

Sustaining soil fertility: useful practices and methods in hill agriculture



FFS farmers' group discussing the quality of their soils. Photo: SSMP

Farmers in the hills of Nepal have, over the past centuries, developed complex farming systems based on a close integration of crop, livestock and forestry/grassland management. Manure derived from livestock is the main source of soil fertility management. About 32% of the fodder resources are derived from crop residues while the rest is derived from terrace risers, bunds and forests. Although fodder is in short supply and milk production is thereby reduced, farmers keep livestock partly for the purpose of manure production.

Farmers have constantly changed and adapted their farming systems over the past centuries as need and opportunities arose. New crops such as maize and potato entered the hills centuries ago and are now staple food crops contributing to food security. The expansion of fruit crops and vegetables is a more recent phenomenon improving food quality and farm income. At the same time, farmers have maintained traditional practices such as terracing, manure management, legume inter cropping, and mulching where appropriate.

Searching for innovation

The rapid intensification of land use, reduced access to biomass from public land, increasing access to input and output markets, new crops and cropping systems have exposed farmers to new challenges. Therefore, farmer-support organisations need to accelerate farmers' efforts to increase the productivity of the farming system with new practices and knowledge while maintaining its diversity and sustainability.

This article summarises experiences on the promotion of sustainable soil management of more than 50 governmental and non-governmental organisations under the common umbrella of the Sustainable Soil Management Programme (SSMP). More than 14000 households in 10 hill districts participated directly in project activities since 1999 through more than 1500 field trials or demonstrations per year. About 700 farmers participated in a recent evaluation of the programme. The major learning points so far are outlined below.

Technical opportunities for SSM

Various opportunities for improved soil management have been identified and confirmed with farmers over the past 3 years. For instance:

- **Farm yard manure quality** can be increased by better decomposition and the N-content can be increased by at least 2 to 3 times from about 0.5% N to 1.5% N through proper management of urine and manure. In particular, urine collection and the proper management of manure are new to most farmers, as many have initiated stall-feeding only over the past 1-2 decades. Previous recommendations for manure (use of starter, turning

etc.) were derived from composting and proved to be too labour demanding and missed the importance of urine collection and N-preservation.

- **Liquid manure** can be prepared from urine and various plant extracts rich in minerals or secondary plant compounds. These "manure teas" were shown to be effective liquid fertilisers on crops such as vegetables and also for organic pest and disease management. Local marketing systems for such "manure teas" are emerging in some areas. The use of urea fertiliser declined in several areas due to liquid manure use.

- **Increased fodder availability** from fodder trees and grasses on private land has improved the fodder supply and quality for livestock. The quantity and quality of manure has increased (remember: about 80% of N in fodder is excreted through urine). Additionally the workload for fodder collection and transport, in particular for women, has been reduced.

- **Legume cropping** was not a successful intervention in many areas. However, it did expand considerably if the legume species was selected with farmers and well targetted to local ecological conditions and marketing opportunities. Groundnut has attracted, for example, the attention of farmers as a cash crop with local processing and marketing potential for women. Farmers have adopted Four-Season Bean, a climbing variety of *Phaseolus vulgaris*, as a vegetable and food crop.

- **Multistorey Agroforestry** systems have attracted farmers' attention in the case of inter cropping coffee (a new cash crop for most farmers), ginger, fruit trees, vegetable and fodder trees in the western and central region. Shade trees are essential for sustainable management of coffee plantations in minimising damage by stemborers, drought stress and low winter temperatures.

- **High value crops with SSM** such as fresh vegetables in areas with market access or ginger in more remote areas have stimulated farmers to care for their land and soil fertility. The initial doubt was whether short-cycle cash crops would contribute to an overexploitation of the soil and to a decline in soil fertility. However, field studies have confirmed that farmers increase their investment into soil fertility, if the information on the cash crop is delivered together with information on sustainable soil management. Fodder and manure production, for example, increased on these farms.

- **Fertilisers** may provide a response of at least 25-30 kg of additional maize yield per 1 kg of nitrogen applied if the fertiliser use is at low-moderate rates, correctly applied and well synchronised with crop demand. Farmers in accessible areas have started to complement manure with an inorganic fertiliser top-dressing. However, farmers' experiences on the correct type, amount, timing and placement of fertilisers in combination with indigenous organic manure management are still limited.

Technical challenges for SSM

Some major challenges remain to be addressed. We herewith invite readers to provide ideas and experiences on how to tackle the following challenges:

- **Preventing the gradual acidification** of soils is the most difficult challenge for sustaining soil fertility in the hills. At least one third of the soils have an inherent low soil pH and these soils will acidify further if inorganic fertiliser use expands and organic matter applications are reduced.
- **Increasing phosphorous availability** is another major challenge for SSM in the hills. Many soils have considerable P-reserves. A large part of the available P is linked to organic matter dynamics ("organic P") and the management of such P-pools, in particular in acidic soils, needs to be explored. Experiences with mycorrhiza application or P-mobilizing crops may be relevant.
- **Organic pest and disease management**, in particular of soil pests and soil-borne diseases, is required to manage soil fertility and soil health in an integrated approach. Experiences on the control of white grubs and red ant, in particular, and organic vegetable management in general are welcome.

Research over the past 5 years has confirmed the need for a combined use of different management practices to maintain or improve soil fertility under an "Integrated Plant Nutrient Management System" (IPNS). A joint effort between staff from the Nepal Agricultural Research Council, the Department of Agriculture, the Ministry of Agriculture and Cooperatives and various NGOs was initiated in 2001 to design and implement Farmer Field Schools on IPNS. Preliminary field trials indicate that the use of external inputs can be reduced to at least one half or can even be eliminated (using urine instead of urea) without yield reduction. More than 20 Farmer Field Schools on IPNS are under implementation in 2002.

Methodological opportunities

The promotion of SSM is not only based on technical interventions but is also a social process. Organisations working with SSMP use various approaches, methods and techniques in the promotion of SSM. Some have gone through a cycle of learning and improvements over the past years. This process continues, while the following conclusions can be drawn:

- **Indigenous and new knowledge:** Women and men farmers have confidence in their indigenous knowledge. New knowledge complements indigenous knowledge. Thus, methods of extension that build on discussion and interactive learning among farmers are most appropriate. Commonly known visual tools for soil characterisation (e.g. pH-paper, hydrogen peroxide, litter bags, erosion boxes) proved essential for stimulating discussion. The Farmer Field School approach for IPNS is centred around such a learning process.
- **Soil fertility and land productivity:** The farmers' concept of soil fertility is closely linked to land productivity as shown by various surveys. Farmers' interest in SSM-practices is much higher, if these are closely linked with complementary practices for increased soil productivity (e.g. vegetable plus better manure).
- **Farmer-led experimentation:** Farmers need to integrate new practices into their highly heterogeneous hill farming systems. Methods of farmer-led experimentation were explored in 2000/2001 by some organisations. Simple experiments on inter cropping, crop arrangements, manure or urine use were most common. This proved to be effective in increasing farmers' role and commitment in the overall testing and diffusion process. Experiences were shared with others and over 30 organisations have started supporting farmer-led experimentation in 2002.

- **SSM implications for women and men:** Slightly more than 50% of all farmers participating in the field activities were women. However, this quantitative participation did not prove to be sufficient, particularly in more traditional communities. Thus, efforts were initiated to assess with farmers the implications of adopting specific SSM-practices for women and men farmers. This resulted in the identification of specific actions to address qualitative gender equity, which have become part of the strategy in a technically-oriented programme.

Methodological challenges

- **Participatory planning, monitoring and evaluation (PPME):** The introduction of new SSM-practices into traditional and complex farming systems is a gradual process of testing, adaptation and learning. Participatory surveys in project areas proved to be of a consultative character and were mostly dominated by staff of organisations. Additionally, surveys were quickly outdated by changes in opportunities and problems perceived by farmers. Thus, a regular process of PPME at the level of the farming community is considered essential to adjust projects to emerging needs and opportunities. SSMP supports this through annual work plans (Activity Proposals) and respective budget allocations to each project. However, the overall process of learning with farmers needs to be further strengthened. An exchange of experiences on PPME and on the integration of constant learning into project cycles would be appreciated.
- **Farmer-to-farmer diffusion:** As improvements of local SSM are a result of the integration of new and traditional knowledge and practices, experienced farmers turned out to be the best local promoters for SSM. Additionally, demand-led extension tends to be more effective and efficient than mandated extension. Thus, a new approach of farmer-to-farmer diffusion is under testing since 2001. The most experienced farmers received additional training so as to enable them to offer their services as local resource persons. A total of 400 farmers groups are expected to hire the service of these farmers with limited financial support by the projects. More needs to be learned about modalities to support demand-led farmer-to-farmer diffusion.

Governmental policies

Recent changes in governmental policies have in general been supportive of SSM. The termination of fertiliser subsidies, the recognition of organic amendments as fertilisers and the incorporation of IPNS into the Fertiliser Policy have set a new framework. The recognition and promotion of partnership between public and private organisations in agricultural development under various policy documents has set the stage for new institutional collaboration. Community forestry has strengthened the confidence in local management mechanisms. These changes were essential for creating a supportive environment. They coincided and were partly a response to a growing strength of civil society actors in the country. The gradual implementation and internalisation of such changes, however, does require continuous efforts and sometimes struggle. ■

The paper summarises the work and experiences of many persons and organisations. For further information please contact: STSS, Department of Agriculture, Harihar Bhawan, Lalitpur, Nepal; or PSU, SSMP, GPO Box 688, Kathmandu, Nepal. Email: psussmp@wlink.com.np.

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