Soil fertility management under pressure

Editorial

Soil fertility management (SFM) is the basis for sustainability in every agricultural production system. Creating favourable conditions for soil life and plant growth, nutrient application and soil conservation are important aspects of soil fertility management. SFM is a complex issue involving many farming practices. Each farming system has its own unique way of SFM which depends on a combination of factors: the condition of the natural resource base, the land available, labour and capital resources and their relative price, the history of local farming, farmers' knowledge, their motivation, skills and degree of market orientation, the relative prices of inputs and, of course, agricultural policy.

It is possible to identify several broad categories of farming systems each with characteristic SFM practices. These include shifting cultivation and fallow systems based on natural processes of soil fertility regeneration; interactive pastoral and fallow systems based on nutrient harvesting by animals and fallow vegetation; integrated and organic agriculture typified by the recyling of nutrients; and modern agriculture in which synthetic fertilisers and mechanisation control soil fertility management. Within and between these categories are a wide variety of practices.

Practices are changing

SFM is not a static concept, practices are being continually modified as conditions change. Typical is the movement from extensive to intensive soil fertility management when population pressure increases and land becomes scarce. Last June a conference took place on **Indigenous strategies for the intensification of shifting cultivation in South-east Asia** (Cairns 1997). Based on the case studies collected for this conference, Cairns developed a framework of typologies of Indigenous Fallow Management. This framework provides a continuum of indigenous intensification strategies in shifting cultivation. Nijhof (page 10) reports on the intensification process of the Mangyan shifting cultivators in Mindoro in the Philippines. He rightly concludes that shifting cultivation is not a static traditional approach to agriculture neither is it doomed to extinction. The traditional strategies of shifting cultivators as they use natural processes to manage their crops and fallow vegetation still provide options for increasing production in a sustainable way. One of these options is the replacement of slash-and-burn practices by slash-and-mulch practices (Thurston 1997).

Another example of changing SFM practices is the still, relatively recent, shift from SFM using natural means to SFM using synthetic fertilisers. This happened where conditions are favourable for market production. At the moment, however, many of these farmers are again looking for alternative SFM strategies as increasing costs, decreasing yields and indicators of soil degradation convince them that the continuous use of synthetic fertilisers, or at least the way these fertilisers are being used is far from sustainable. Mulleriyawa and Wettasinha (page 18) report on a process of participatory technology development designed to find alternatives to the use of synthetic fertilisers in paddy production in Sri Lanka.

Practices fit specific conditions

Each SFM strategy fits, but also needs, specific conditions, and farmers combine those practices which suit them best. As Subedi (page 16) explains, subsistence farmers in Nepal cannot afford - and sometimes have no access to - synthetic fertilisers and therefore depend on natural means of SFM such as green manures. Roland Bunch (page 12) presents the latest insights into situations where green manures/cover crops can be successful in replacing or complementing synthetic fertilisers or slash-and-burn practices. Where labour is scarce (extensive agriculture), or relatively expensive compared to the cost of synthetic fertiliser (modern agriculture) farmers cannot afford labour intensive recycling of organic waste like that being initiated in Egypt (Zakaria et al. page 24). Benzing (page 14) illustrates this further by showing the relationship between different farming systems/SFM strategies and the varying types of conditions under which farming is carried out in the mountain valleys of Ecuador. He also makes recommendations on how SFM could be improved by optimising the use of natural means of SFM.

Sustainability threatened

Today the ecological sustainability of agriculture and finding ways to increase production are pressing issues. The NUTMON nutrient balance study in Kenya shows that farmers who participated in this programme obtained about 30% of their income from nutrient mining. This confirms earlier findings in Africa (see Vlaming et al. page 6). Elsewhere in the tropics the situation is probably not much better as Mulleriyawa and Wettasinha (page 18) indicate.

This is only one side of the picture, however. There are also places where lost or exported nutrients accumulate: sediments washed out in soil erosion, accumulations of organic waste in city areas, nutrients leached into the ground water and volatilised nutrients in the air. All these cause pollution. Synthetic fertilisers are frequently used in an unbalanced, inefficient and hence polluting way, leading to soil degradation and declining yields. But also, each kilogramme of synthetic fertiliser used corresponds to an approximately equivalent amount of nutrients contained in organic matter and which are being wasted at the moment.

You might wonder how seriously these sustainability problems are being dealt with by researchers and policy makers. There are no broadly-based studies on the many processes involved in agricultural sustainability. For example, it was only in 1995 that the International Rice Research Institute (IRRI) finally initiated a major study -covering eight countries (page 36)- on **Reversing trends of declining productivity in intensive irrigated rice systems**. The study will analyse what is going on and attempt to design alternative strategies to present practices. Probably a much broader study will be needed to analyse the full extent all the problems involved in the use of synthetic fertiliser and their socioeconomic and cultural implications.

No money for synthetic fertiliser

Where farmers cannot produce competitively for the market or are resource poor, the cash income they obtain from farming is too small to allow them to buy external inputs. High transport and credit costs are amongst the factors that make these inputs expensive and risky to use. Where ecological conditions are not particularly favourable for farming or the soil has been degraded, using synthetic fertilisers is relatively inefficient. In these conditions, synthetic fertilisers do not generate enough profit to make them a viable option in compensating nutrient losses. Increasing numbers of farmers are being confronted with these problems as the relative cost of synthetic fertiliser increases and soil degradation accelerates. If these farmers continue to produce for the market and export/loose nutrients in quantities higher than they can afford seen their options for compensation of nutrient losses, further nutrient depletion, soil degradation and yield decline will be unavoidable. At the moment this process can be seen in many regions in Africa and elsewhere in the tropics. Subsistence farming based on ecologically sound practices, therefore, seems to be the only sustainable basis for livelihood within the reach of these farmers. This does not entirely exclude production for the market but must be kept to levels that farmers can afford.

Back to traditional farming strategies?

Many farmers in regions where agricultural conditions are less favourable - and this includes many groups of indigenous people - are trapped in this dilemma. The drive towards modern, market-oriented farming is causing severe ecological degradation and economic marginalisation. Market agriculture, migrant labour and the desire to participate in the consumer culture are sapping the cultural and spiritual basis of traditional society and place a heavy burden on survival strategies (COMPAS 1996).

Reorientation towards traditional farming strategies or urbanisation and the consequent weakening of indigenous culture seem to be the two, far from attractive, development polarities available to indigenous communities and resource-poor farmers. The case studies collected by ICRAF (Cairns 1997; Fuijsaka and Escobar 1997) and the case described by Nijhof (page 10), however, set out evidence that shows traditional farming strategies can still provide a sustainable basis for livelihood. Batterbury (1996), Phillips-Howard and Lyon (1994) and Tiffen et al. (1994) also present examples of how farmers make their way between subsistence farming, market-oriented agriculture, and urban employment and succeed in intensifying land use whilst keeping ecological degradation within bounds. These farmers often complement natural methods of SFM with the judicious use of small amounts of synthetic fertilisers. There are, however, many cases where farmers have been less successful and find themselves trapped in such poverty and ecological degradation that they are forced to migrate to the cities.

One of the problems confronting farmers who reorient their farming towards traditional farming strategies is that conditions for agricultural production have changed during the period they were focusing on a market-oriented agriculture supported by the use of synthetic fertiliser. Population growth, the degradation of soil and natural vegetation mean that traditional farming practices can no longer be applied as in the past and adaptations have to be made. The new 'Kekulam' rice production system described by Upawansa (page 20) is an example of the adaptation of a traditional system with minimal dependence on the use of external inputs of synthetic fertiliser. It would be very interesting to compare the socioeconomic, ecological and cultural performance of such systems with conventional systems.

Ecologically sound market agriculture

The importance of strategies that combine the use of internal and external sources of nutrients in the way best for a given local situation is sometimes called Integrated Nutrient Management (Vlaming et al. page 6) or Integrated Plant Nutrient Systems (FAO). The value of Integrated Nutrient Management (INM) is increasingly being recognised by researchers. Innovative farmers, sometimes alone, sometimes with the support of outsiders, have already developed many INM strategies. The case described by Mulleriyawa and Wettasinha (page 18) is an example of the participatory development of Integrated Nutrient Management. These strategies allow a more efficient, profitable and ecologically sustainable use of synthetic fertilisers and other external inputs in market agriculture which in turn lowers the threshold for farmers working in less favourable conditions to become part of, or remain within the market economy without degrading their system. Resource poor farmers cultivating in areas where conditions are favourable for market production can benefit from these strategies: production costs are lowered and their dependence on usurers and expensive credits is reduced.

Decreasing the cost of transport, marketing, inputs and credit can help farmers to become more competitive in the market. However, where population and the urbanised market economy are growing fast, as in many South and South-east Asian countries, even improving these conditions cannot prevent or halt the process leading to the economic marginalisation of small farmers and their flight in search of urban employment.

Learning to adapt farming

Given changing conditions, needs and insights, farmers have constantly to adapt their soil fertility management practices. However, new practices do not only have to accommodate prevailing natural, economic and cultural conditions but also the way agriculture and society has evolved over time.

Where development workers and researchers try to introduce SFM practices that do not fit the prevailing natural, economic and cultural conditions or where insufficient attention is paid to farmers' own learning process and accumulated knowledge, their efforts are bound to fail. The articles by Hagmann (page 26) and Sharland (page 28) show how such learning processes can be enhanced by learning tools and dialogues that build on traditional practices and insights.

Coen Reijntjes

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