A platform for groundnut improvement

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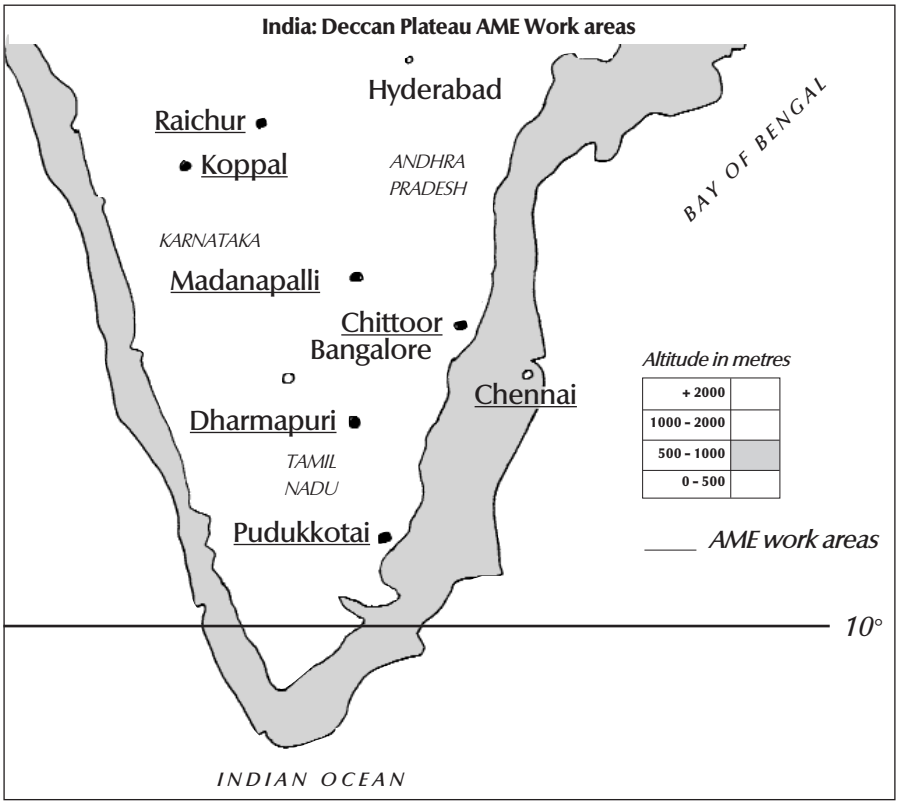
To broaden the basis for assessment in the ILEIA Research Programme, ILEIA collaborated with AME. AME facilitates a research platform of farmers, NGOs and research organisations that focuses on the improvement of groundnut production on the semi-arid Deccan Plateau in India. Additional studies have been funded to get more insight into the systems of groundnut production and their dynamic context through the ILEIA research programme. The groundnut platform is one of the platforms facilitated by AME, others focus on the production and marketing of rice, cotton and vegetables. Like ILEIA, AME is a programme implemented by the ETC Foundation

This section deals with the groundnut production programme. The first article provides information about agriculture on the Deccan Plateau and the history and sustainability of its groundnut production. The second article will focus on AME's strategy for technology development, the process of stakeholder concerted action and PTD experimentation.



The Deccan Plateau, a vast area of roughly 1000 by 300 km lies at about 600 m above sea level. It is a chronic drought prone and resource poor region, lying in the rain shadow of the Western Ghats, in the states of Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu. Annual rainfall ranges from 500 to 900 mm and can be very variable with substantial dry spells. Natural soil fertility is generally low. Total population in the region is about 100 million or about 20 million families some 10 million of which are farming families. Another 4 million are agricultural labourers. Eighty percent of the region is under rainfed farming and the rest is under irrigation.

Sustainability at stake

Farms on the Deccan plateau are generally small (one to ten acres) and the majority of farmers have less than three acres. In this vast area many types of farming systems are found. However, on most rainfed farms pearl millet, finger millet, sorghum, sesame, horse gram, foxtail millet, cow-pea, pigeon-pea and groundnuts are grown. Formerly these were cultivated in mixtures but today they are increasingly being grown as pure crops. Rice, bananas, cotton, and sunflowers are cultivated in irrigated areas. Farmers use a small amount of farm yard manure (about 1200 kg/acre) once in four years on rainfed land and the same quantity each year on irrigated land. This is supplemented with Di-Ammon Phosphate and urea. The use made of phosphorus fertilisers is about half what it should be. Micronutrients are generally not applied. About 50% of the farms have access to animal traction. Others rely on hiring bullocks for ploughing or, increasingly, on tractors. Pesticides are mainly used in irrigated agriculture. Trees and animals play an important role in the farming systems of the plateau.

Groundnut is a major cash crop in the three southern states and are grown on about 4 million hectares. This represents 50% of India's total groundnut area and is about 12% of the cultivated area of the Deccan plateau. Groundnuts are usually grown by marginal farmers with limited or no access to irrigation. Groundnut cultivation is favoured because the crop is fairly drought resistant, can be readily marketed and loans are easy to get. Besides it is a cost effective proposition to grow this cash crop and use the earnings to buy subsidised food grain from the Public Distribution System (PDS) (see Box 1).

New farming technologies have helped the richer pockets but this is offset by declining productivity in vast marginal areas. Over-exploitation of the natural resource base is an all-pervasive phenomenon that keeps the majority of farmers trapped in poverty. Traditional systems and resource management institutions have weakened and no alternative options are readily available.

Many marginal farmers and young people have been forced to stop or are unwilling to continue with agriculture as their main occupation. The rapidly growing industrial and service sector in the region has facilitated this economic transition. Male migration is increasing fast and has lead to the degeneration of family, gender and community relations. Many of these developments can be traced back to inappropriate resource use patterns and the inability of research and development

Box 1 **Public Distribution System (PDS)**
PDS provides rations of food at highly subsidised prices. Rice for example is sold in Andhra Pradesh for Rs 3.5/kg through PDS compared with Rs 10/ kg on the open market (1998). A poor family of about 5 persons has the right to purchase 25kg rice each month under this system.

organisations and the commercial sector to support farmers in the development of more profitable and sustainable agricultural practices.

A short history of groundnut

The groundnut entered India in the mid-sixteenth century either from China or the Pacific islands. Until 1900 'guarani', a variety which matured in 195 days and required 2-3 irrigations after the monsoon, was cultivated on less than 230,000 ha. During the next decade two varieties that could grow in rainfed conditions - Big Japan and Spanish - were introduced. Thus, spreading, semi-spreading and bunch varieties with higher oil content and maturing in 105-145 days, gained entry and reigned. Later, in the sixties and seventies, the short-duration, bunch varieties (95-105 days) were introduced. These could be grown in drought prone belts with shallow unproductive soils. Literature reveals that the average yield of groundnut (pods) declined from 1200kg/ha in 1920 to about 800 kg/ha in the fifties and remained stable until the late sixties. From the seventies onwards yields gradually rose to about 900kg/ha (see Box 2) .

Declining productivity in the fifties resulted from:

- the proportional increase in acreage of short duration varieties leading to reduction in the period of photosynthesis. The inherent production potential is lower than that of long duration varieties;
- the steady inclusion of low fertility soils for growing short duration groundnut varieties (between 1954 and 1973 the area expanded by 24% while yield increased by a mere 10%).

Until 1970, groundnut was only grown as a Kharif (rainy season) crop. After 1970, however, the area under irrigated (Rabi) groundnut expanded to about 1.5 million ha and this gave an interim increase in average productivity. Today, about 19% of groundnut land is irrigated. Support prices for groundnut also rose from Rs.350/100kg in 1984-85 to Rs.900/100kg in 1995-96 . Groundnuts commanded better prices than other oilseeds and food crops. Improvement in relative profitability during this period could have triggered off expansion into irrigated groundnut cultivation.

Groundnut farming in trouble

Thus far the groundnut story appears promising: increases in average productivity and total production, larger areas and remunerative prices. But in reality the development trends are quite negative.

Soil degradation induces pests

There are slow but definite changes that are progressively endangering sustainability in the rainfed groundnut cultivating areas.

By the sixties farmers moved *en masse* into groundnut cultivation in marginal areas, characterised by shallow (less than 60 cm deep), red, loamy sand soils on sloping (>5%) land. In 50 years an estimated 15-30 cm of topsoil has been lost to erosion.

The fragmentation of farms, the overexploitation of common lands and the disappearance of cattle and bullocks have led to an acute scarcity of organic manures. This, coupled with an excessive application of nitrogenous fertilizers has depleted the organic matter in these soils. According to scientists, there are extreme cases where soil organic carbon content is below 0.3%, a third of what it used to be. Because groundnuts have been cropped continuously they have assumed a central place and account for anything from 25% to 80% of the crops grown in the farming systems of our operational areas.

The combined effects of these three factors - erosion, rapid mineralisation of organic matter and continuous groundnut cropping are:

- Loss of waterholding capacity and aggravated susceptibility to water stress, especially during dry spells;
- Increased micro-nutrient deficiencies (Zn, B);
- Extreme susceptibility to fungal diseases;
- Increased presence of inoculum of diseases; and
- Increased pest populations.

Box 2 **Irrigated versus rainfed groundnut productivity**

At present average groundnut production stands at 900 kg/ha pods with a shelling percentage of about 70%. There are important differences between production conditions. Under fairly good rainfed conditions on fairly good soils one can expect a pod yield of about 1200 kg/ha. Under adverse rainfed conditions pod yields can be as low as 300 kg/ha with a shelling percentage of 55%.. Under irrigated conditions yields up to 3000 kg of pods/ha would be possible.

Fungal diseases such as leaf-spot (early and late), root collar rot and stem rot are on the increase. Pests like red-hairy caterpillar, whitegrub, leaf-miner and tobacco army worm are creating increasing problems. As a result groundnut yields continue to decline in the marginal areas while production becomes more risky. At present, even in a year with average rainfall, many a farmer just about breaks even with a yield of 600kg/ha. The monsoon fails once in three years and yields fall to a mere 175ka/ha barely enough to replace the seed sown. Over the years the crop has become a loss making proposition for the resource-poor farmer. Ironically, even though many groundnut farmers are heavily in debt they continue with groundnuts because this is the only crop on which money lenders are ready to advance their expensive loans (at interests of up to 120% a year).

Severe competition

Roughly 80% of the groundnuts produced in India are for oil extraction, 15% for seed and only 2% are table grade and exported. Since 1994 the economy has opened up gradually and imports and international competition now play a larger role than ever before. The expensive Indian ground-

photo: Bert Lof

If the government would opt for deregulating groundnut prices, this would lead to losses for most farmers.

Getting our act together

nut oil has now to compete with cheaper edible oils such as palm oil on the world market. Malaysia palm oil, for example, is cheaper because:

- palm oil production per unit of land and time is much higher than for groundnut oil, whilst processing costs per unit of oil are comparatively low;
- oil milling in India is far from efficient; most mills run at sub-optimal capacity and are beset by a plethora of administrative problems including over-staffing and weak accounting procedures.

The net effect is that oil millers have difficulty making a profit and staying in the market. Since the government maintains price support for groundnut - something crucial for many poor farmers - millers will have to increase production effeciency - an unlikely proposition at the present time. Some of them may have to close shop unless the government comes to their aid.

Alternatively, if the government opts for deregulating groundnut prices, lower farm-gate prices and decreased profits would lead to declining acreages (particularly marginal land) and losses for most farmers. The livelihood of poor farmers relying on groundnut income to buy food would be seriously undermined. With a loss of food security, migration to urban areas will become inevitable for poor farming families.

Given the gloomy ecological and economic situation as far as groundnuts are concerned and the high population pressure it is clear that something has to be done to improve sustainability of rainfed groundnut production and agriculture in general on the Deccan Plateau.

Institutional responses to land degradation are gradually increasing and public investment, effort, and the numbers of institutional actors are all growing. The nature of the response is also changing and has moved from the primarily reactive efforts of single institutions focusing on technical interventions, to a more coordinated, pro-active, and people-centered approach. This is most significant in the field of watershed management. It may be noted, however, that dryland agriculture continues to be a relatively neglected area, and efforts to tackle its increasing problems continue to be disjointed.

In Southern India NGOs constitute an important interface between farmers and the government in such matters as agricultural research and watershed management, for example. However, despite significant achievements there is still a long way to go because their geographical spread and expertise in participatory development of sustainable land use is often limited. Further, though there have been instances of government-NGO linkages, the degree of synergy between these and other institutions in sustainable land use is inadequate. AME fills an important niche between these different types of organizations.

AME and its working strategy

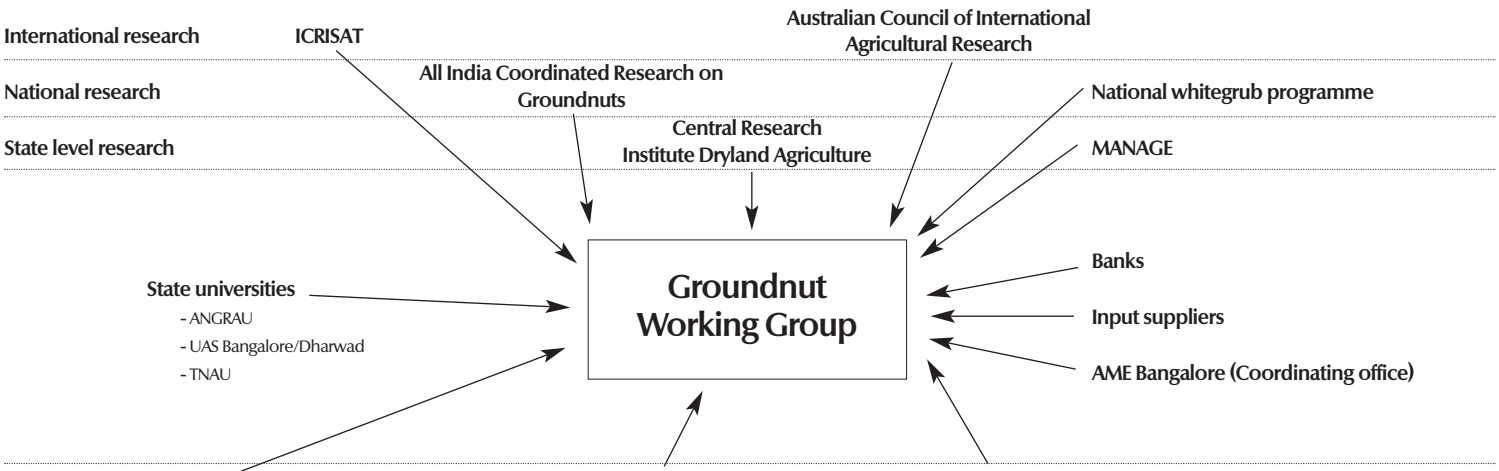
Since 1985 AME has been active in Southern India as an organisation focusing on training and professional support in the development of ecological agriculture. In 1990 PTD and SCA components were added to its programme. Its aim is to assist NGOs through capacity building in participatory technology development and contribute to the establishment of stakeholder platforms for research and negotiation in the interests of sustainable land use. AME believes that, to get a fair share of what the land has to offer or to be more effective in their own development role, all stakeholders in land use should participate in the effort to increase sustainability.

AME's approach is to focus initially on the ecologically sound production of a specific crop. Gradually the approach is broadened to address a variety of issues in the development of sustainable integrated farming systems and watersheds. Beginning with a single NGO or a homogenous group of NGOs, it facilitates the steady build-up of relationships with other institutional actors such as panchayats (community councils), government departments, research institutions, input suppliers and credit institutions. This cumulates in the establishment of stakeholder platforms as a strategy for up-scaling participatory and integrated land use development.

PTD in groundnut: getting started

While initiating a PTD process for groundnuts with small and marginal dryland farmers in south India, we discovered that local knowledge was not necessarily the answer to their problems. Traditionally long duration varieties were cultivated within the context of mixed cropping systems. It is possible that pest and disease problems were not so significant and therefore farmers did not have much knowledge about control measures. Perhaps because they

GROUNDNUT PTD AND EXTENSION PROGRAMME, AME INDIA



Box 3 **Our strategy was to restore soil fertility**

Farmers experimented with cheaper sources of nitrogen (rhizobium bacteria) and phosphorus (mussooriephos plus phosphobacteria) and applied gypsum at the flowering stage. We found yields had increased when compared to control plots where chemical fertilisers (DAP or other compound fertilisers) had been applied. Yields were similar or lower when compared to plots where substantial quantities of farmyard manure had been used. This focused our attention on farmyard manure. We found that when some 5 to 7.5 metric tons were applied per acre the monetary returns were twice as much as the costs involved. Our main problem was to generate the required quantities of farmyard manure as the average farmer has only two head of cattle producing about 4 metric tons of manure annually, not enough for one acre but the yield increases of groundnuts grown with this amount of farmyard manure is such that the area under groundnuts can be reduced without income being affected.

The area freed can be used for green manure production. One of the partners has started green manure production plots to evaluate the feasibility of this approach.

have only recently had to deal with new varieties and because many marginal farming communities are not traditional farmers, their knowledge of groundnut cultivation is limited. Also, the younger generation has lost interest in learning about traditional practices. The PTD process initiated by AME, therefore, had to rely more heavily on formal research.

AME's first experience with a groundnut PTD process took place in 1994 with an NGO and sixty farmers in the Dharmapuri district of Tamil Nadu. Here two groups of farmers decided to implement experiments. A fairly good insight into important factors influencing groundnut production was obtained over a two-year period. By 1996 this work expanded to Chittoor district in Andhra Pradesh where groundnut cultivation faced many problems. Working with 20 individual Dalit farmers in one village proved to be a slow process because their familiarity with farming was less than 25 years old. The Dalit were erstwhile untouchable, landless, agricultural labourers.

Consolidating and expanding PTD

A first sustainability analysis could be made on the bases of the Dharmapuri and Chittoor experiences and a strategy was developed to restore soil fertility and physical characteristics at low cost (see Box 3). With these experiences, a provisional groundnut production manual was published in early 1997 and provided a basis for working in other areas.

Having identified problems through PRAs and found similarities, it was not a question of looking for things to try, but rather a matter of getting started in a demonstration mode. But due to differences in climate and soils, new problems emerged and proper PTD experimentation on these issues started in 1998 and 1999.

Platform building for SCA

In the new areas we encountered the problem of whitegrub and leaf miner. AME had little information about these pests and we approached the researchers. This lead to a workshop in late 1997 which we organised with the National Institute for Extension Management (MANAGE). Representatives from the All India Coordinated Project on Groundnut and Whitegrub, state agricultural universities, ICRISAT and a broad group of NGOs also attended. We learned a lot from each other and established important links with the researchers. In this way the Groundnut Working Group (GWG), a platform for SCA was born. The idea was elaborated to create a platform that would bring together researchers, input suppliers, policy makers, NGO's and farmers on a regular annual bases to create more synergy through the exchange of experiences and information. This whould lead to more 'need'- driven research, an improvement in the knowledge of all parties involved, a better supply of new, environmentally-friendly inputs and improve farmers access to the banking system.

In 1998, NGOs presented findings from the 1997 PTD experiments to researchers and representatives of national programmes at a second GWG workshop organised at MANAGE. Banks and input suppliers were involved in the hope that they would become interested and willing to provide credit and ecofriendly inputs to the experimenting farmers. The workshop focused on whitegrub and leaf miner control and tried to promote collaborative efforts. The result was the birth of the whitegrub programme (see Box 4).

Scaling-up PTD and SCA

The first experiences with PTD experimentation in Dharmapuri in 1994 involved 60 farmers. Now the technology selected by PTD farmers is used on about 5000 acres by an estimated 2000 farmers. AME has also linked with two more NGOs, one in Chittoor (20 PTD farmers in 1997 now about 60 PTD farmers and 150 users) and one in neighbouring Anantapur district (20 PTD farmers in 1997, now about 30 PTD farmers and 700 users) working with the women farmer members of a self-help group and a young male farmers' group.

Now AME partners 14 NGOs and 500 farmers in five districts in Andhra Pradesh, Karnataka and Tamil Nadu in PTD processes. Further, other NGOs and an estimated 1500 farmers have been influenced in their way of cultivating groundnuts as they too use the results of our work.

AME has designed various ways of up-scaling:

- NGO staff train their colleagues in proven technologies which are then disseminated through normal extension.
- Farmers who attended the training take it upon themselves to assist other farmers trying out the proven technologies. Some aspects of PTD experimentation might be incorporated but it is mostly extension;
- New groups of farmers are identified by NGOs and new PTD processes are initiated;
- Farmers who participated in the PTD processes give interviews for radio programmes on agriculture;
- Small, user-friendly manuals with good illustrations are produced in local languages;
- Neighbouring farmers start using part of the technology which they have assessed to be valid.

Box 4 **The whitegrub programme**

One outcome of the GWG workshops was the decision of the Australian Council for International Agricultural Research (ACIAR), the Indian Council for Agricultural Research (ICAR) national whitegrub programme, ICRISAT, the Chittoor and Anantapur NGOs and AME to embark on a joint research initiative on ecofriendly whitegrub management. The objective was to isolate a congregation pheromone for whitegrub adults which would attract them to one spot making it easy to kill them before they could lay eggs. This would significantly reduce the pesticide load and would be much more economical than the present method of control. Such a congregation pheromone has been identified for the species in north India and after two years of control the level of pest infestation was reduced for five years.

At present a systemic insecticide is applied as a seed coating to control whitegrub. This insecticide also controls jassids, white flies and leaf miner to a certain degree but is expensive for farmers.

After the first year there were discussions at the level of the national whitegrub programme. The all India coordinator was not sure how important the pest was in south India. It was suggested that a survey be carried out there. In the third GWG workshop (1999) it was suggested that the NGOs take part in this effort. About 25 NGOs reacted positively and embarked on a systematic collection of whitegrub. Many insects were caught and sent to University of Agricultural Sciences, Bangalore and ICRISAT for identification. A collaborative survey of larval density is being carried out in endemic areas. Recently an area was discovered where damage was observed to be 100%. This observation is in sharp contrast to the prevailing government view that whitegrub is not a major pest in south India.

A major expansion of the PTD programme is presently taking place (see Box 5) since the experienced farmers have assumed the important role of training other farmers. The larger part of the programme comprises extension training in proven techniques of groundnut production, selected by PTD farmers in the area concerned.

New issues are coming up

In the third workshop (early 1999) organised at CRIDA (Central Research Institute for Dry-land Agriculture), problems related to groundnut diseases were explored. Farmers had incurred serious losses due to fungal diseases, mainly collar and stem rot, in the preceding growing season.

Leafspot and stemrot control

During the workshop it became clear that leafspot and stemrot control are interrelated. To prevent stemrot it is necessary to control leafspot. The most common way of controling leafspot is by spraying with chemical fungicides (Dithane M45, Bavistin, etc.) at regular interval starting at about 60 days after seeding and repeating applications at intervals of about 15 days. This means that about 3 sprays are required. This is too labourious and expensive for small-scale dry land farmers .

The early warning system developed by ICRISAT makes a more accurate timing of sprays possible. It can also indicate that conditions are unfavourable for the disease and spraying is unnecessary. This reduces labour and cost. Even so farmers found it still too expensive so we set about looking for alternatives.

In the literature we found that magnesium deficiencies could enhance susceptibility to leaf spot. Thus we tried magnesium fertilisers and saw a moderate decrease of disease incidence in the field. A partner NGO informed us that a concoction of leaf extracts of *Lantana camera* and eucalyptus has fungicidal properties, so we tried this as well. Farmers complained that spraying is difficult and expensive even with botanicals. We discussed the farmers' evaluation in the workshop.

Scientists and NGO agronomists assured us that resistant groundnut cultivars exist and perform well both on station and at farm level. They agreed to supply the NGOs with a basic quantity of seed of five cultivars. Quite a number of plots have been planted, NGO staff and farmers monitor disease incidence and ICRISAT staff visit the plots and train NGO staff and farmers in disease recognition and scoring. Scientists from national agricultural research institutes also presented research results that showed that a high dose of gypsum at planting time (200kg/acre) significantly reduced the incidence of stem rot. Other scientists expressed interest in the scientific validation of botanical extracts and homeopathic medicine in leaf spot control. The whitegrub programme has also decided to test the effectiveness of homeopathic medicine in controlling whitegrub as well.

Partcipatory documentation

We had found that many farmers and NGO staff were confusing the reasons why groundnut plants were dying. The whitegrub team took the initiative to develop a field determination booklet called *'Why are my groundnuts dying?'* This booklet provides a pictorial guideline for determining the cause of death. The draft was discussed in the workshop and comments have significantly altered the layout, choice of photographs and the text. A joint press conference with CRIDA provided newspaper, radio and television coverage which resulted mainly in political interest in our collaborative efforts.

What does the future hold?

Over the past five years we observed that the PTD process which AME initiated in a small way has gradually generated enormous enthusiasm, and spread rapidly to neighbouring areas. Today many organisations are involved. It is satisfying to witness that certain processes have become self-propelling, no longer requiring any effort from our side and that AME could gradually phase out its involvement.

We have also observed that not everything scales up by itself. Technologies once validated by farmers, spread fast. Yet, the experimentation process itself, which in the first place resulted in learning about technologies does not scale up so easily. It requires continuous nurturing, able guidance and intensive monitoring.

Knowing that the number of farmers who have become actively involved are a mere fraction of the total farming population and that much more remains to be done, we conclude that scaling up the capacity to guide experimentation remains a major challenge. It will perhaps require another half decade before this ability becomes self-perpetuating. ■

***Box 5* Involving women in PTD**

After two years of PTD experiments, a federation of self-help groups of women members in the Anantapur area decided to adopt gypsum, rock phosphate and biofertiliser application as proven technologies. They are now disseminating the technology throughout their federation of 120 women's self-help groups that have a total of 2000 members. About 700 of them started to use the tested technology in 1999. The self-help group involved in PTD experiments was able to inform the federation by inviting the leaders to PTD evaluation sessions.
Women's groups in particular performed well in our PTD experiments. Men often mixed up their experimental and control plots whilst most of the women maintain the plots separately and collected data meticulously.

photo: Bert Lof

Women groups decided to adopt gyprum, rock phosphate and biofertiliser as proven technologies.

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