1986** issued by **Trop Soils** is an interesting and informative document reporting on the collaborative research carried out by four American Universities (North Carolina State, Texas A&M, Hawaii and Cornell) in three agroecological zones of the tropics, in cooperation with a large number of institutions. The work in the humid tropics agroecological zone was conducted in Indonesia and Brazil; the semi-arid tropics in Niger, Mali, and Burkina Faso in the Sahelian West Africa; and in the arid savannas of Peru and Brazil. Trop soil aims to develop improved soil management technologies that will reduce constraints to agricultural production, and to ensure that the improved agro-techniques are agronomically, economically and ecologically sound for developing countries in the tropics. Copies of this excellent technical report covering 268 pages and published in June 1987 are available from: Trop Soil Management Entity, Box 7113, North Carolina State University, Raleigh, N.C. 27695-7113, USA.

4. Drought is a normal climatic reality in the dry tropics and it recurrence is inevitable. Thus fore planning for drought management is an important issue. The resource poor societies of the developing world are particularly vulnerable to its ravages. The Institute of Agriculture and Natural Resources of the University of Nebraska-Lincoln, the Illinois State Water Survey of the Illinois Department of Energy and Natural Resources in cooperation with several national and international organizations have published an excellent resource book on '**Planning for Drought: towards a Reduction of Societal Vulnerability**'. It is edited by D.A. Wilhite and W.I. Easterling with Deborah A. Wood and is published by Westview Press, Boulder, Colorado 80301, USA in 1987. This 597 page book analyses the complexity of drought phenomenon with pervasive societal ramifications which is often aggravated by human actions. Contributors to the volume are acknowledged national and international leaders in agricultural research and development related activities from around the world. They assess current knowledge of drought and determine what information is necessary to improve both national and international capacities to cope with its effects. The physical and societal implications of drought from the local to supernational regions and within the context of developed and developing nations are discussed for South, East, West Africa, North America, South America, Australia, portions of Asia, and Europe.

5. To cope with the weather abberations in semi-arid tropics, I found the book entitled '**Response Farming in Rainfed Agriculture**' by J. Ian Stewart, published by the WHARF Foundation Press, Davis, CA 95617-1158, U.S.A. in 1988 (Cost: $ 28.50 per copy) an interesting contribution to the literature on agricultural droughts. This 103 page book presents a new approach based on a seasonal rainfall predictions at the start of each year's rainfall or rainy cropping season, coupled with advice on modifying cropping systems or crop production practices in accord with the predicted rainfall and/or rainy seasons characteristics. Result of Response Farming case studies in some countries of the mediterranean region; in Kenya and Niger; and in some countries of the Asian sub-continent are presented. Some 20 locations in 11 countries are studied. The approach presented is new, it's state of the art, and simple solutions to complex problems of dryland agriculture in the seasonally dry tropics are provided.

S.M. Virmani, ICRISAT, Patancheru P.O., A.P. 502 324, India.

One Hundred Innovations for Development, 1989, 80 pp, ISBN 1 8539 095 X, IT Publications, 103-105 Southampton Row, London WC1B 4HH, England £6.95.
The inventions presented in this volume are winners of an International Inventors Awards competition held in Sweden in 1986, and come from 43 countries around the world. the winning innovations were chosen for their ability 'to promote economic and social development in the third world'. The 50 best innovations are described in detail, illustrated with plans or photographs. All the innovations have practical applications; many are already in use. The International Inventors Awards organizers, plan to repeat the competition in 1989. They hope to further 'stimulate both technical and social creativity for the benefit of the poorest people in the third world'.

Green Deserts, Education Pack: '**Life in the Desert**'. Rougham, Bury St. Edmunds, Suffolk IP30 9LY, England.
For five years now, Green Deserts (with semi-autonomous branches in Ghana and New Mexico, USA) has worked with nomadic communities in the Hasaniya mountains of Sudan. By getting local people to set up plots of trees, demonstrating tree-growing techniques, and supplying seeds and seedlings, they have been encouraging the planting of mesquite (Prosopis chilensis) as a first step to reclaiming the desert. As a result of their work, Green Deserts has recently produced an interesting cross-curricular active learning pack about desertification and the environment. Originating from England, it aims at giving 8-13 year British pupils at school an insight on trees, deserts, the environment or related subjects, in both Africa and Britain. It could, however, very well be used by school teachers in third world countries.

Another publication is '**Green Deserts**', their magazine. Issue Number 20 contains information on: Sudan; news from other groups (Ecuador, India, Dominica, England); sustainable grazing in Arabia; establishing ecological community villages; and a 'permaculture' farm in Tesai, the low and middle hills of Nepal were it's estimated that deforestation will be complete by the year 2000.

Permaculture, a Designers' Manual. Mollison, B., 1988. 575 pp, ISBN 0 90822801 01 5, Tagari Publications, P.O. Box 1, Tyalgum, NSW Australia 2484. US$60.00
This book is about designing sustainable human settlements, and preserving and extending natural systems. 'The world can no longer sustain the damage caused by modern agriculture... and in the near future we will see the end of wasted energy, or the end of civilization as we know it due to human-caused pollution and climate changes'. 'Permaculture design' is a system of assembling conceptual, material, and strategic components in a pattern which functions to benefit life in all its functions. A book full of practical ideas!

NETWORKING

Discovery and Innovation
Academy Science Publishers, P.O. Box 14798, Nairobi, Kenya.
'Discovery and Innovation' is a new, multi-disciplinary quarterly journal with emphasis on scientific advances and technological development in Africa and other Third World countries. The journal hopes to fill a real need in that it is not restricted to a particular specialty. The topics treated will encompass basic sciences, engineering and technology, applied sciences (like agriculture, medicine and climatology), Ecology, Traditional African Science and Technology, social and human sciences and Anthropology. Contributions should be the results of original research. Review papers, policy issues, book reviews and new technologies and product reviews are welcomed too and have to be submitted to the Editor.

Forestry for Rural Development: New Approaches and Survey Techniques
This new post-graduate course is designed for foresters, agriculturalists and others with responsibility for the execution of community forestry programmes and projects and other rural projects with important tree components. New approaches are emphasized for the integration of trees in predominantly agricultural landscapes by using a participatory approach. Analytical skills to survey the socio-economic, institutional and physical/biological situation in a given area will be developed. Skills to apply this knowledge in the participant's own country are developed during the final part of the course and a one-month fieldwork period in a tropical country is part of the course. Courses start each year in October; duration: eight months; a number of Dutch fellowships are available.
More information: the Dean of Students, ITC. P.O. Box 6, 7500 AA Enschede, the Netherlands.

Coordination among European Networks
ODI London, Réseau Recherche-Développement Paris, CIRAD Montpellier and ILEIA met late January to discuss areas of common interest that could more cost-effectively be exploited jointly than individually. Networks in Europe represent a powerful force in the targeted dissemination and exchange of information.
Common features of the Networks are: networking; management of renewable natural resources in the South, with the aim of increasing resource-productivity on an equitable and sustainable basis; and a primary concern for resource-poor, 'difficult' farming areas in the South.
Cooperation is desirable in translation and dissemination of selected material from French to English; in the organization of seminars to enhance the flow of information to practioners; and in research, e.g.: 'NGOs as a link between resource-poor farmers and formal agricultural research and extension services - unexploited potential?'
More information: Contact the respective Networks.

CIKARD News, Bulletin of the Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD), 318B Curtiss Hall, Iowa State University, Ames, Iowa 50011, USA.
This introductory issue is established to provide information on Indigenous Knowledge (IK) as part of a capacity to provide meaningful and sustainable development in a world that is rapidly changing. The Editor's Notes cover a definition of IK and why it is so important. Furthermore, numerous publications on this theme are given, as well as information on meetings and symposiums. CIKARD has also established an indigenous knowledge Documentation Unit from which bibliographies will be published on a periodic basis. CIKARD (see also ILEIA Newsletter Vol.4, No.3, page 25) invites to send contributions of documents for accession and storage. At a future date, CIKARD hopes to be able to provide a dissemination service.

Henry Doubleday Research Association, National Centre for Organic Gardening, Ryton-on-Dunsmore, Coventry CV8 3LG, England.
The HDRA is an association of organic gardeners and growers, mainly located in England. It carries out research into organic methods of horticulture and the findings are published in their quarterly newsletter, which is free for members.
Short courses for agriculturalists and horticulturalists going to work in the Third World are organized by the HDRA.
The HDRA also maintains a strong commitment to apply its expertise to other parts of the world. An example is 'The HDRA Drought Defeaters Project: Sustainable Agriculture and Forestry for Arid Areas' (paper by P.J.C. Harris, October 1988). This programme aims to select and evaluate potentially useful species for integration into sustainable agriculture and forestry.
Studies have been executed on *Prosopis cineraria* in the Wahiba Sands of Oman, a leguminous tree which is an important component of the Wahiba desert. Sixty other potentially useful Prosopis accessions have also been obtained from seventeen countries. The HDRA is participating in a major research programme in the Republic of Cape Verde.

KAY PACHA: Escuela, Ecologia y Comunidad Campesina. 64 pp. First issue of the 'Proyecto Escuela, Ecologia y Comunidad Campesina', Apartado 140016 - Lima 14, Peru.
This Spanish bulletin aims at helping the schoolteacher to improve the education of rural and village children of Peru with respect to the rational use of natural resources in the framework of their cultural reality. Themes included are a.o.: how much does a rural child know? soil erosion control; prevention of diseases and plagues in the field; how to improve agriculture and the life of peasants? The articles conclude with pedagogical activities.

Agriculture Ecologique en Afrique Francophone.
Editors: Agrecol-Switserland, Enda-Senegal, Geyser-France and Inades-Ivory Coast. 1989, Agrecol, Oekozentrum, 4438 Langenbruck, Switzerland.
This booklet is produced to list the available information in French on ecological agriculture in Francophone Africa. It contains 171 references, the larger part of them annotated. Furthermore, 58 organizations working on ecological agriculture, or that might supply information on it are listed per country. Finally 25 French periodicals are mentioned.

Seed Sowers
The On-Farm Seed Project (OFSP), Centre for PVO/University Collaboration in Development, Bird Building, Western Carolina University, Cullowhee, N.C. 28723, USA
The Newsletter of the OFSP is designed to assist farmers at the local level in Senegal and The Gambia in adapting and using improved methods of seed production, harvesting, processing, and storage. Vol. 1, Number 2/3 (summer/fall 1988) reveals a.o. collaborator's visits to project sites in Senegal and The Gambia; information on seed training programmes and courses.

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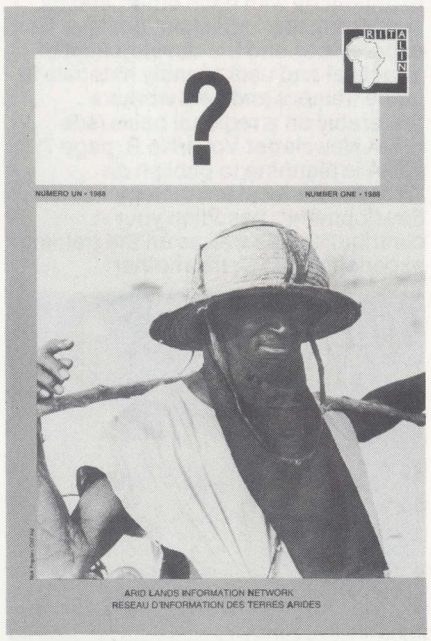
The Arid Lands Information Network Magazine of Oxfam.
1988, 32 pp., Arid Lands Unit, Oxfam, 274 Banbury Road, Oxford OX2 7DZ, England.
This attractive new magazine of Oxfam for the arid lands of Africa (from Senegal across the Sahel to Somalia, and down into Tanzania) will probably be called BAOBAB, as a title competition revealed.
It aims at Networking, primarily among Oxfam projects and partners, by sharing ideas, experiences (successes and mistakes) and a vision of a better future. Information on other NGOs, other networks, publications and relevant research will also be included. It will be published, however, only after the members of the network have sent enough material to put a magazine together. The features are a.o.: Country news, Project focus, Working with..., On a technical note (simple methods of preventing soil erosion and conserving water), On the subject of..., Meeting Place, Odds & Ends.



Training for Participatory Technology Development

A Call for Sharing Experiences

One of the major recommendations of the ILEIA Workshop on 'Participatory Technology Development', Leusden, April 1988, was to develop new methods, formats and manuals for training development workers in the methods and practices of participatory and sustainable technology development.

We are happy to see that the number of organizations and development workers that are practicing Participatory Technology Development is increasing rapidly and evenso is the wealth of experiences with various approaches and techniques. What is lagging behind still is the documentation and analysis of such experiences and even more so the development of suitable training formats and manuals.

The Network

The recommendation of the workshop participants is confirmed by the growing demand from development practioners for support in the development of training methods and manuals, and for assistance in the training of trainers.
ILEIA wants to assist these practioners by stimulating field workers to document and share their training experiences with each other, and by supporting the 'digestion' of these field experiences and the development of 'practical and user friendly manuals to guide trainers and field workers', preferably on a regional basis (see ILEIA Newsletter Vol.4/No.3, page 7).
ILEIA is planning to publish on 'Training for local technology development', based on your contributions as well as on the training experiences ETC, the mother organisation of ILEIA, will be directly involved in. ETC sees this as a first step in the development of a continuing exchange between the persons involved in the training of fieldworkers in PTD.
Together with other organizations involved in this field ETC plans to organized a small workshop on 'Training PTD' October 1989. Hopefully ETC will be able to build this workshop on your contribution too.

Some Key Questions

Some key questions for your contribution are:
- What do you mean by 'training' in the context of participatory technology development?
- What are the main concepts you apply and develop (or in your opinion should be applied and developed) with participants in such training events?
- What are the main topics/problems that you deal with (or should be dealt with) in a training of fieldworkers in PTD?
- What characterizes your training style and methods when preparing fieldworkers for PTD-activities? What turned out to be essential for a good performance (criteria) in the field?
- How did you develop fieldworkers' ability to develop their own methods in the field?
- What are the training materials (manuals, cases, AV media, etc.) you used in the training? How do you judge (criteria?) these materials?
- What kind of materials would be extremely useful in your opinion? Do you plan to develop new training materials?
- How did you deal with gender issues in the training?
- How did institutional factors influence the training process? How can institutionalization of this type of training be promoted best?
- What are other essential questions with respect to training fieldworkers and farmers in PTD we missed here?

Start documentation and exchange now

Good documentation of training experiences in the field of PTD are still very scarce. A lot of the persons involved just do it and seldom have the time to look back and systematize and reflect. However, before hand-on experiences can be shared these need to be documented and exchanged in some form.
We hope to receive from the practioners in the field (apart from articles and discussion papers): training reports, manuals, videotapes, slide series, other means of documenting training experiences in PTD.

If you are involved in processes that are highly relevant for development of training in PTD, but do not have any possibilities to document them, please let us know. Maybe we might find ways to mobilize support for you to do so.

Contact person: Henk de Zeeuw, ETC Foundation, P.O. Box 64, 3830 AB Leusden, The Netherlands.

ILEIA
P.O. Box 64
3830 AB Leusden
The Netherlands

ILEIA was established in 1982 by the E.T.C. Foundation, Consultants for Development Programmes.

The general aim of ILEIA is to provide development intermedia with relevant information on low external-input agriculture, on practical methods and scientific backgrounds as well as on strategies to introduce low external-input methods in agricultural development.
Low external-input agriculture means to us: agricultural systems which make optimal use of locally available natural and human resources (such as: climate, landscape, soil, water, vegetation, local crops and animals, labour, local skills and knowledge) and which are economically feasible, ecologically sound, culturally adapted and socially just. The use of external inputs such as mineral fertilizers, pesticides, tractors, hybrid seeds, is not excluded but has to meet the above-mentioned criteria of sustainability.

ILEIA is realizing this aim by:
* Documentation. A data-base on low external-input agriculture is being compiled.
* Information Services:
- Question and Answer-service: on request information will be given on documentation on special subjects or organizations and projects in a special country or persons who are active in a special field.
- Permanent Documentation and Information-services to governmental and Non-governmental organizations and projects.
* Quarterly publication of the ILEIA Newsletter.