6 TAKING SUSTAINABLE SOIL MANAGEMENT TO SCALE – Experiences with Practices, Methods, Approaches, and Policies for Nepalese Hillsides

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Abstract

The promotion of sustainable soil management (SSM) implies the exploration of technical interventions and social processes. The former includes combinations of indigenous and new knowledge and practices, the latter refers to methods of promotion, approaches in working with farming communities, and policy-level support. Both have implications for gender, social, and economic equity. This chapter describes experiences in SSM promotion by government and non-government organisations in Nepal over the past four years. Emphasis is given to the following: (1) a national competitive grant system for innovation; (2) a system of decentralised demand-led farmer-to-farmer diffusion for scaling up at the local level; (3) joint efforts between farmers, researchers, and extension staff for technology innovation from an open 'basket of knowledge'; (4) farmer leadership in the overall innovation and diffusion process that is cost efficient and effective; and (5) open linkages and feedback with the policy level to ensure a supportive environment. Gender, social, and economic equity are cross-cutting themes at all levels.

Experiences with the promotion of SSM in Nepal indicate that neither technologies nor processes for SSM extension are based on a straightforward scaling up of research results. It is rather the diversity of inputs from research, extension, policy level, and farmers, that induce changes in SSM at the farm and higher levels. In the case of SSM in Nepal, almost no researched practice has been scaled up as originally designed. However, intended and unintended information from research have provided vital input into a 'basket of knowledge' and many bits and pieces of these research inputs have gone to scale.

Introduction

Soil is the primary resource base for agricultural production. Farmers in the hills of Nepal are well aware of this and have developed elaborate indigenous methods of soil conservation and soil fertility management (Tamang et al. 1993). Integrated crop-livestock systems are common across the hills with substantial nutrient transfers

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between grazing, forest, and agricultural land. Ecological, economic, and social conditions are highly diverse in the hills resulting in highly heterogeneous production conditions.

Traditional knowledge may not provide farmers with solutions to tackle new challenges that originate from recent intensification in agricultural land use and reduced access to biomass from common property land. New practices such as the application of inorganic fertilisers and the planting of nutrient-demanding crops, such as vegetables, are gradually spreading without thorough experiences of farmers on integrating these into their farming system. The degree and pace of change differ widely across the hills and different pathways of intensification emerge. These pathways largely depend on two main determinants: access to markets with use of external resources and access to local private or common property natural resources.

Background and Sources of Information

The SSMP started in 1999 with the objective of promoting the uptake of sustainable soil management (SSM) practices by women and men farmers in the hills of Nepal. The programme supports government and non-government actors in working with local communities in this effort.

The experiences of SSMP and its collaborators with practices, methods, and approaches for the promotion of SSM were analysed in 2002. The methods used for the assessment include

- external evaluation of projects by farmers from non-project areas;
- self-assessment of projects by farmers and organisations;
- topic-specific studies by external experts;
- analysis of experience through stakeholder workshops.

More than 600 farmers, staff from more than 40 organisations, independent experts, staff from the STSS under the Department of Agriculture, and staff from the PMU of SSMP contributed to this effort. This summary was prepared by the PMU and STSS based on the above-mentioned sources. References are cited where possible. However, as usual in extension projects, learning and subsequent adjustments have priority over documentation and the diversity and richness of the underlying processes remain largely undocumented.

Experiences with the Promotion of SSM

A word of caution first. Experiences are gained under specific circumstances and may differ accordingly. Additionally, a period of four years (1999-2002) is short, thus, we prefer to talk about a process of continuous learning rather than experiences. Experiences today may be overcome by new learning tomorrow. Nevertheless, we use the term ‘experiences’ in its wider meaning.

The promotion of SSM comprises a technical intervention and a social process, these are difficult to separate from each other. In spite of this, the following sections try to outline experiences related to technical, methodological, and approach matters separately.

Developing the approach

In 1999 SSMP encountered the challenge of a largely compartmentalised institutional environment. Linkages between actors in research and extension were weak and a large number of mostly district-level non-government organisations (NGOs) had emerged. Most of these local organisations came into existence after the establishment of multi-party democracy in 1990. They have largely focused on activities related to social mobilisation. The bigger NGOs tend to be managed by local elites and depend on external funding for their operations.

Competitive Grants

SSMP was designed as a competitive grant system so as to capitalise on the existing institutional diversity and related comparative advantages. This implied the involvement of government and non-government organisations (NGOs) in the process. Competitive grant systems have been used globally in many countries for funding research. The Hill Agricultural Research Project introduced such a system for financing agricultural research in Nepal in 1998 (Mathema 2003). SSMP could build on these experiences in research funding. However, the establishment of a competitive grant system for agricultural extension was new for Nepal and had to be built on limited international experiences (see AKIS 2000).

The overall management of the SSMP competitive grant system is similar to the one described for research by Mathema (2003). A total of 67 organisations (called collaborating institutions (CIs)) were supported in 2002. Among these, 15 were government organisations, 5 farmer associations, 29 local NGOs, 10 national NGOs, and 8 district-level farmer-to-farmer diffusion fund committees. The organisations implemented projects in 213 village areas of 10 mid-hill districts. A total of about 1,925 leader farmers (LFs) and 18,700 group farmers (GFs) were involved (Figure 6.1).

So far, the experience with providing project support under a competitive grant system indicates the following.

- Collaboration based on confidence building and performance
  The government extension service can multiply its impact through technical advice and support to local NGOs. However, the development of a trusted collaboration between government organisations and NGOs in a district happened as a gradual process over three to four years. SSMP supported it through quarterly district-level reviews and planning workshops and special support to collaborative efforts. However, collaboration was not an enforced precondition for project support. Organisations had to gain and maintain their reputation.
- Comparative advantage of organisations
  National NGOs are best positioned to fulfil the administrative requirements of a competitive grant system. They are most experienced in writing proposals and most of them have professional staff for project management and implementation. Most

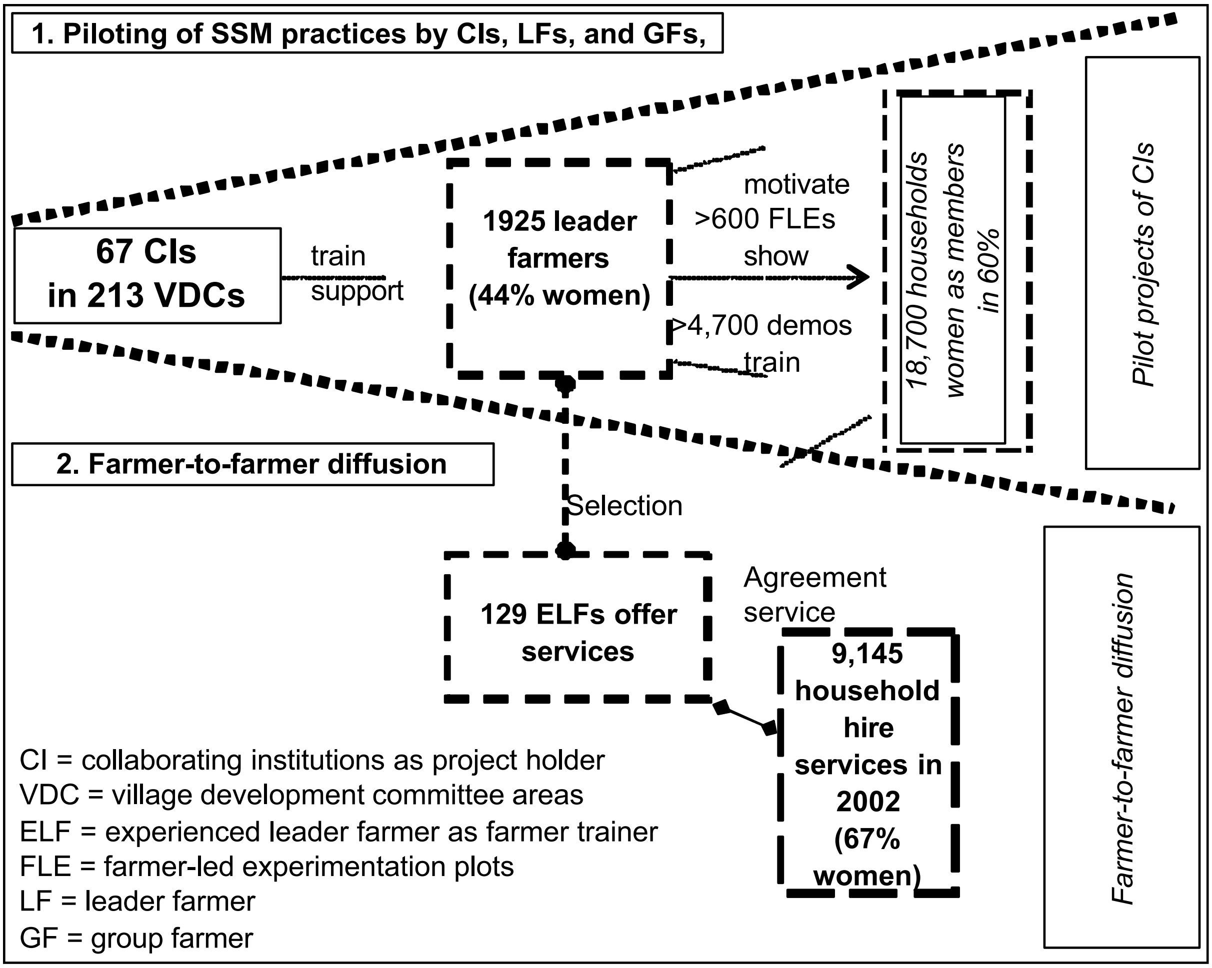

Figure 6.1: **The approach of SSM-testing and diffusion: CIs test and demonstrate new SSM practices with LFs and GFs in pilot areas.**

Once a technology has proven successful, the most 'experienced leader farmers' (ELFs) offer their services to GFs outside of the pilot area for wider farmer-to-farmer diffusion. The numbers indicate the support provided by SSMP in 2002.

of their staff are not locally recruited and senior staff take responsibility for proposal writing and reporting. Field observations indicate that farming communities often perceive projects implemented by national NGOs as external projects in spite of the commitment to participatory methods. Project implementation costs in terms of investment per attended farm family tend to be higher for national NGOs than for local NGOs and government organisations. SSMP's experiences indicate that national NGOs can best contribute to the promotion of SSM by providing technical and institution-building support to local-level organisations. The intensity of this support depends on the experience and maturity of the local-level organisations.

- Capacity building in local NGOs

  Local NGOs can be the most effective and cost-efficient implementers. This applies in particular to the local NGO that is well-rooted in the community and whose members have a farming background. However, a large number of local NGOs were created for the benefit of their members rather than for the benefit of the community. Therefore, a critical assessment of detailed institutional profiles of all organisations forms an important step before the project concept notes can be accepted by SSMP. Whereas local NGOs normally do not have trained staff, SSMP has developed training modules on technical and methodological aspects. The first year of project implementation by local NGOs is mostly a year of learning, experience building, and performance testing on a very limited scale. Government organisations can greatly contribute to this process through technical advice.

- Competition and collaboration
  Support to regular district-level workshops for all project implementers, including district-level authorities, has been an essential element for gradually developing concerted efforts in a district. At the same time, each organisation is free to prepare its own proposal and is accountable for its performance. Thus, SSMP supports organisations individually under a competitive grant system, while collaboration and concerted efforts increase the chances of the organisation to ensure continued support.

Institution-led pilot projects
The main purpose of these institution-led ‘pilot’ projects is to test and identify with farmers relevant innovations for SSM that contribute to better income and/or food production. The pilot projects are implemented in a well-defined and limited target area. Once such innovations have been identified (for example, vegetables with SSM, groundnut as a food and cash crop, urine as liquid fertiliser), the main challenge becomes the wider diffusion of these practices. In this case, the extension service needs to shift its attention from active promotion of the practice towards supporting suitable conditions for wider diffusion. This may imply support to marketing opportunities that attract farmers to adoption and the creation of an effective and low-cost diffusion service.

Farmer-to-farmer diffusion
SSMP is presently assessing if an approach of demand-driven farmer-to-farmer (FTF) diffusion can serve the purpose of a low-cost and effective diffusion system for SSM. Under FTF, the most experienced farmers from pilot project sites are identified and receive additional training to upgrade their communication and service skills. Subsequently, farmer groups in neighbouring areas can hire the service of these experienced leader farmers (ELFs) to learn about and implement the new SSM practice. An ELF is free to explain and show the SSM practice in the way they have adopted it on their own farm. Simple service agreements are signed between the group and the ELF. These can be presented to a district-level committee for funding support. The Department of Agriculture, district-level authorities, local NGOs, and farmers are members of the FTF committee. Funds are allocated on a competitive basis. Priority is given to the most needy communities. The involvement of SSMP is limited to the additional training of ELFs and to contributing to the district-level FTF fund.

More than 9,000 households have hired the service of ELFs in 2002, the second year of operation of FTF diffusion. First experiences indicate a high rate of adoption of the main practice (for example, vegetable production), while the SSM component behind the main practice (for example, better manure management under vegetables) may be less adopted (Table 6.1). This needs further observation and discussion with ELFs and demand farmer groups in 2003.

Table 6.1: **Comparison of adoption rates under different extension methods for vegetable and farmyard manure management**

Diffusion process	**Adoption rates (% farmers)** (preliminary data)	
	Better FYM	**Vegetables**
LF to GF approach *(GF adoption in pilot projects by CIs, after 3 years)*	42	46
FTF diffusion *(Adoption by demand farmer groups, after 2 years)*	36	>90

SSMP (unpublished) preliminary data based on field surveys in 2001 and 2002 in more than 5 districts involving more than 500 farmers FTF diffusion is used in areas adjacent to CI pilot projects

Investments

An analysis of the investments for diffusion indicates that the cost per GF household under the pilot projects implemented by CIs is approximately US$ 20-30/year. This is significantly lower than the average investment of about US$ 45-50/household in 20 development projects implemented by government organisations and NGOs in Nepal hill areas over the past decade (SAPROS 2001). The investment per supported farmer household under the FTF-diffusion is about US$ 3.5. Thus, FTF diffusion indicates an opportunity for effective low-cost extension. However, the demand for FTF diffusion will depend on the continuous availability of attractive innovations from the pilot projects and on marketing opportunities for the new practices.

Developing SSM practices

Farmers in the hills base their soil fertility management on organic matter management. An average of 3-10 t/ha of farmyard manure (FYM) is added every year to rain-fed crop land (Subedi et al. 1989). The amount varies depending on the number of livestock in the farm unit and the amount of fodder and bedding material accessible to the farm. The applied manure maintains soil organic matter levels at about 2-5%. Higher organic matter levels may prevail in the higher hill areas while organic matter levels tend to be around 1-2% in the low hills. Lower levels in the low hills are due to higher decomposition rates under more intensive land use and because of limited access to forest biomass for fodder or bedding material.

The use of inorganic fertilisers has increased over the last two decades, particularly in areas with good market access and with planting of cash crops like vegetables. No, or very limited, amounts of fertiliser are used in remote areas. However, since the gradual removal of subsidies for fertilisers over the past five years, farmers have tried to limit their investments in fertilisers by using urea instead of the more expensive diammonium phosphate (DAP). In addition, farmers have observed a decline in soil fertility under the continuous use of fertilisers. A common observation is, for example, that land fertilised with inorganic fertilisers becomes hard and difficult to plough (unpublished reports, CI of

SSMP). Therefore, there has been a high interest by farmers in organic soil amendments. Basically all projects supported by SSMP promote practices of organic matter management.

CIs experienced a much higher interest in SSM practices when these were combined with crops and agricultural enterprise activities which have market and income-generating potential. This has resulted in substantial changes in the projects presented to SSMP over the last four years. The proportion of projects integrating SSM with income-generating activities has increased from about 25% in 1999 to more than 75% in 2002. Vegetable production, fruit trees, coffee, ginger, fodder for dairy, and other income-generating commodities have become integral components of most projects. SSMP supported these changes by actively encouraging CIs to analyse experiences with farmers and by offering the opportunity to change project activities on an annual basis. Flexibility by SSMP to adjust projects on an annual basis has been an essential element for supporting these changes.

Sources and pathways of identifying SSM practices

Farmers' interest in new SSM practices varies by gender, social belonging, economic status, and access to resources. For example, men tend to be more interested in cash crops than women, who often lack control over the income from such commodities. Methodologies to address these issues and their implications for the selection of SSM practices are discussed in the section below on developing methods.

The sources and pathways for technical innovations varied widely and included the following.

- Enrichment of local innovation*:* learning and experimentation with farmers on local resource management
- Stakeholder design of external innovations: design of a new technology through a working group from research, extension, and policy level and subsequent testing with farmers
- Demand-based transfer of innovations: training, demonstration, and farmer-led experimentation in response to market demand

Examples of identified innovations are described in Table 6.2.

The combination of new and local knowledge is common to all three although the first originates in farmers' knowledge while the second originates in research. Farmer-led experimentation for local adaptations is an essential step in all three (see next section).

Innovation in FYM management

The introduction of improved FYM management is an example for learning and experimentation with farmers on more efficient local resource management (Figure 6.2). Previous research had developed recommendations for improved manure management which included the following main elements: digging a pit; covering with a roof against rain and sun; and turning 2-3 times for better decomposition. Promotion of this practice

Table 6.2: **Experiences with SSM practices of SSMP collaborating institutions**

SSM Practice Adopted by Farmers	Contribution from Research / Research needs	Experiences at Farm Level of Farmers and CIs	Driving Force for the Diffusion of Practice	Experiences with Equity Implications
FYM management Simple piling, plastic sheet cover, urine collection About 42% adoption	Data on nutrient content and flows (fodder, manure ...) Trials on combined use of organic and inorganic fertiliser *Research needs* *Urine as liquid fertiliser* *Urine plus plant extracts for pest control*	Less use of inorganic fertiliser (urine replaces urea) Combination of organic and inorganic with use of inorganic for top-dressing Higher crop production from quality manure	Removal of subsidy on fertilisers Soil fertility decline and more work to plough land after fertiliser use Adoption of crops responsive to increased nutrient supply Stall feeding with urine availability	Local inputs available to farmers without access to markets and fertilisers More workload, mostly for women Less cash for external inputs (implications depend on family) Not for poor farmers without livestock
IPNS Cropping system based over 1 year Nutrient balance estimate for organic matter and main nutrients Includes overall crop and field assessment	IPNS trials by research Data on soil dynamics, nutrient flows, and losses Trials on use of organic and inorganic fertilisers *Research needs* *More data on soil dynamics (for example tillage effects, organic phosphorous, micronutrients)* *Nutrient flows in farming systems (forest crops ...)*	Basal nitrogen often not necessary as sufficient free nitrate in soil Top-dressing time and use of urine as top-dressing as key learning on nutrient management in first year Reduced rates of fertiliser with appropriate timing in external input systems	Increased factor productivity (mostly output per unit of local or external input, output per land area) Interest in combining efficiently local inputs (for example, FYM) with external input (fertiliser) Learning and experimentation on nutrient management	Access to resources (local and external), not their effective and efficient use, is the main constraint for landless or very poor households High interest and participation by women farmers, however, women IPNS groups may need to be formed in traditional societies
Vegetables and SSM Vegetables for food and as cash crop About 45% area increase per farm	Agronomic practice for vegetable production Trials on use of urine as liquid fertiliser Varieties of vegetable Pest and disease identification *Research needs* *Organic pest management using local resources* *Local varieties*	Farmers' interest in easily marketable vegetables (for example, cauliflower, four season beans) Vegetable production stimulates farmers to invest in soil fertility management	Cash income from vegetables Reduced external input cost for vegetable production Improved soil fertility under vegetables plus SSM Better nutrition for family from vegetables	Better workload sharing among men and women in gender aware groups More workload but limited benefits in areas of dominance by men Poor household participation through land leasing

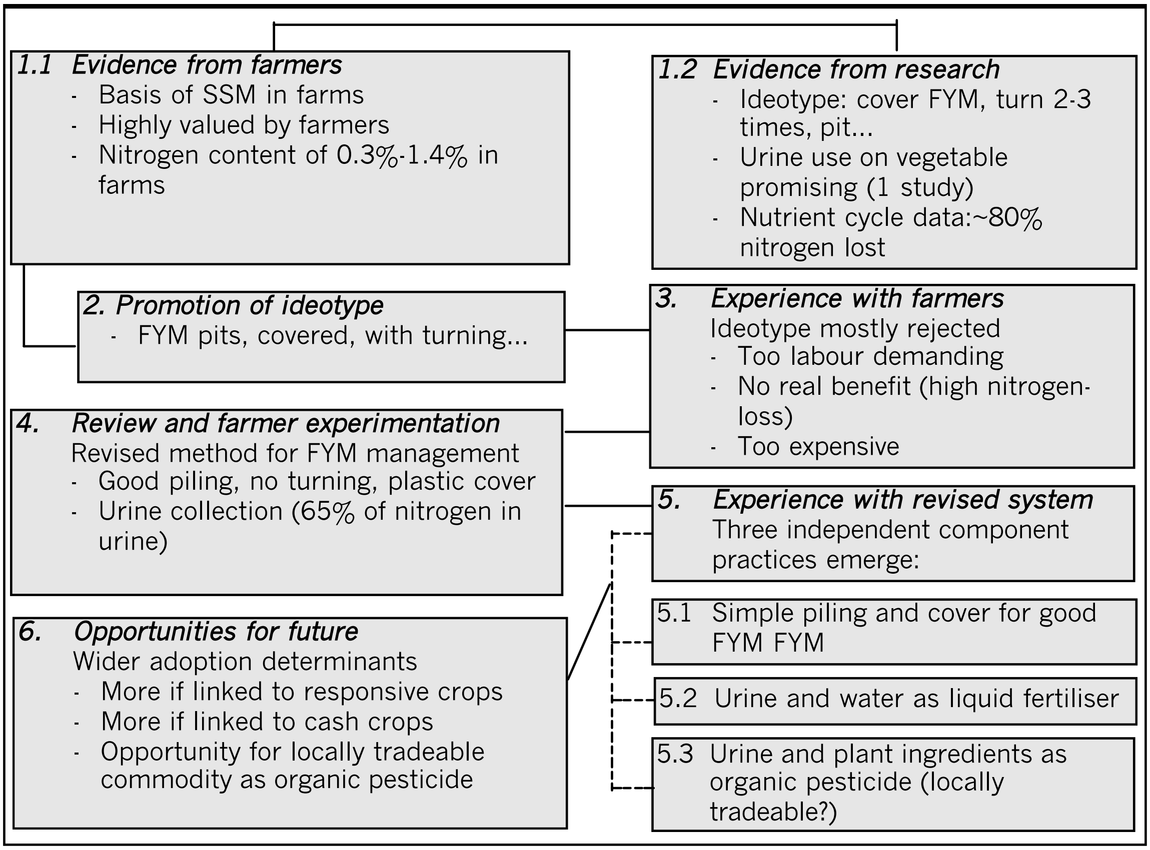

Figure 6.2: **The process of change of a local technology (example, manure management) through learning and adjustments with farmers (based on experiences of SSMP collaborating institutions, 1999-2002)**

in 1999 failed as farmers rejected it as being too labour demanding and not resulting in improved crop production. Further literature reviews, field observations, and discussions with farmers resulted in a revised system: simple piling of manure, urine collection for nitrogen-preservation, covering with plastic sheets, no turning, and protection from run-off water. This was taken back to farmers with special emphasis on the fact that about 65% of the excreted nitrogen is in urine not in the dung. Farmers tested this in 2000-2001 and experimented with the manure management and with the use of urine as a liquid fertiliser. Three component technologies are emerging: (1) a simple method of manure preparation (piling, plastic cover, no turning), (2) urine collection and use as liquid fertiliser, and (3) use of urine combined with various plant ingredients for the preparation of organic pesticides as well as fertiliser. The latter may have the chance to become a locally tradeable commodity (Ojha et al. 2002a).

Integrated plant nutrient management

The introduction of an Integrated Plant Nutrient Management System (IPNS) developed along another pathway. Various researchers under the National Agricultural Research Council, Nepal (NARC), together with international collaborators, implemented trials on IPNS or related topics over the past years (Pilbeam et al. 1998; Gardner et al. 2000; Maskey 2000; Tripathi et al. 2001). The Ministry of Agriculture and Co-operatives and the Department of Agriculture committed themselves to the introduction of IPNS in extension. Therefore, a working group on IPNS was formed among all actors to summarise the available information and to develop a common concept for IPNS. The wide range of different experiences and the pulling together of information and expertise from different sources were the basics for developing a practical concept of IPNS for extension. Trials, for example on the combined use of organic and inorganic fertilisers (Bhattarai et al. 2000; Tripathi et al. 2001), provided essential data for IPNS but were not the basis for taking IPNS from research to extension. A major technical challenge for the design of IPNS for Nepal hill farming systems was the predominant role of organic matter management in hill farming. Most IPNS work in other countries had focused on the appropriate use of inorganic fertilisers while giving less importance to organic matter dynamics in soils (Dobermann and Fairhurst 2000). Research and extension experiences with organic matter management in African farming systems provided relevant input for the design of IPNS for Nepal (for example, Swift and Palmer 1995; Scoones 2001).

Vegetables and SSM

Vegetables are highly valued by farmers because of their utility as food and as cash crops. Over the past decade, vegetable production has rapidly spread in areas with good market access. Farmers from other areas observed this and demanded training and demonstration of vegetable production under SSMP-supported projects. However, field observations indicate that fertiliser and pesticide use are widespread under intensive vegetable production without proper knowledge about their judicious use. This raised the concern that the planting of highly nutrient-demanding crops, such as vegetables, may actually cause a decline in soil fertility and may not be sustainable. The combination of vegetable production with SSM practices was therefore considered an essential element of SSMP-supported projects. A study in three field sites, where vegetable production had been combined with SSM practices for the last three years, indicated that the planting of vegetables had indeed stimulated farmers to increase their investment in soil fertility maintenance. Vegetable-producing farmers had increased the application of manure in the vegetable fields, increased fodder planting for more manure production, and invested more in inorganic fertilisers, including DAP (Table 6.3).

Lessons learned about SSM practices

The lessons that emerged from these experiences are described below.

- New knowledge to enrich local resource management
  Practices perceived by research and extension as a single technology may be broken down by farmers into several component practices. New knowledge about practices (for example, the relatively higher proportion of nitrogen in urine against dung), not skill development, may be essential for farmers to initiate their own experimentation. This applies in particular to innovations in local resource management.
- Reporting research results
  Research trials may provide information that is not expected or is not part of the intended outcome. Such information may still be highly relevant for extension purposes. For example, a large number of research trials on erosion control were planned and financed on the assumption that erosion is a major problem. Many of

Table 6.3: **Effects of the integration of vegetables and SSM on soil and farm systems**		
Characteristic	**Vegetable Grower Plots**	**Non-vegetable Grower Plots**
Fertilisation *per year*		
- Manure (t/ha)	31	14
- Urea (kg/ha)	74	38
- DAP (kg/ha)	66	20
***Soil* analysis**		
- Soil organic matter %	2.2	2.1
- Soil phosphorous kg/ha	41	28
- Soil pH	6.6	6.4
***Fodder* production**		
% change, private land	+ 50	+ 20
Crop yield (% change/ha)		
- Maize yield	+36	-
- Millet yield (maize shade)	-2	-
- Cauliflower (more disease)	-16	-
Data for 20 farms in Parbat. Fields close to farmhouse with 2-5 years vegetable production (Ojha et al. 2002b)		

these trials indicated that erosion is rarely a major problem in farmers' mostly terraced fields. However, such information does not get widely distributed and many researchers as well as extension staff remain reluctant for a paradigm shift from erosion control to soil fertility management.

- Technologies and knowledge for complex farming systems

  The expectation that research needs to develop new technologies may not apply if the challenge is to improve complex crop-livestock-forest farming systems. Research on such systems tends to be highly site specific. Thus, trial results cannot be extrapolated. Therefore, quantitative information on resource flows in these systems, not technologies, is important for extension. This, however, is only valid if close research-extension linkages ensure that the information derived from research is translated into practically relevant extension knowledge. This is the main challenge for further development and local adaptation of integrated resource management practices, such as IPNS.
- Markets and sustainable farming

  Market access provides a strong incentive to farmers to adopt new practices. It is essential early on to combine the promotion of these practices with sustainable resource management. However, most research on market-oriented crops is based on high external input management.

Developing methods for SSM extension

Methods for testing new ideas together with farmers, for increased farmer involvement in extension, and for interactive learning have been documented widely (for example, Bunch 1996; Holt-Gimenez 1996). Methods have shifted from message delivery from research-to-extension towards methods of interactive learning. Research is no longer perceived as the only authorised source of extension content and processes of multi-source enrichment are recognised. These conceptual changes went along with innovations in participatory methods such as farmer-led experimentation and farmer-field schools. Some of these innovations have been implemented in Nepal over the last decade, although often at a limited pilot scale. NGOs have often taken the lead but, in several cases, government organisations were also major actors in innovation (for example, Scheuermeier 1988; Chand and Gibbon 1990; Pandit 1996).

The challenge for SSMP was to test relevant methods accessible to its partner organisations and to promote their adaptation and use. This was initially done in collaboration with more experienced national organisations that subsequently shared their knowledge with other partner organisations of SSMP. However, some local NGOs and some district-level government offices turned out to be more dynamic and innovative in testing new methods with farmers than some of the national organisations. Therefore, SSMP promotes increasingly a working group approach for exploring new methods. The working groups may include members from national and local organisations and government and non-government actors.

Sources and pathways for identifying methods

The source and pathways for innovations in methods are more difficult to trace than those for technical innovations. Examples of identifying innovations are described in Table 6.4. They respond to the following requirements.

- Methods for local innovation at field level
  Need for local testing and adaptation of SSM practices by farmers in highly complex farming systems and heterogeneous environments (for example, farmer-led experimentation)
- Methods for knowledge enrichment
  Need for knowledge sharing with farmers in order to enhance the decision capacity of farmers combining indigenous and new knowledge (for example, farmer-field schools)
- Methods for participatory planning and evaluation
  Well-targeted and learning-oriented projects through a stronger involvement of farmers in the planning and assessment of projects (for example participatory project evaluation)
- Methods to assess equity implications of technical change
  Need to critically analyse the implications of project activities on gender and social equity and to design appropriate actions

The first two method needs mentioned above respond to interests expressed by farmers and the implementing partner organisations. The latter two are requirements that are all too easily overlooked by leaders in organisations and in communities. Thus, SSMP is gradually enforcing these as prerequisites for project support.

Training and demonstrations

Different methods of training are widely used for knowledge and skill transfer. They are efficient in informing farmers and in developing specific skills (for example, nursery establishment, citrus die-back control). Practical demonstrations of new SSM practices are used by most organisations although the main actors for demonstrations are not staff but LFs in coordination with their groups. LFs implemented more than 4700

Table 6.4: **Experiences by collaborating institutions (CIs) of SSMP with methods of SSM promotion**

Method and Use	Source of Information	Experience at Field Level of Farmers and CIs	Driving Force for Utilisation of Method	Experiences with Equity Implications
Farmer-led experimentation Testing of new SSM practices About 30 CIs use farmer-led experimentation with more than 600 farmer-led experimentation plots in 2002	On-farm research and participatory variety selection (for example LI-BIRD) Working group on farmer-led experimentation *Future needs* *Link with research stations to enrich experimentation*	Highly stimulating for farmers Integration of new SSM practices into local systems Data recording and documentation weak	Lack of research on local system improvements Farmers' interest in testing innovations	Farmers with more land and resources tend to be leaders in experimentation Risk of not sufficiently including indigenous knowledge or women
Participatory planning, monitoring, and evaluation Increase GF involvement in project planning Project evaluations by farmers 20% CIs apply in 2002	Development organisations (PDDP, community forestry projects, ...) *Future needs* *Simple economic evaluation criteria and methods* *Stronger role of poor households in participatory planning, monitoring, and evaluation*	Limited commitment of organisations to prepare proposals based on participatory planning, monitoring, and evaluation Group processes often not sufficiently sensitive for intra-group equity	Interest of genuine local NGOs and farmer organisations to involve farmers in participatory planning, monitoring, and evaluation Increased chances for project approval if based on farmers' demand Support to local cooperative formation	Local elite tend to dominate the process Separate planning sessions with women farmers essential in traditional societies Very poor households have different livelihood base
Gender implications of SSM practices Assessment of implications of adoption on women and men Identification of actions for better sharing About 13 practices characterised	Research by University of East Anglia and others Working group of CI *Future needs* *Characterise technologies for gender implications* *Extend to social equity*	Relevant for farmers if concrete actions defined (seed thresher to reduce women's workload, ...) Local restrictive or supportive actors need to be involved Local promoters needed for advocacy in district	Search for action-oriented gender work Local promoters essential to move process forward and to maintain stimulus Increased chances for project approval if equity concern addressed	Local adaptations needed depending on local gender relations
Farmer-field school Strong GF involvement Visual learning tools very useful (pH, nitrogen, ...) 30 farmer-field schools in 2002	IPM experiences in Nepal and elsewhere *Future needs* *Simple tools for nutrient balance estimates* *Development of integrated crop management*	Nutrient balance calculations difficult One learning plot and individual plots for testing in each farm Combination with farmer-led experimentation very effective for learning	Regular and integrated learning approach on SSM easy to implement High interest by farmers in regular social gathering with learning and experimentation	Very poor households prefer to work for earning income instead of attending farmer-field schools

demonstration plots in 2002. Practical demonstration remains a simple method for creating awareness and teaching about a practice or method.

Farmer-led experimentation

Farmer-led experimentation was new to most organisations in 1999. However, based on experiences in Nepal (Staphit et al. 1996; Gautam et al. 2002) and elsewhere (Holt-Gimenez 1996; Ashby et al. 2000; Reij and Waters-Bayer 2001), a working group of five national and local NGOs developed a method of farmer-led experimentation for Nepal. This included the initial design of a step-wise implementation process, its field testing over two seasons, and the documentation of experiences in a field guide (Sharma and Bajracharya 2002). More than 30 organisations have adopted farmer-led experimentation in 2002 and more than 600 experimental plots were implemented by farmers.

Farmer-led experimentation has greatly enriched the process of innovation for SSM. It has enabled the organisations to shift project activities from demonstration and training of recommended practices towards a design of innovations with farmers. As planning of experiments is done with farmer groups, it has also diversified the range of SSM practices tested and promoted under SSMP-supported projects.

The recording of information from farmers' experiments remains weak. We presently consider the sharing of information among local farmers and groups more important than the formal recording of experiences. The involvement of researchers in the design and evaluation of farmers' experiments has been limited. However, farmers and the supporting organisations recognise increasingly that involvement of researchers can enrich the ideas for experimentation. Recent changes in the research system, like actively seeking partnership with NGOs and giving more independence to regional research stations, are supportive to local partnerships for innovation.

Participatory planning, monitoring and evaluation

Although GFs are involved in training, demonstrations, and farmer-led experimentation, their role often remains limited. Therefore, participatory planning, monitoring, and evaluation methods, have been promoted over the past three years to ensure that projects are more clearly based on GFs' priorities. Experiences in Nepal (Hamilton et al. 2000; Participatory District Development Programme (PPDP) personal communications and field observations) and elsewhere (Gohl and Germann 1996; Obando et al. 2001) were again instrumental inputs for designing methods for SSM promotion in Nepal. An important innovation has been the evaluation of all three-year projects by farmers. This implies that a team of evaluating farmers external to the project area, visits a project site and assesses with the resident farmers the activities and impacts of the ongoing project in the area (Dhital and Dhakal 2002). About 40 projects have been evaluated using this method in 2001 and 2002. Experiences indicate that the outcomes from farmers' evaluations are more critical than evaluations done by the organisations. Farmers' evaluations (or, in more general terms, evaluations by beneficiaries or clients) can be powerful tools to assess project performance in competitive grant systems. A challenge remains in the documentation of evaluations by farmers, as they do not conceptualise their findings in the way trained research, extension, and development staff do.

Gender implication assessments

Women farmers contribute greatly to farming and soil management in the hills of Nepal and have substantial indigenous knowledge. A wide range of projects and institutions in Nepal have promoted awareness of gender disparities and have contributed to women's empowerment although a lot remains to be done in changing attitudes, policies, and social relations. The main challenge for SSMP is how to support partner institutions to integrate issues of gender equity into technical projects. Discussions with staff of CIs and with women farmers indicated a desire for concrete change rather than further efforts through gender awareness campaigns. Literature on methods and tools for gender equity did not offer what staff and farmers requested, although it enriched their ideas on how to tackle the issue.

Most enriching were the discussions of a working group of dedicated field staff from various partner organisations, experiences from other countries, and direct interactions with experts working in other social environments (Zweifel 1998; Locke and Okali 1999). The implications of technical change in SSM on gender equity were identified as a major objective to address. When women and men farmers have knowledge about these implications, they can discuss the sharing of workload and benefits, before adopting or not adopting new practices. The development of a method to address this issue was done through action research at the field level. The main outcome is a method to analyse gender implications of SSM practices together with farmers. These discussions contributed to the identification of concrete actions to improve equity in workload and benefits (Shakya et al. 2002). An example of one of the outputs from an analysis of the implications of vegetable integration into the farming system is outlined in Table 6.5. The introduction of organic pest management practices, men's commitment to contribute more time to vegetable cropping, and the initiation of a marketing cooperative are the main concrete actions that came from the analysis.

Table 6.5: **Results of an analysis of gender implications of vegetable production with women and men farmers**

Women farmers	Men farmers
Positive effects	
1. Income for household expenditure 2. Soil quality improved 3. Better schooling of children 4. Better nutrition and health	1. Land productivity increased 2. Income increased 3. More employment 4. Social status improved
Negative effects	
1. Workload increased 2. No leisure time left 3. Insect pest problems increased 4. Lack of market facilities	1. Lack of improved/quality seed 2. Insect pest problems increased 3. Could not get expected price of the product in the market

The information resulted from discussions on gender implications of SSM with farmers in Kavre district, based on various tools such as effect tree and priority setting (Bajracharya 2002)

Farmer-field schools

Since 2001, farmer-field schools on IPNS have been set up, based on the experiences with integrated pest management (IPM) under the Department of Agriculture and collaborators in Nepal and elsewhere. However, adjustments had to be made from experiences in IPM to meet the needs of IPNS. For example, SSM needs to be planned over an entire cropping cycle, at least one year, while IPM is crop specific for one season. Pest incidence and severity may change over a few days requiring weekly group meetings, while changes in soil nutrient status may only be observed over a period of 2-4 weeks. A prerequisite for the implementation of IPNS farmer field schools was the availability of simple tools that visualise soil dynamics. Nitrate strips, pH paper, hydrogen peroxide, and other tools (Subedi et al. 2000) were found very useful. Most of these tools were not derived from research but from extension organisations in other countries. Research has in the meantime started to calibrate these tools and to develop new tools. Another innovation used in IPNS farmer-field schools is the combination of farmer-field schools with farmer-led experimentation, also reported elsewhere (Braun et al. 2000).

Partner organisations of SSMP are free to use their own methods for working with farming communities, as long as these methods meet the principles of farmer participation, gender equity, and the combined use of indigenous and new knowledge. Additionally, SSMP supported the development of training modules and manuals on these methods, while respecting the independence of each organisation in its process of implementation. This has resulted in a diversity of methods used by government and non-government, and national and local organisations. It is an ongoing process that further enriches experiences.

Lessons learned on methods for SSM extension

Below are the lessons that emerge from these experiences.

- Diversity of organisations
  A range of methods can be used depending on the objective and circumstances. The diversity of local and national and government and non-government organisations working with SSMP has enriched the overall learning. Action research on methods through working groups composed of different organisations has been particularly productive.
- Participation and effective delivery
  Farmers' patience, in particular women farmers' patience, with lengthy participatory processes is limited when farmers have clearly identified their need. In such cases, concrete action is more important, such as training on skills (for example how to make a coffee nursery), demonstration plots (for example, management of cauliflower), or simple farmer-led experiments (for example, women workload reduction with a seed thresher).
- Technical research on methods
  Technical research mostly intends to develop the content of extension messages, while social research looks at methods of extension. However, technical researchers (for example, soil scientists) can greatly contribute to enrich extension methods. For example, the development and calibration of simple tools to visualise soil processes

and to measure soil processes at the field level are essential for interactive learning in farmer field schools (for example, nitrate strips to measure soil nitrate and to define the need for nitrogen application; see also Stocking 2003). The demonstration of soil analysis in a laboratory is of little use to farmers if they have no access to simple tools to measure their own soils.

- Decision support
  Methods of interactive learning and tools to assess problems (for example, pH paper to measure soil acidity) are of little use if they are not combined with methods of decision support for concrete action. Farmer-led experimentation has been identified as an excellent method for testing or adapting new practices. However, simple decision support tools to identify relevant options for experimentation are lacking. Institutional responsibilities need to be clarified. Who is responsible for compiling knowledge across disciplines into a simple decision support tool (for example, vegetable management including soil, pests, and varieties)? Who updates such knowledge (for example, translates new results from a manure experiment into the decision support tool)? How can we avoid decision support tools being misused for external planning and decision-making?
- Scaling up is not a linear process
  Pressure on research institutions and projects for scaling up results is intended to increase impact. However, this greatly ignores the way innovations happen at field level and how research results are used. In the case of SSM, a wide range of sources contributed to the identification of innovations in technologies and methods for SSM. Bits and pieces of information and experiences have been scaled up, but not a single SSM technology has been scaled up as originally designed.
- Equity implications of technical change
  Technical researchers can contribute as much as social researchers to social change. An example is the characterisation of implications of technical change on gender equity and the identification of opportunities for change.
- Poverty orientation in agricultural projects
  SSM primarily benefits those who have land. Landless households and wage labour with very small landholdings may barely benefit directly from such programmes. The analysis of SSM projects over the past four years confirms this. Therefore, a new initiative was started in 2002 to develop a specific line of project activities that explicitly target the very poor households. This implies a much broader look at livelihoods in these households, including their direct or indirect relationships to SSM. A working group has started action research on how best to address this challenge.

Developments in the policy environment

Research in Nepal over the past years has indicated that soil fertility can best be maintained if inorganic fertilisers are combined with organic fertilisers (Bhattaria et al. 2000; Tripathi et al. 2001). At the same time farmers indicated that the use of inorganic fertilisers had resulted in a decline of inherent soil fertility and an increased workload to plough the harder soil (Maskey et al. 2000). The successful promotion of improved manure management as part of SSM indicated opportunities for better soil fertility management through changes in local resource management. Positive experiences with farmer-field schools in IPM and the development of farmer-field schools on IPNS outlined a technical and method concept for better fertility management of agricultural soils in Nepal.

The review of these research and extension experiences and the joint efforts by a working group for developing IPNS provided baseline information for a revised 'Fertiliser' Policy. It recognises organic amendments as fertilisers, defines IPNS and farmer-field schools as essential elements for fertility management in the country, and includes NGOs as actors in the promotion of better fertility management.

Experiences with competitive grant systems for research (Mathema 2003) and extension (SSMP) have stimulated the government to establish a National Agricultural Research and Development Fund (NARDF). The fund is open to government organisations and NGOs and recognises the diversity of actors in agricultural development. SSMP intends to gradually hand over the management of competitive grants for SSM to NARDF while concentrating increasingly on capacity building for district-level government organisations and NGOs to compete for funds from NARDF.

His Majesty's Government of Nepal intends to gradually decentralise planning, decision-making, and management of its agricultural extension system. To be effective, a concerted effort needs to be made among government organisations and NGOs at the district level. Therefore, the national competitive grant system for innovative pilot projects needs to be combined with decentralised, district-level planning. SSMP supports a process whereby organisations compete under a national grant system for innovative pilot projects, while a competitive district-level fund supports the broad extension of proven practices through FTF diffusion. The elements are in place, but further testing and learning is essential to create an effective system.

Conclusions and Challenges

SSMP was established with an explicit mandate for the extension of SSM. This was based on the assumption that technology on improved soil management is available and that this technology needs to be promoted. The assumption proved to be wrong in the sense that few SSM practices could be taken from the 'shelves of research'. The assumption proved to be right in the sense that research and extension had accumulated considerable experience on soil fertility management and methods of technology diffusion. Thus, the major challenge for SSMP was to capitalise on available information, build on institutional expertise, and involve farmers in the design and testing of SSM practices appropriate for local farming systems.

Based on the experiences over the last four years, we can conclude the following.

- Scaling up into a basket of knowledge.
  Scaling up of research results on SSM is not a straightforward process in hill farming systems. It is often not the technology developed by research that enters

the diffusion process, rather the following are scaled up: bits and pieces of information that contribute to improve local farming systems; simple tools for local measurement; rules of thumb that support decision-making; and ideas for new components in the system. For example, farmers started to experiment with improved manure management when they knew that about 65% of the nitrogen is in urine, that the organic matter quality of soil and manure can roughly be measured with hydrogen peroxide, that a cup of urine is about equal to the application of about 2-3 kg urea, and that urine can be enriched by fermenting it with certain plants. In the case of new crops and varieties, farmers prefer to have a range of options to be tested under local conditions. Research results and experiences from extension organisations contribute to enriching a 'basket of knowledge' for SSM. Current investments by research on testing location-specific adaptation and on targeting of specific technologies may better be allocated to an enrichment of local innovation by farmers in close collaboration with extension services and development organisations. This can best be achieved, when decision-making and accountability in research and extension organisations are sufficiently decentralised to promote local joint action.

- Competitive grant for innovation in extension.
  The establishment of a competitive grant open to government extension and non-government development organisations can contribute to local innovation in extension. As mentioned above, this is particularly important in heterogeneous hill farming systems. The involvement of local development organisations and district-level government agencies has been particularly important for SSMP. Although these organisations needed most support for developing their capacity on SSM, proposal writing, and project management, they are emerging as effective and cost-efficient implementers. Collaboration among organisations at the district level can best be developed through gradual trust building and performance-based recognition.
- Local fund for demand-driven diffusion
  Innovation in pilot projects results in locally proven new SSM practices. The wider diffusion of these practices can be managed under a locally-managed fund that supports farmer-to-farmer diffusion. The latter should be demand driven with complementary efforts to create and improve reliable access to markets.
- Equity in technical change
  The implications of technical change on gender, social, and economic equity often become visible only years after their introduction. Families and communities may therefore be confronted with 'unexpected' change in equity. The analysis of gender implications of technical change in SSM has proven a useful tool to stimulate men and women to consider carefully the implications of adopting a new technology. Such discussions need to become an integral part of introducing new practices into farming communities. Additionally, we call on technical researchers to participate in such an analysis with farming communities and to contribute ideas to overcome equity constraints.

In summary, we confirm that research on natural resources management has an important role in contributing to innovations in technologies, methods, and approaches.

The integration of research results into the continuous development of farming systems remains a challenge. It needs to be done through an open interface between research, extension, and farmers.

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