National Workshop on Sustainable Soil Management Program

(Workshop Report)

Organized by :

Soil Management Directorate
&
Programme Management Unit (SSMP)

Held in Kathmandu, 8th June 2007

Report editors:

S.N. Mandal, S.S. Ghimire, K.H. Maskey,
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Background

Nepal is an agricultural country and soil is one of the important non-renewable natural resources of the country. It is a medium to support plant growth which provides food, fuel and fibre for human existence. People have exploited soil for the betterment of their livelihood from time immemorial. Early days before the introduction of chemical fertilizer when the population was low the agricultural system was sustainable. Foods demand of population created more and more pressure on soil resources without taking much care of it resulting the fertility declining of the soil. The wide gap between the removal of plant nutrients by the crops grown and their replenishment through various sources in this system in Nepalese agriculture always suffer chronic nutrients deficit.

Now plant caring capacity of soil is at a critical stage and sustainable soil management at friendly environmental ground become a major concern in agricultural development. The whole existing agricultural situation demands for a fresh look on the basis of multidimensional approaches like: locally available organic means, assessable inorganic means and microbial means of soil fertilization with a suitable crop rotation scheme. The situation formed the back ground to Integrated Plant Nutrient System (IPNS) in the field of Sustainable Soil Management. Treating the apparent negative trends as indications of soil fertility decline IPNS work on the identification and understanding of the factor contributing to them.

The Program Management Unit of Sustainable Soil Management Program (SSMP) is launching the "sustainable soil management program" since 1999. The Soil Management Directorate (SMD) is working as a partner institution of SSMP as Nepal Government representative. The program is being launched through both Government and Non-Government Organizations (GOs and NGOs) as a Collaborating Institutions (CIs) in the twelve mid-hill districts of the country. Involvement of GOs and NGOs as a partner in development work has been found to be quite effective, because of which Nepal Government/N has already approved to involve NGOs in Nepal Government funded development works in policy level. Because of different organizational set up, administrative and financial mechanism, both GOs and NGOs have strong and weak points in their working pattern. Therefore, a national level workshop involving representatives of CIs, SSMP, SMD, and DOA was felt necessary for strong coordination between different stakeholders for reviewing ongoing programs and future planning and implementation of the sustainable soil management programs.

Theme: Improving Soil Fertility and Productivity for Increased Food Production, Food Security and Farm Income was the main theme of the workshop.

The sustainable soil management program (SSMP) started in 1999 and is implemented in selected hill districts. It promotes sustainable soil management techniques for bari dominated mid hill farming systems. Sustainable soil management program now is launched in 12 districts with technical and financial support of governmental and non governmental organizations. In this context, in a fiscal year 2063/64, a national workshop on sustainable soil management is planned with selected below mentioned objectives.

Objectives:-

- To provide a forum for assessing the current fertility status of Nepalese soils and their management criteria.
- To explore and institutionalize sustainable soil management activities in the government system.

Workshop Schedule

Name of Workshop: National Workshop on Sustainable Soil Management
Organizer: SMD, Hariharbhawan / SSMP Bakhundole
Date: 25 Jestha 2064 (8^{th} June 2007)
Time: 10:00 am to 5:00 pm
Venue: Meeting hall of Agri-business promotion and market development directorate, Hariharbhawan

Time	**Activities**
10:00-10:30	Registration of the participants
	Inaugural Session (1st Session)
10:30-11:00	- Arrival and seats taken - Chair Person Dr.D.B.Swar,DG,DOA - Chief Guest, Mr.S.K.Varma, Joint Secretary, MOAC - Workshop Inauguration by Chief Guest - Welcome address with objectives of workshop-Mr.S.N Mandal - Address by Chief Guest - Inauguration remarks and closing address by chair person
11:00-11:15	Tea and Snacks
	Paper Presentation , Comments and Plenary Session (2^{nd} Session)
11:15-11:20	Chair person: Mr.Shankar Lal Chaudhary Commentator : Mr.Gopal Shrestha, Program Director, FDD
11:20-11:40	Paper I : DOA policies and position on sustainable soil management- Mr. Bharat Upadhayay , DDG, DOA
11:40-12:00	Paper II : Experiences on sustainable soil management practices in Nepal (current practices and potential for future).- Dr.K.B.Karki (NARC).
12:00-12:10	Discussion
12:10-12:20	Commentator Remarks
12:20-12:30	Closing of 2^{nd} session addressing by chair person
12:30-1:00	***Tiffin Break***
	3^{rd} seassion
1:00-1:05	Chairperson : Dr.H.Dahal, Joint Secretary, MoAC Commentator : Mr. Shankar B Pradhan
1:05-1:25	Paper III : Current soil fertility status of Nepalese soil and their management- Mr. SN Mandal, SMD
1:25-1:45	Paper IV : Experiences of SSM practices in farmers and regional level- Mr. T.B. Subedi, Soil Scientist, RSTL, Pokhara

1:45-2:05	Paper V : SSMP-Out scaling the successes-Dr.J uerg Merz (SSMP)
2:05-2:15	Discussion
2:15-2:20	Commentator Remarks
2:20-2:25	Chair person remarks and closing
	4th scassion (Group Exercise)
2:25-3:00	Chair person : Mr.Vijay Kumar Mallik, RD,CDR Commentator : Badri Bishal Karmacharya, DDG, DOA Group A - Prepared a list of sustainable soil management practices moving towards sustainability of Nepalese soils. - Developed a suggestion for action plan for working with SSM practices. Group B - Prepared a list of forces for and against the DOA moving to wards soil sustainability. - Developed a suggested action plan towards up scaling the SSM program.
3:00-3:10	Group A Presentaion
3:10-3:20	Group B Presentaion
3:20-3:30	Commentator Remarks
3:30-3:40	Closing remarks by chair person

Workshop programmes & participation

106 participants attended the workshop from different disciplines and institutions. Among them they were former soil scientists, extension officers from District Agriculture Development Offices, From SMD and RSTLS development workers from various NGO/INGO institutions, decision make's form MoAC & DOA, staffs from SSMP. Details of participants are given in appendix I.

The programme included one day of deliberation divided into 4 sessions. Five invited papers each from NARC, DOA, SMD, RSTL (Pokhara) and SSMP (PSU) were presented in the paper presentation, comments and plenary session of the workshop. Session 4th was completed in simultaneous discussion and presentation by 2 groups. The first group focused the discussion on the sustainable soil management practices moving towards sustainability of Nepalese soil, and the second group discussed on forces for and against the DOA moving to wards soil sustainability. Each of the two groups, headed by a convenor. The group convenors presented group reports to the plenary meeting which were further discussed and modified.

The invited papers are included in its original form in the technical chapter for their wider circulation, and the major inferences that emerged during workshop are documented in discussion and recommendation chapter.

Inaugural Session:

Joint Secretary Chief Guest of inaugurals session Mr. S.K.Varma opened the workshop with a welcome note to all participants. He stressed that the workshop fit into the perspective of Soil management role as a supportive for enhancing sustainable agriculture development programs. He also stressed the importance of discussion among GO and NGO to catch up the challenges, which arise when the project is finished. He addressed this workshop would be useful to minimize the complexity in lunching the program and find out the options for sustainability of the programme. He remarked some options like:

-vertical and horizontal scale up of the success activities

-project implementation process in future

-research and extension linkage

Dr. Deep Bahadur Swar (DG, DOA), Chairman of inaugural session, stated the importance of sustainable soil management activities under the umbrella of integrated crop management (ICM) and also focussed on the relation between the agricultural production and environment protection as part of sustainable soil management aspect. He also advised to implement of success sustainable soil management activities in regular program.

Acting Chief soil scientist of SMD, Mr. Satya Narayan Mandal delivered the welcome speech to all of the representatives of the workshop. During his speech he stressed that the workshop fit into the perspective of SMD and SSMP role as a facilitator for enhancing development programs in sustainable soil management. He address that this workshop will deliver the success activities of soil management and request for feedback for sustainability of the program in future.

In the technical session 5 scientists were presented the technical paper as follows.

S.N.	Name	Organization	Presentation
1.	Mr. Bharat Upadhayay	DDG, DOA	DOA policies and position on sustainable soil management
2.	.-Dr.K.B.Karki	Senior Soil Scientist NARC	Experiences on sustainable soil management practices in Nepal (current practices and potential for future)
3.	Mr. SN Mandal,	Chief Soil Scientist SMD	Current soil fertility status of Nepalese soil and their management-
4.	. T.B. Subedi,	Soil Scientist, RSTL, Pokhara	Experiences of SSM practices in farmers and regional level- Mr
5.	-Dr.J uerg Merz	(SSMP)	SSMP-Out scaling the successes

Technical Chapter Paper Presentation:

Mr.S.L.Chaudary and Dr.H.Dahal Chairpersons of technical session expressed their views and feeling towards participatory approaches of SSMP programme especially educational campaign and FYM/Compost Improvement activities and their satisfactory adaptation at farmers level. They also focussed their remarks on the sustainability of the Sustainable Soil Management Programs.

Compilation of the technical paper presentation:

Paper Presentation Session :

Paper-1:

DOA policies and position on sustainable soil management

Mr. Bharat Upadhayay .
DDG, DOA

Introduction:

Nepalese farmers still farming in a traditional way in some of hilly and remote areas, irrespective of great changes and available modern technology. Concerning food security the augmented food production to cope up with the need of increasing population is a great challenge for us. Many efforts were done in the past but nevertheless problems were solved. The productivity decline is be the neck of intensified agriculture mainly due to over mining & improper use of FYM/Compost, green manures (GM) & other local resources as recycling of organic wastes.

The main problem for implementing the agriculture projects. (Lack of proper coordination among the various organizations/institutions). The National level is APP formulated and the activities implemented at the district for efficient & better functioning. But due to lack of coordination & understanding the very theme or philosophy or the objective of APP is not fulfilled, because of the fact that grateful feelings that APP is for agriculture people or the authority involved in agriculture. Many Ministries are involved in it for achievement of common national goal and accountable for equal partnerships, in fact it is not happening so. To get the things done smoothly and efficiently, NGOs and CBOs or the better options to cope up the problem as essential. To overcome these problems, IPNS is one which plays an important role in helping the farmer's problems in curtailing the use of mineral fertilizers. Government logistic support is not enough to rectify the above problems. So, some alternative resource is needed to match the problems and SSMP is one, which is already in progress and has performed very well to go for the next phase. The program support unit of SSMP, keeping the present situation and sustainable production & productivity the soil testing has framed the sustainable soil management program and service section is exercising as partner institution of SSMP on behalf of GON. Now a day NGO & INGOs are working very effectively & meeting the targets of GON, where government interventions are not fully committed. Both NGO & GON are working very closely on common grounds & on common interest keeping in view of income generation, equity, gender issues, disadvantaged & marginal beneficiaries, employment opportunities & poverty reduction.

So at a national level SSMP, SMD & different representatives from DOA, MOAC & other have a good articulation among stakeholders for the on going programs & final implementation of SSMP. Sustainable Soil Management Program came as a pilot project with Helvetas support in 1999. Since then, two phases of the project have been undertaken, ending in 2007.

Present situation.

1. Other than SSMP districts (12), no districts have made SSM package program interventions significantly. If so, only in pieces (particularly compost making demonstration).
2. Even in SSMP districts, program concentration is in project sites.
3. Districts have not significant linked -up program of fertilizer recommendation and soil management with extensive soil testing.
4. Still, emphasis is on subsidized fertilizer transportation. Can't we think of diverting the present fund on this to promotion of SSM?
5. In the recent past, emphasis was on fertilizer management, rather on soil management.

Policies & Issues

Multidimensional approach will be taken in implementing these activities covering different partner's competitive groups. DOA is also excercising long-term extension strategic plans. Different NGO, CBO & others involved in agriculture will be the key actors/partners.

1. GON involves NGOs INGOs based on their performance & competitiveness.
2. NGOs are selected based on their past experience & comparative advantages.
3. NGOs are selected in a place where GON cannot involve itself.
4. NGOs are given opportunities based on local conditions & their contributions & to adapt under local conditions to involve wider beneficiaries.
5. NGOs/INGOs work should be monitored & evaluated by concerned agencies of DOA/MOA.
6. All the programs should be involved in the annual programs & proposals.
7. APP implementation began in the Ninth Plan that identified sustainable natural resource management as one of the priorities. Since then, SSM has remained in priority.
8. In the proposed three year interim plan sustainable soil management (SSM) program is also included.

Key strategies proposed

Cover 60%of the most potential mid hill commercial vegetable pockets.

Strategies:

- Prepare a critical mass of practicenor leader farmers (F-F).
- Promote non-governmental service providers in backstopping leader farmers.
- Introduce vermicompost as a component of SSM.
- Coordinate with DLS.
- Encourage FOs and local governments to share resources.
- Establish SSM as one of the pillars of organic farming.
- Impose strict fertilizer quality control measures.
- Capacity and capability building of field staff.

Thematic areas

There are many organizations involved in these programs. There are various thematic areas where we can study in detail as

1. Soil and water management
2. Soil fertility and nutrient management
3. Grain crops in rainfed water management
4. Role of livestocks, fodder and tree crops
5. Role of high value crops
6. Farmers'organisation actions knowledge and perceptions
7. Institutional arrangements.

On the basis of documented evidences and the present state of the art in the field of SSMP various recommendations are given.

- Integrated plant nutrient management
- Massive soil testing and preparing soil fertility maps
- Increasing farmer's access to soil test services
- Use of GIS to build soil database
- Soil fertility enhancing cropping systems
- Community mobilization led by leader farmers in the community.
- Fostering partnership with service providers available in the community.

Weakness and Limitations

1. Lack of research & extension linkages.
2. Lack of National extension strategy.
3. Placement of manpower inadequate
4. Based on projectization & partnerships technicians not oriented.
5. Resource constraints in sharing & implementations.
6. Norms not fully compatible based on present needs.
7. Administrative as well as financial act, by laws and regulations complicated
8. NGOs /Ingo's& other organizations sometimes not fully participative in coordination /collaborations.

Sometimes lack of experiences in the field level takes longer time in contracting out in negotiation aspects. However, if there is understanding and better cooperation in the field, it works like anything else. Win situations become most effective in the resource-constrained conditions if there is mutual thinking. With low input & resources, maximum achievements are obtained. There is qualitative as well as quantitative works & also no overlapping in the programs. Under partnerships programs most of the works are very cost effective. Risk is minimum outcome is more and adapts to local conditions. For local and ecologically selective NGO's performance is better though the coverage is not very high in the case of government. So for better outcome there must be strong cooperation and coordination among various NGOs and Government agencies.

Suggestion:

Start thinking now on the policy and strategy suggested before preparing commercially feasible crop-based action projects by including SSM as a component in it.

The project could demonstrate some good practices that could be replicable in mid-hill uplands.
They are:

- Improved animal shed can produce dung, litters and urine which, after necessary treatments and bio-processing applied in the fields, can substantially substitute fertilizers, increase yields and improve soil health and quality.

- This does not require very sophisticated technology but very simple reform in the indigenous practices that the farmers have been doing themselves.
- Upcoming interim plan has envisaged scaling up this GAP.

References.

1. National workshop on review & planning of sustainable soil management program. April, 2006
2. Sustainable management of soils in rain-fed cropping systems in the mid - hills of Nepal.APROSC, August 1996.
3. Environmentally friendly plant nutrition management through IPNS in Nepal.April2002.
4. Nepal agricultural extension strategy (NAES) its present scenario and future vision in the context of APP
5. Agricultural perspective plan (APP) its vision and implementation aspects during 4-5 years period in the district.
6. Decentralization act processes and its implementation aspect in the light of APP.

Paper-2

NARC Experience on Sustainable Soil Management Practices in Nepal
(*Current Practices and potential for future*)

Dr. Krishna B. Karki

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Phone: 5521149

Introduction:

The word sustainability is widely in use after Brunt Land Commission 1987 submitted a report on the sustainable development. It has been more popular after the Earth Submit in Rio De Janeiro, Brazil in 1992. The way the pace of development progressing in the developing and developed world, there was world wise concern about all the natural resources be exhausted and the world would be in trouble especially in the natural resources in future. Even the air that every living being need every second may be in scarce. The developed world, the rich and industrial countries, did not want to slower their pace of development but easy to pressure the developing world with exception of Brazil, China and India. Their development is still progressing on a steady way and without them the industrial countries' development would suffer. Bruntland Commission indicated sustainable development means it is for ever. Then in 1992 American Congress concluded that sustainable agricultural development should address food security, enhance environment quality, appropriate use of natural non-renewable resources, apply biological cycle and biological control of pests and enhance the quality of life for farmers and society as a whole.

Agricultural sustainability as defined by the American Congress in 1992 "Capable of maintaining their productivity and usefulness to society indefinitely. Such systems must be resource-conserving, socially supportive, commercially competitive, and environmentally sound". It has basically gave importance to the following points:

- satisfy human food and fibre needs
- enhance environmental quality and the natural resource base upon which the agricultural economy depends
- make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- sustain the economic viability of farm operations
- Enhance the quality of life for farmers and society as a whole.

Soil sustainability: Soil management means appropriate management of soil for its economic crop production. For this health and soil quality should also be considered. When we talk about soil quality it takes into account of 24 descriptive soil physical, biological and chemical properties. It also includes 14 descriptive properties related to plants yield and quality products; 3 descriptive properties related to animals and human health, and 2 descriptive properties related to water quality (Karki, 2005).

When we talk about the soil sustainability it goes side by side of soil quality or soil health. Soil's quality or health is assessed as a function of soil, plant, animal and water properties identified by the farmers. Going through the different physical, chemical and biological properties of soil and the different factors that control soil quality the soil health scorecard could be listed as:

- 24 descriptive properties related to soil including; erosion, soil depth, soil structure, soil texture, compaction, surface crust, drainage, water retention, aeration, biologic activity, organic matter, soil fertility, pH, and soil test values.
- 14 descriptive properties related to plants including: crop appearance, nutrient deficiency, growth rate, seed germination, yield and feed value.
- 3 descriptive properties related to animals; human health, animal health and wildlife, and
- 2 descriptive properties related to water: chemicals in groundwater and surface water

Soil Sustainability in Nepalese context: For crop production inputs are provided in the form of fertilizers, organic manure, atmospheric deposition, biological fixation and sedimentation. The supplied plant nutrients are lost through crop harvest, crop residues, leaching, gaseous and water erosion. Soil is only sustainable when harvested and lost nutrients are replenished. This should also include temporary and permanent fixation (Mengel and Kerkby, 1987). In Nepalese context, soil fertility is declining and is not said to be sustainable because the soil contain low organic matter, have low pH and low nutrients including micronutrients, light in texture and high soil erosion including shallow depth (STS, 2002, Karki et al 2005, ICIMOD 2002).

Nepalese soils are characterized by light soil. The soil texture is dominated by silt which means the soils are new (Cameron et al. 1997). Fig. 1 indicates the components that bring down the Nepalese soils from sustainability. They are low in soil pH (Karki and Dacayo, 1990, Joshi 1997, Karki et al 2005.a). They are low in organic matter and low in micronutrients (Karki et al 2005. b.) and have high soil erosion problem (Shreier et al 1995). They also shallow in depth (Carson 1992). With all these properties of Nepalese soil it is not easy to bring it to sustainability. Organic matter problem can be managed so is:

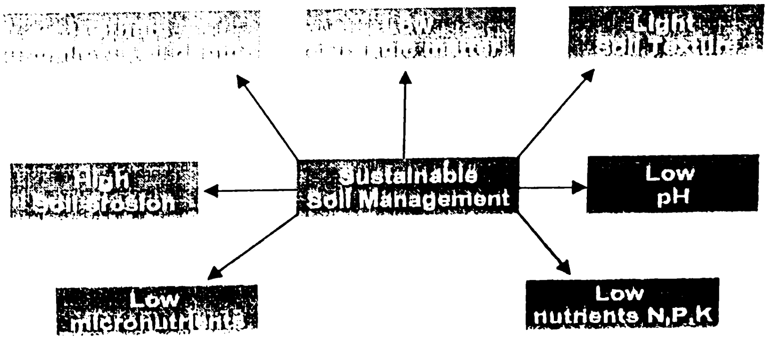


Fig 1. Sustainable soil management in Nepal

the soil erosion. Problem of soil nutrients and pH could be managed by adding sufficient amount of micronutrients and lime but there is no way that soil could be made heavy however, addition of sufficient amount of organic matter can to some extent add the properties of soil heaviness.

Soil sustainability has been heavily dependent on soil organic matter because it plays a major role in soil productivity as it supplies plant nutrients continuously, enhances cations exchange capacity, improves soil aggregation and hence water retention and also supports biological activities (Swift and Woomer, 1993; Dudal and Deckers, 1993). Farming in Nepal is based on the organic manure and large amount of FYM/compost has been found applied by the farmers to maintain soil fertility of their farms. In most of the cases farmers apply organic manure to every crops in rotation. Understanding the importance of organic matter in soil Nepalese scientists also have done some works in this line (Maskey and Bhattarai 1994, Karki, 2003, Karki 2004, Maskey et al 2004, Karki, et al 2005 a.). All of these workers emphasized the importance of organic matter in crop production and sustainability. Keeping plant production in the center, it needs nutrients. These are added to soil through mineral fertilizers, organic manure, atmospheric deposition of nutrients, biological N fixation and sedimentation. The applied nutrients are lost through crop harvest, crop residues, leaching of nutrients, gaseous loss and lost through water erosion. The box below indicates how the nutrients are balanced.

Plant nutrient balance system

Inputs		Outputs
Mineral fertilizers Organic manures Atmospheric deposition Biological nitrogen-fixation Sedimentation	Plant	Harvested crop parts Crop residues Leaching Gaseous losses Water erosion

Soil erosion in Nepal: Soil erosion has been a serious problem facing Nepal. Several projects are running to check the soil erosion still the soil loss from the different land uses are heavy. Lowest soil loss is recorded in well managed forest and well managed paddy terraces that are 5-10 t ha^{-1} followed by well managed maize terraces. The worst soil loss was recorded in poorly managed sloppy terrace and degraded range land that accounted to be 20 to 1000t ha^{-1} (Table 1)

Table 1. Soil Loss from different land uses in Nepal

Land use categories	Soil loss rate (t/ha/year)
Well- managed Forest land	5-10
Well -managed paddy terraces	5-10
Well- managed maize terraces	5-15
Poorly -managed slopping terraces	20-1000
Degraded range land	40-200

Source: ICIMOD 2001

Considering the above factors there has been a study conducted in four districts of Nepal. Two districts, Ilam and Shyangja represented hills and Nawalparashi and Jhapa in the Terai. The study reveals that the nutrients uptake and losses of applied plant nutrients in early rice, normal rice, wheat and maize crop rotation, there is no sufficient nutrients on soil as residue of applied fertilizers. The crop was supplied with 80 to 100 kg of N, 30-40 kg of P_2O_5 and 40-60 kg of K_2O. When calculated the harvested and other losses the nutrients all were in negative balance except P_2O_5 in early rice that left 13kg/ha positive (table 2) because the crop removed up to 204 kg of N, 130 kg of P_2O_5 and 254 kg of K_2O per hectare (Ghani and Brown, 1997).

Apart from the soil erosion, nutrients are also lost from other sources. The same study reported nutrients balance in some of the crop fields. Crop harvest is the major removal of nutrients that removes in early rice, normal rice, maize and wheat crops 88 kg, 120 kg 204 kg and 114 kg ha^{-1} of N, respectively. Phosphorus removal by the same crops was 27 kg, 129 kg, 97 kg and 49 respectively. The amount of K removed ranged from 117 to 254 kg ha^{-1}. All of these crops leave negative balance when we calculated with the fertilizer applied by the farmers except nitrogen in case of early rice.

Table 2 Nutrients balance in cereals

Crops	Biomass	Nitrogen			Phosphorus			Potassium		
		Removed	Applied	Balance	Removed	Applied	Balance	Removed	Applied	Balance
E.Rice	12807	88	80	-8	27	40	13	185	40	-145
N. rice	17531	120	83	-37	129	30	-99	254	40	-198
Maize	14312	204	100	-104	97	40	-57	237	60	-177
Wheat	10015	114	80	-34	49	40	-9	117	40	-77

Sources: Ghani and Brown 1997

Nutrients are also lost from other sources. Fertilizer that is applied to the crops all is not taken up by the crops but lost trough several ways. Leaching loss and fixation are also accountable. Erosion and leaching loss is calculated as 30 to 35 kg ha^{-1} of N, 10 20 kg of P and K (Table 3). Almost same amount or even higher amount of fertilizer elements are immobilized or fixed. These elements that are fixed temporarily can be released for the crops when favorable condition in soils occurs but the permanently fixed elements will be made available to plants in any circumstances (Ghani and Brown 1997).

Table 3. Losses of nutrients from cultivated fields (kg/ha)

Eco. Region	Erosion and Leaching					Immobilization			
Hills	Nutrients	Rice	Wheat	Maize	pH	Nutrients	Rice	Wheat	Maize
	N	35	20	20	Low pH	N	20	20	20
	P	30	10	10		P	35	35	35
	K	35	20	20		K	20	20	20
Terai	N	15	15	15	High pH	N	20	40	20
	P	15	15	15		P	40	40	40
	K	15	15	15		K	25	25	25
					Med. pH	N	15	15	15
						P	30	3	30
						K	15	15	15

Sources: Ghani and Brown (1997)

Researches in NARC

There are several studies carried out by the staffs of Soil Science Division directly funded by NARC or other international organizations. Karki (1995), Maskey et al (2005a), Karki et al (2005b) are some of the examples. Soil conservation studies, SALT study, and use of organic and inorganic fertilizers on crop yield and the residual effects of fertilizers are some of the studies to be mentioned. Worth mentioning results of these studies can be listed as follows:

1. Nutrient replenishment needs to be emphasized with appropriate soil and nutrient conservation practices

   Recommended organic manure rate- 50% recommended rate of inorganic fertilizers and 10 ton of well decomposed organic matter

   - Resources conserving technology/ SRI-zero tillage is very popular

2. Quality of organic matter produced in the rural areas needs to be improved

   - Vermicompost , press mud, and systematic composting, bone meals etc

3. Promote the use of city waste compost and sewage sludge as sources of plant nutrients

   - 28 t/ha of city waste compost was comparable with 100 kg N /ha but fear of heavy metal for the long time use

   - Sewage sludge use – need dehydration before it should go to the field- Guheswori plant

1. In 80 years time from now there will be a serous problem of P and in 20 years time S supplementation in agriculture. Therefore, crop species that are capable of releasing bound P and local sources of S needs to be explored. K reserve may not last even 10 years time

5. Integrated approach of nutrient management needs following ICM to be emphasized- We have research finding from time to time

6. Appropriate soil amelioration techniques should be implemented- we have data from field experiments and recommended lime on the basis of lime requirement studies and crop response (Collaboration with GMI).

7. Micronutrients need to be supplemented- We conducted an international workshop on micronutrients in South and South-East Asia in 2004. " Genetic exploration" Needs a Mega Project"

8. SALT results shows that hedge rows with N-fixing plants have been appropriate soil conservation techniques in sloping lands.

Is pure sustainable agriculture really possible?

In its purest form, sustainable agriculture would be a complete reversion to subsistence agriculture relying on organic wastes and manures within farms without applying any fertilizer or other chemicals. Is that really possible with the world's current population? Mind it; land is already saturated and inelastic. Nepal needs to go for increased crop production per unit area. The option is open to policy makers.

Future Prospects

We have two options

- Go for feeding growing population (High production), or
- Go for low production and sustainability
  - Organic farming could be one option- Is it possible in Nepalese context. The answer is only for certain commodities

Conclusion and recommendation

Sustainability has been a catch words for many donors and recipients. These days organic farming is getting popular. Now the question comes if we go for complete organic agriculture, there are ways that nitrogen and potash need of the crop could be supplemented through organic manure, but where does the phosphorus requirement comes from? So serious thought should be given to supplement this element and produce sufficient food for the need of growing population. It is for sure, the yield from organic agriculture as compared to inorganic one incomparable. The developed and rich world with the minimum percentage of population engaged in agriculture can feed the rest of their population but what about the poor countries. If we go for organic certainly the cost of production will go up as yield per unit area decreases. It will be far beyond the reach of ordinary people. Moreover, what about the industries that have been producing fertilizers, pesticides and the other heavy machineries? It means we shall have to produce food on the primitive methods. That means the scientist, whose tireless effort help the world agriculture to develop to this stage wasted their time resources and brain.

References

Cameron, K.C., H.J.Di, and R.G.Mclaren 1997. Is soil and appropriate dumping ground for our waste?. Aust. J. Soil Res. 35:995-1035.

Carson B. 1992. The land, the farmers and the future. ICIMOD occasional paper No. 21. IVIMOD, Kathmandu, Nepal. P. 111.

Cassman K. G. and P. L. Pingali 2005. Intensification of irrigated rice systems: Learning from the past to meet future challenges. GeoJournal, 35:299-305

Dudal R and J. Deckers, 1993. Soil organic matter in relation to soil productivity. In: K. Mulongoy and R. Mereck (ed). Soil organic matter Dynamics and Sustainability of Tropical Agriculture, 377-382

Ghani , A. and M.W. Brown . 1997. Improvement of Soil Fertility in Nepal through Balanced Application of Fertilizers. Report submitted to Ministry of Foreign Affairs and Trade, Wellington

ICIMOD, 2001.State of the environment, Nepal 2001. ICIMOD-MoPE/HMGN-SACEP-NORAD_UNDP.

Joshi D. 1997. Soil fertility and fertilizer use in Nepal. Soil Science Division, Khumaltar, Lalitpur, Nepal. pp 70

Karki, 1995. Influence of organic and inorganic fertiliser in sustaining crop productivity in the central hills of Nepal. A PhD. Dissertation, Universitae fuer Bodenkultur, Vienna. (Unpublished).

Karki, K. B. 2005. Research Direction for Sustainable Agriculture Research. Green Field Journal of Himalayan College of Agricultural Science & Technology.2:9-16

Karki, K. B., A. Mentler and W.E.H. Blum, 2005 (a). Crop Productivity and Food Security in Kathmandu Valley, Nepalese J. of Development and Rural Studies, 2 :14-22

Karki, K. B., J. K. Tuladhar, R. Upreti amd S. L. Maskey 2005 (b). Distribution of micronutrients available to plants in different ecological regions of Nepal. In : P. Andersen, J. K. Tuladhar, K. B. Karki and S. L. Maskey (ed.) Micronutrients in South and South East Asia. (Proceeding of an international workshop held 8-11 September 2004, Kathmandu Nepal). ICIMOD/NARC/ Bergen University, Norway.17-29.

Karki, K.B. 2004. Status of potassium in intensively cultivated soils of Kathmandu Valley. Nepal Journal of Science and technology 5:83-89.

Karki, K. B., 2003. Biogas, environment and crop production in Nepal. Agriculture and Environment Nepal 3:37-43

Maskey S.L. and S. Bhattarai (1994) Effect of long-term application of different sources of organic manure on Maize/Wheat rotation - Paper presented at the II National Conference on Science and Technology RONAST, 1994

Maskey, S.L. S. Bhattarai and K. B. Karki 2004. Long –term effect of different sources of Organic manures on wheat-soybean rotation. SARC Jn. of Agri., 243-256

Mengel, K and E.A. Kirkby 1994. Principal of Plant nutrition (revised ed.) International Potash Institute, Worblaufen-Bern/Switzerland.

Schreirer, H., P.B. Shah and L.M. Lavkulich, 1995. Soil acidification and its impact on nutrient deficiency with emphasis on red soils and pine litter additions. Challenges in mountain research management in Nepal. Processes, trends and dynamics in middle mountain watersheds. Proceedings of workshop held in Kathmandu, Nepal, 10-12 April, 1995. Edited by Schreier, H., P.B Shah and S. Brown. ICIMOD, Kathmandu, Nepal.

STS, 2002. Annual Report, Soil Testing Services, DOA, Kathmandu

Swift, M.J., and P. L. Womer, 1993, Organic matter and the sustainability of agricultural system: Definition and measurement. In: K. Mulongoy and R. Mereck (ed). Soil organic matter Dynamics and Sustainability of Tropical Agriculture, 3-18.

Paper- 3 :

Nepalese Soils and their Management Criteria

S.N.Mandal

Soil Management Directorate

Introduction

Nepal has complex topography and diversified agricultural practices. It is the best way to diagnose the sub-optimal of soil fertility for plant growth and its further improvement. Geology, climate and hydrological characteristics of each physiographic region/zone are different which and resulted in the formation of various types of soils. Thus soil fertility status and soil fertility management must be considered within the context of the agro ecological and production system based.

Agricultural scientists, agricultural extension workers and even farmers themselves widely support the view that declining soil fertility is a major problem in Nepalese agriculture. Soil erosion is regarded as the major factor responsible for fertility decline in hills of Nepal. Soil erosion may be resulted by geological process as well as due to human influence. Geological process play the main role in increasing soil erosion in hills, where as in valley bottom and Terai reduction in FYM/Compost, unbalanced use of chemical fertilizer and intensified cultivation are considered important for the decline in soil fertility.

The natural resources especially the land resource and human resources of the nation allow potential scope for agriculture and economic growth both in short and long term. The resource potential has hitherto been barely tapped. Indeed it has not even been fully recognized because of limited land resources information and tradition cropping system. So, land vulnerability assessment for food security using agro-ecological zoning and land resources information system is essential for Nepalese agriculture. Food security and land vulnerability both are complex in Nepal.

Rice cultivation is unique and soil fertility management is quite distinct from upland soil management. Standing water in rice fields inhibits weed growth, encouraging the growth of azolla and blue green algae, both of which are nitrogen-fixers and act as soil improver. Bari and pakho is more common in hills, where maize is the dominant crop. The fertility management of Bari lands is different from that of irrigated khet land. As the upland improved FYM developed in the upland supply the nutrient requirement for upland cultivate. With increased cultivation of wheat and case crops, the traditional soil fertility management is under considerable strain and needed sustainable soil management practices with maximum use of renewable sources of plant nutrient giving more focus on available local resources.

Objectives

To explore current soil fertility status of Nepalese soils.

To get familiar with the existing soil management practices.

To assess the farmer's participation in SSM activities.

Current Soil fertility status

All present currently 60% soils of Nepal have low organic matter, 23% have low phosphorus and 18% have low potash. Primary nutrients N,P and K content of our soil is also poor, comparatively phosphorus content (High in 53% soil) is better than that of potash, Similarly 67% our soils are acidic figure 2. Geographical land distribution and intensity of cropping pattern influencing a lot in organic matter content of the soil, 52% hill soils are low in OM where as more than 82% soils of Tarai are low in OM Figure 3,4 & 5,6.

Figure 1: Soil Fertility (N,P, K and OM) Status

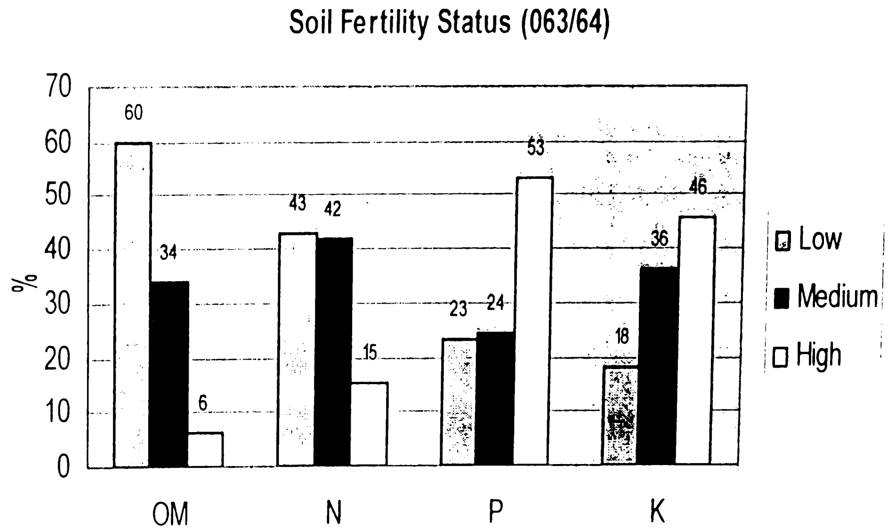
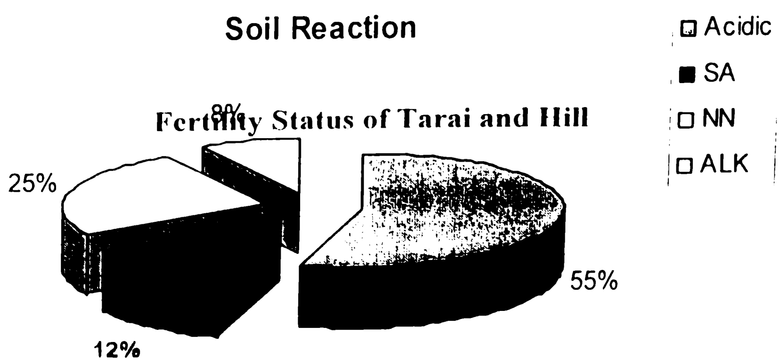


Figure 2: Soil Reaction



Fertility Status of Tarai and Hill

Figure 3: SOM Status in Terai

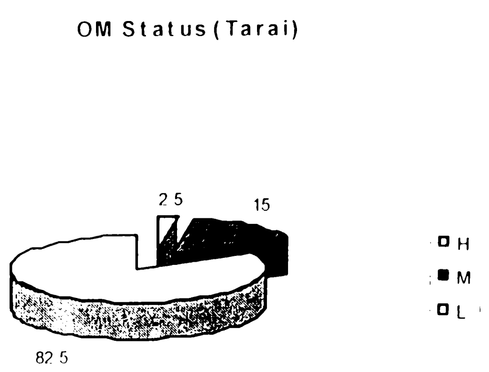


Figure 4: SOM Status in Hills

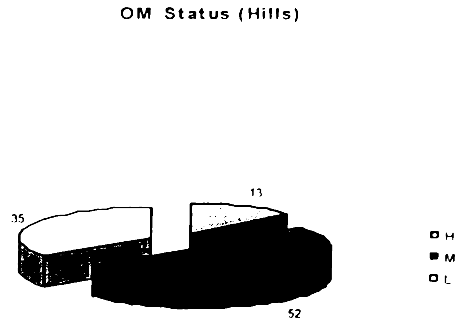


Figure 5: OM Status of Tarai Districts

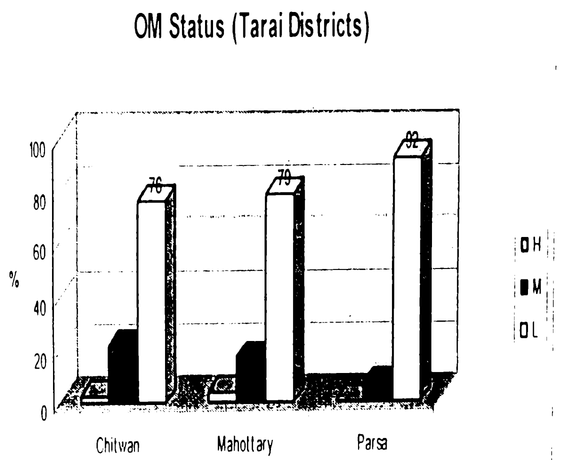
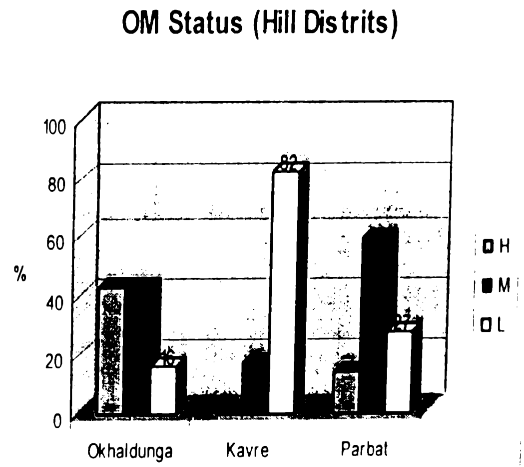


Figure 6: OM Status of Hill Districts



Soil fertility of Eastern and western Nepal also vary especially soils of Eastern Nepal is more acidic compared to Western part of the country Figure 7 and 8.

Figure 7: Soil Reaction of EDR

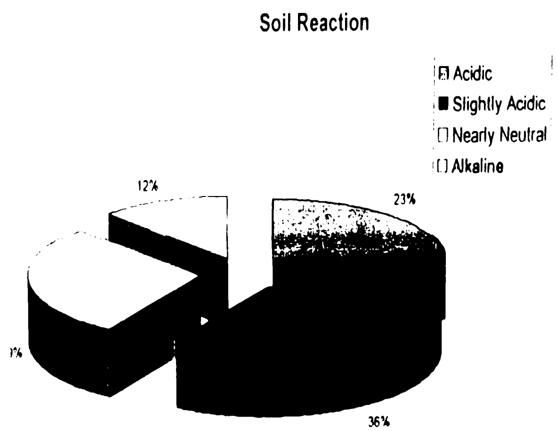


Figure 8: Soil Reaction of FWDR

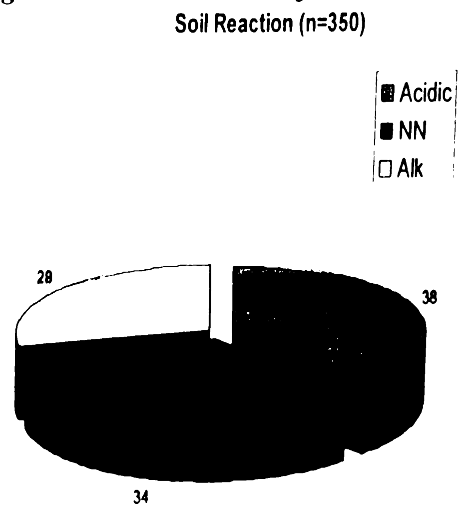


Figure 9: Fertility Status of Rupandehi

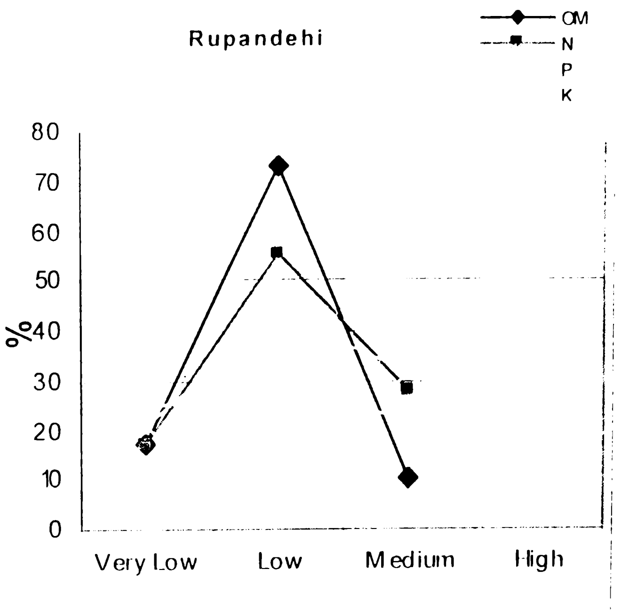
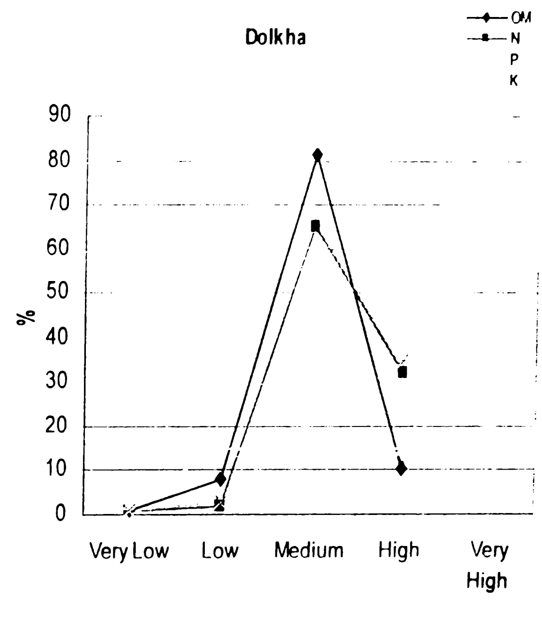
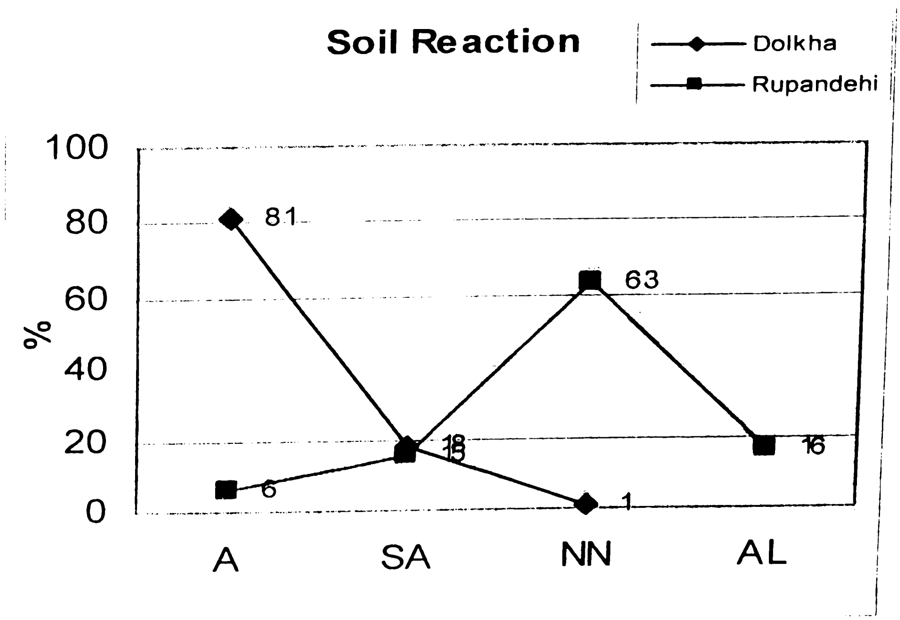


Figure10: Fertility Status of Dolkha



Above Figure 9 & 10 show the fertility comparison of Rupandehi and Dolkha district, it is challenging that 90% soils of Rupandehi are low in OM content. Level of phosphorus and potash are also low in Rupandehi than that of Dolkha. In soil reaction aspect compare with the 25% acidic soils of Rupandehi in Dolkha 99% soils are found acidic Figure 11.

Figure 11: Soil Reaction of Dolkha and Rupandehi



Change in Soil fertility

Current soil fertility status is compared with soil fertility status of last five years. It is very interesing to note that before last five years 58% Nepalese soils were low in OM now 60% soils became acidic. Similarly 58% soils were high in potash now it drops to only 28% soils high in potash Figure 12 & 13. Acidification of the soil is also increasing, before last 5 years it was 63% now it reach to 67% Figure 14.

Figure 12: Soil fertility status 2059/60

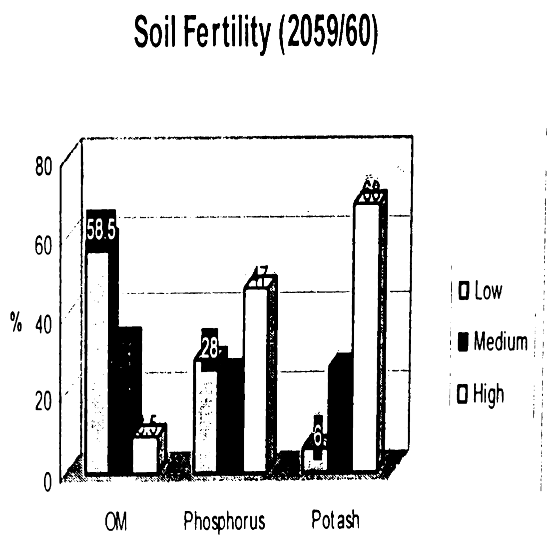


Figure 13: Soil fertility status 2063/64

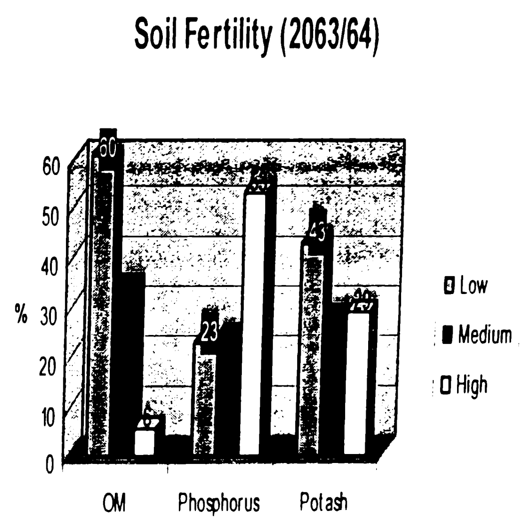
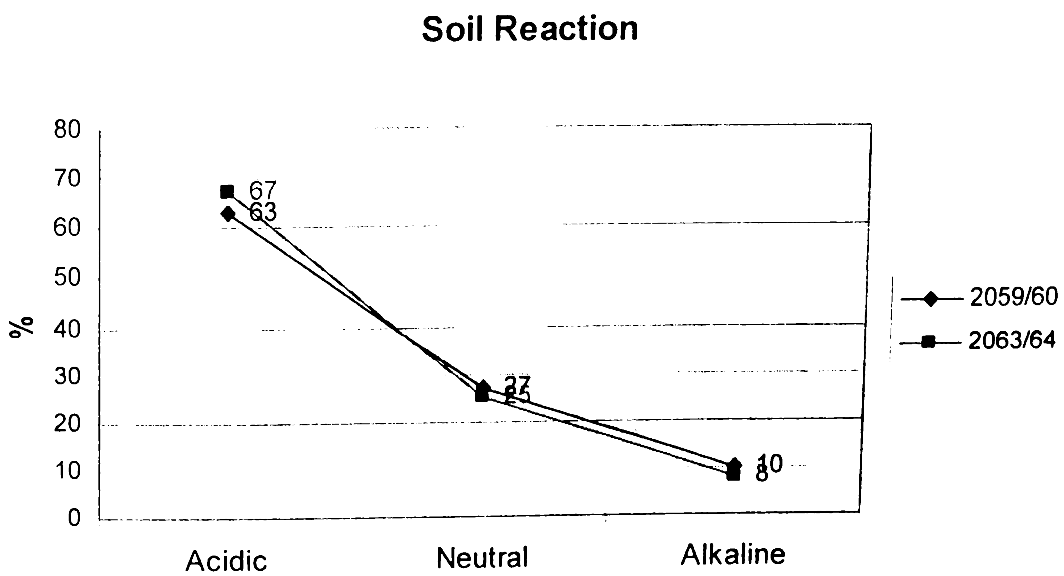


Figure 14: Soil Reaction of 2059/60 and 2063/64



Fertilizers Quality

During the 10th five year plan from 2059/60 to 2063/64 about 700 (Figure 15) different fertilizer samples (Figure 16) were analyzed by Soil Management Directorate for their quality measurement. Among those strait fertilizers namely Urea, Ammonium Sulphate, Muriate of Potash and Single Supper Phosphate were found well and good Figure 17, whereas fertilizers like DAP, Sona, Sagarmatha and mixed fertilizers were found not maintaining the required nutrient ratio in the formulation Figure 18.

Figure 15: Analyzed fertilizer samples

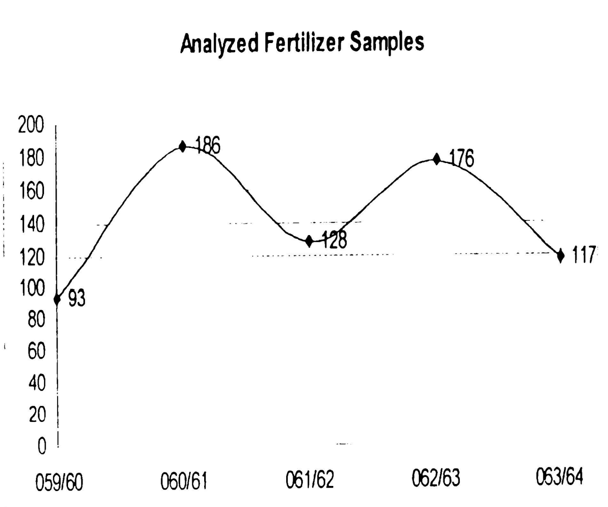


Figure 16 Type of fertilizer analyzed

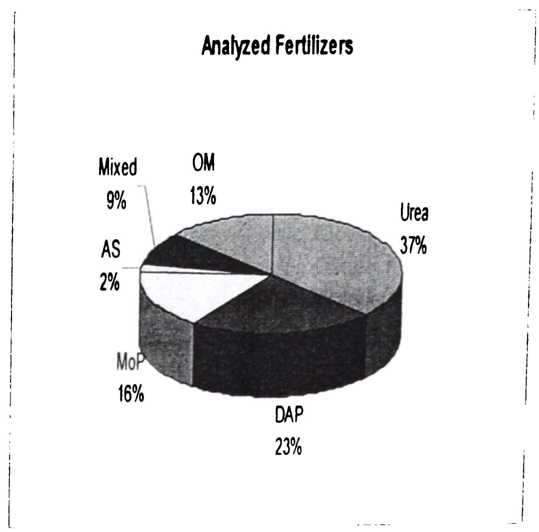


Figure 17: Quality of Strait Fertilizers

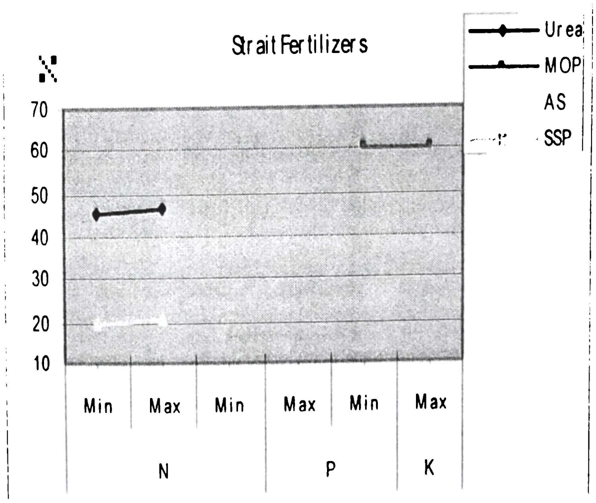
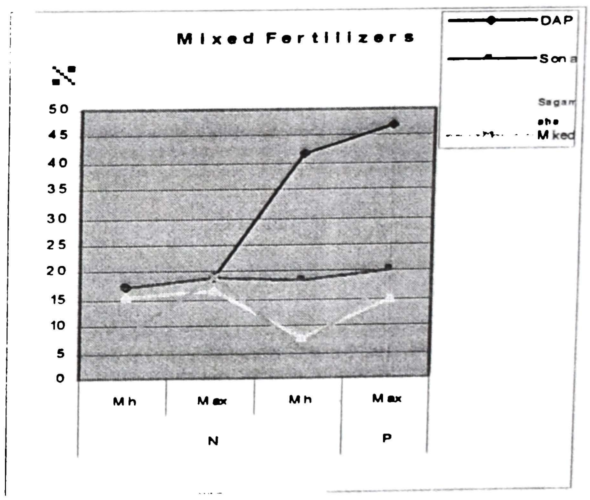


Figure 18: Quality of Mixed Fertilizers



Fertilizer nutrient use rate per hectare in Nepal is more or less stagnant of around 25 kg/ha. In 1994/95 and 2003/04 it was about 30 kg/ha whereas in 2004/05 it drop down to about 20 kg/ha Figure 19. Our nutrient use rate is lowest in comparison with in our neighbor countries Figure 20. This figure is based on the fertilizers imported by legal importers i.e. AICL and private companies. In Nepal fertilizer also coming through illegal informal way from

India (Figure 22), in such case the nutrient use rate may increased if consider the informal illegal way of fertilizer entry.

Figure 19: Fertilizer Nutrient Use Rate

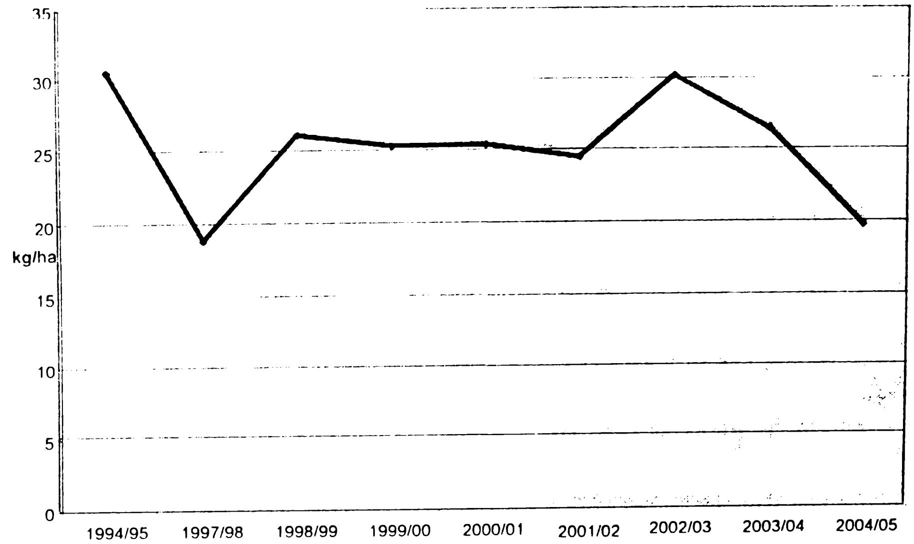


Figure 20: Fertilizer Use Rate

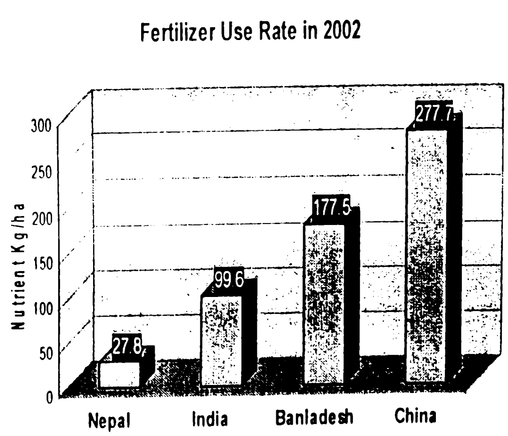


Figure 21: APP Target for Fertilizer Use

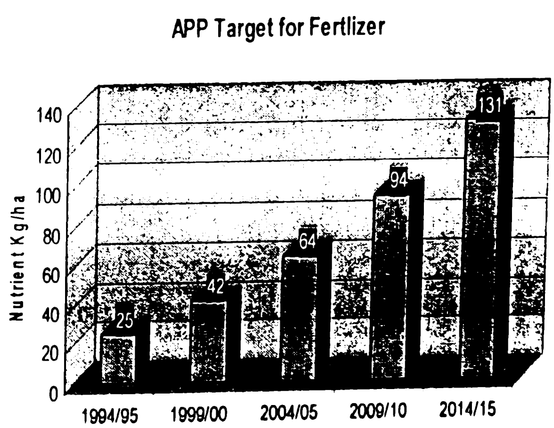
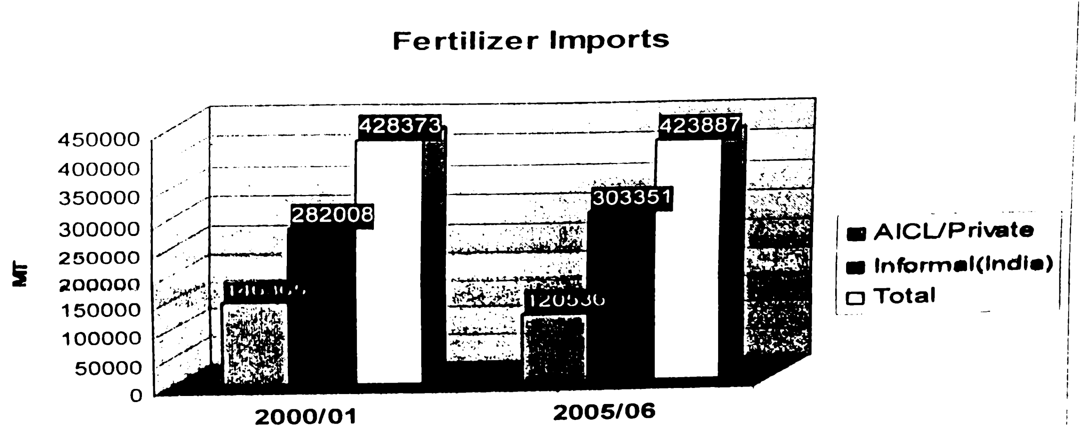


Figure 22: Imported Fertilizer and Importers



How Farmers are Managing Their Soils

- Terracing on sloppy land
- Use of cover crops and growing grasses and fodder trees in the bund
- Farmers know very well about the importance of organic manure
- Other manuring practices in soil fertility management.

What? SMD is doing

- Soil, Manure and fertilizer analysis
- Human resource development
- Net working of stakeholders
- Soil fertility mapping
- Technology Promotion

  - Microbial fertilizers

  - IPNS-FFS

  - Soil campaign

SSMP Topic Area

SSMP Topic Area

Organic matter management

-Manure (FYM, GM) management

-Biomass and compost management

-Slurry (biogas) management

Inclusion of legumes in crop rotation

Promotion of mixed, inter and multiple cropping systems

Organic farming

IPNS-FFS

SSMP Program 2007

Districts	12
VDCs	208
Projects	75
Activities	293

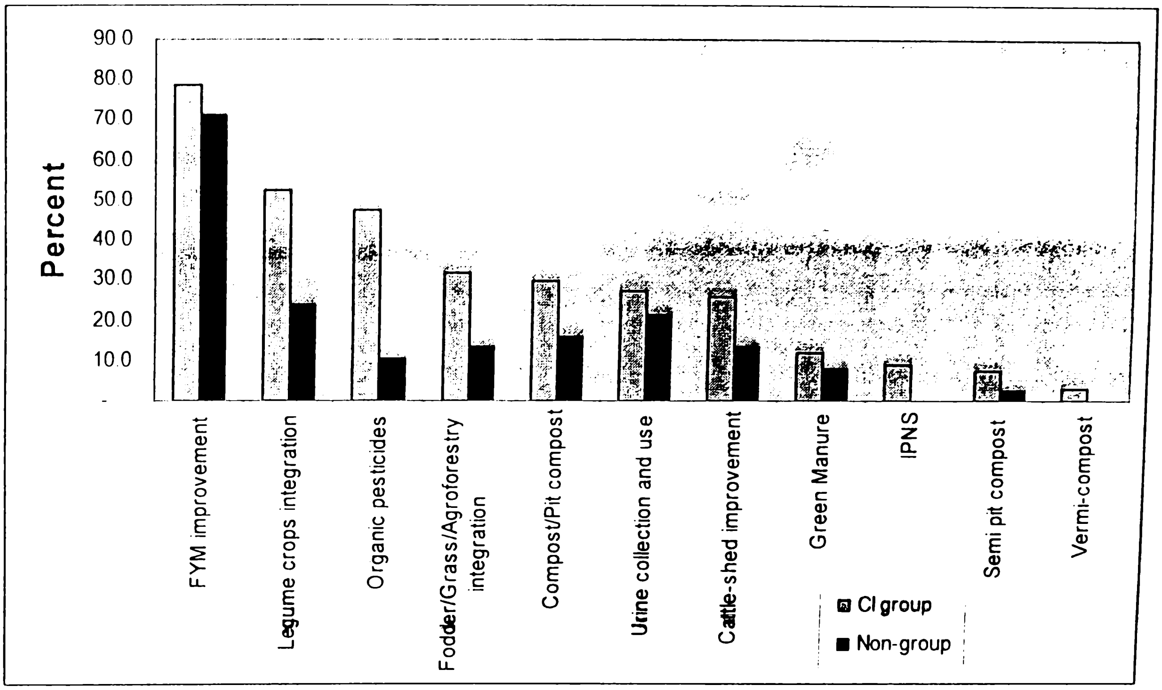
IPNS-FFS 52 (32 CIs staffs, 20 Farmers)

CIs 73 (Go-22, NGO-47, NARC-4)

Adoption of Sustainable Soil Management (SSM) Technologies

Various SSM activities have been conducted under the heading of ten SSM topic areas, among that FYM improvement and legume intercropping are the most adopted SSM practices by Collaborating Institutions as well as by the farmers Figure 23.

Figure 23: Adoption by Type of SSM Technologies



Challenges

- Polycentric approach of SSM often create problems with resource distribution.
- Lack of Chemical Fertilizer Act
- Lack of lab buildings for RSTL, Hetauda and RSTL, Pkhara
- Inadequate or unavailability of Agriculture lime
- Lack of updated technological training to technicians

Opportunities

- A SSM program is recognized by agriculture development policy
- A Participatory approach, Pluralism in the delivery of services
- A Synergy among partner members establishes the grounds for a sustainable sharing of knowledge and resources
- A Capacity building of local resource person, and shifting accountability of service providers towards community

Recommendation

Recommendation for institutionalization of approach

Considering the soil management aspect, it is high time to scale up the success SSM practices in wider areas in/out side the district.

Recommendation for SSM practices

The training on the specific SSM technologies should be more practical and additional training has been recommended for maximum number of farmers.

Impact of Sustainable Soil Management (SSM) Activities on Soil Fertility Status in Western Hills of Nepal

T.B. Subedi[1]

Abstract

A study was conducted about the impact of sustainable soil management (SSM) activities on soil fertility status in the 9 hill district of Western Nepal. The study included 4 Sustainable Soil Management programme (SSMP) district (Syangja, Parbat, Baglung and Myagdi) ,where different SSM activities were promoted by the project, and 5 non-project district (Gorkha, Lamjung, Tanahun, Kaski and Mustang) where government funded regular agriculture extension activities were implemented.

Data from the bench mark plot established by Sustainable Soil Management programme (SSMP), and the soil analysis (collected randomly from different districts) data of the year 2005/06 and 2006/07 and the purposive sampling from 70 different participant and non-participant farmers from SSMP districts were taken for study.

It was found that the SSMP project area, where SSM activities were implemented intensively, had relatively higher soil pH than that of non-SSMP district. Similarly a significant higher soil organic matter (OM) and available potassium was found in SSMP project districts than that of non- SSMP districts. Similar result was found in total nitrogen and phosphorus but the effect was little low compared to soil organic matter and available potassium. Similar trend was found in the participant and non-participant farmers in the SSMP project districts but the change was low compared to project and non-project districts indicating dissemination of SSM technology through different means in the vicinity of project area. A significant improvement was observed in the soil properties of bench mark plot and was reflected by the increase in yield of maize and rice yield.

From the data it can be concluded that promotion of SSM activities, not only help to improve soil fertility but also help to increase the crop yield specially in remote areas of Western Hills having low access to external input.

1. Introduction

Soil is one of the important non-renewable natural resources. From time immemorial, people have been exploiting the soil for the betterment of their livelihood. In the past low crop intensity, low use of external input, use of low yielding varieties of crops and low yield resulted in stable soil fertility status but with the change in time the use of high yielding variety of crops, increase in cropping intensity and increase in use of external input, has increased the crop production per unit area but at the same time it has negative impact in soil fertility. It is reported that, if no proper measure is taken the problem of soil fertility decline may lead to desertification of agricultural land.

[1] Soil Scientist, Regional Soil Testing Laboratory, Pokhara

Population growth rate is 2.5 percent while food production growth rate is 2.3 percent over the period 1980/81 to 1990/91 (CBS, 1999) and is 2.29 and 2.30 percent respectively during the period of 2001/02 to 2004/05 (CBS, 2006). Almost all of cultivable land is already brought under cultivation and there is little chance of increasing cultivated land. The only way to increase production to feed the growing population is by increasing the cropping intensity, useing high yielding variety of crops and useing of external input. Such a practice, if not used very cautiously and judiciously, will have negative impact in soil fertility and reduced production and yield per unit area.

To overcome the problem of soil fertility decline, sustainable soil fertility management activities (SSM) should be given priority in agricultural projects. The problem of soil fertility decline is the major problem in midhills especially in unterraced bariland. Therefore, Sustainable Soil Management Programme (SSMP) was implemented in the midhills of the country. SSMP primarily focuses on small land holders and subsistence farmers with particular attention to female, dalits and janajatis. Besides it has also become imperative to identify and promote technologies that provide both short-term benefits as well as improve the soil fertility. Sustainable soil management programme is implementing different programs for improving soil fertility. Major activities of SSMP are as follows

- FYM improvement
- Legume integration
- IPNS Farmers filed School
- Urine collection and utilization
- Promotion of grass and fodder trees
- Income generating activities (vegetable, ginger, fruit crops, goat raring)

Poor farmers inhabit the bariland of midhills with little access to external input due to remoteness and low income. Under such condition the only way to increase the crop yield and sustain soil fertility is through maximum utilization of local resources. Therefore, SSMP has focused in improving the quality and quantity of compost by increasing the biomass recycling, efficient utilization of urine, promotion of legume intercropping etc.

Soil Management Directorate (2006) reported that soil organic matter content of mid hill districts is about 2.0 percent, while most arable land should contain about 3.0 percent organic matter. Likewise soil is becoming acidic day by day. Major plant nutrient, nitrogen, phosphorus and potassium are also low to medium levels in mid hills districts (RSTL, 2006). To improve the deteriorating soil condition the government implemented sustainable soil management programme (SSMP) a Swiss government funded programme, in 12 mid hill districts since 1999. The first phase of SSMP started in January 1999 and is in its second phase which last till December 2007. SSMP was successful in demonstrating a number of opportunities for sustainable soil management. Some of these include improvement in the method of FYM preparation and application of liquid manure, legume cropping, agro-forestry, and plantation of fodder trees and grasses in private lands.

2. Statement of the problem

Inappropriate and inadequate nutrient management is one of the major production constraints of crop production in Nepal (Mudvari, 1998). Among the different means of increasing productivity, soil fertility management is one of the key factors. Pandey (1995) stated that Nepal's food security would not be guaranteed if measures to cope the declining soil fertility problems were not taken in time. The productivity of the farming system is declining due to decreasing soil fertility caused by nutrient mining and soil erosion and this is more pronounced in case of the poor farm households whose livelihoods entirely depend on Bari dominated farming system.

Soil Management Directorate (2002) reported that organic matter content of mid hill districts soil is about 2.0 percent, while most arable land should contain about 3.0 percent organic matter. RSTL Pokhara (2006) reported that 57, 25, 35 and 82 percent of samples analyzed are low to medium in nitrogen, phosphorus, potassium and organic matter respectively in western hills. Likewise 80.9 percent of soil falls under acidic reaction. Nitrogen, phosphorus, potassium, Calcium, magnesium and sulfur are more available when soil pH is 6.0 to 7.0 (Tripathi, 2001). Thus soil management issue is crucial in mid hills of Nepal. Similarly micronutrients especially zinc and boron level in the soil is low for most of the crops and their management is also equally important.

3. METHODOLOGIES

3.1 Selection of Site (SSMP and non-SSMP districts) for study:

Nine hill districts of western development region were taken for study. Four of them (Syangja, Parbat, Baglung and Myagdi) are the districts where sustainable soil management programme (SSMP) was implemented starting from 1999 and five districts (Gorkha, Lamjung, Tanahun, Kaski and Mustang) are non-SSMP districts where no special SSM activities were implemented. In total 756 soil samples collected randomly by farmers, non-government organizations and district agricultural development office during the period of 2005/06 and 2006/07 were analysed for pH, total N, available P and K and Organic matter and considered for comparison between SSMP and non-SSMP districts. In case of micronutrient 187 samples were collected for available Zn, Fe and Cu and 140 samples were collected for B analysis during 2006/07.

3.2 Participant and non-participant farmers

To study the impact of SSM activities on soil fertility and crop productivity, seventy farmers were selected purposively from Baglung and Syangja district. Thirty-nine of them were directly involved in SSM activities (training, improvement in quality and quantity of FYM, urine collection and utilization, legume incorporation and grass and fodder production) through collaborating institutions (CIs) of SSMP and rest of the farmers did not involve in the SSMP programmes directly and managed their farm traditionally. The participant farmers were interviewed using closed questionnaire regarding soil management, use of manure and fertilizer, yield of major field crops etc. Soil samples were also collected from the field of participant and non-participant and analysed for pH, organic matter (OM), total nitrogen (N), available phosphorus (P2O5) and available potassium (K2O).

3.3 Bench mark Sites

Sustainable Soil Management Programme (SSMP) established bench mark sites in the project area to measure the impact of SSM activities in the project area. Twelve bench mark plot from Syangja were analysed for the study. The bench mark plot were so selected that the owner of the bench mark plot was involved in SSM activities thorough the collaborating institution (CI) of SSMP. The bench mark plots were established in the first year of the project (1999). The soil samples from the bench mark plot were analyzed for pH, OM, total N, available P2O5 and K2O. Soil samples were taken after 7 years of project implementation (2006) and were again measured for the same parameter analysed in the first year. Records were also taken for the crop yield, amount of manure and fertilizer applied, time for incorporation of FYM/Compost in the field etc. The data from the bench mark were analysed and compared to study the impact of SSM activity in crop yield and soil fertility in bariland of Syangja after a period of 7 years.

3.4 Analytical methods

The soil samples were analyzed by the methods as described by Pradhan (1995). The following methods have been used for soil sample analysis. The soil testing data were classified according to interpretation used by STSS (2002).

Table 1 Soil chemical analysis methods.

Particular	Method used
Organic matter (%)	Modified Walkley and Black method
Total Nitrogen (%)	Macro- Kjeldahl
Available phosphorus (Kg P_2O_5 ha^{-1})	Olsen's method
Available potassium (Kg K2O ha^{-1})	Neutral normal ammonium acetate method
pH (1:1 soil water suspension)	Beckman Glass Electrode pH meter
Available Boron	Hot water extraction
Available Zn, Fe and Cu	DTPA Extraction

Table 2 Nutrient Interpretation table

Details	Low (L)		Medium (M)		High (H)
O.M.%	<2.5		2.6-5		>5.0
N %	0.1		0.11-0.2		>0.21
P_2O_5 (Kg ha^{-1}) Olsen method	<30		31-55		>55
K_2O (Kg ha^{-1}) NN AAcetate	<110		111-280		>280
Micronutrient	Deficient (D)		Sufficient (S)		Toxic (T)
Available Zn ppm*	< 0.8		> 0.8		-
Available Fe ppm**	< 5		5-300		> 300
Available Cu ppm**	< 2.5		>2.5		-
Available Boron ppm**	< 0.2		0.2-2.0		> 2.0
pH rating H_2O (1:1)	Acidic	SA		NN	Alk
	<5.5	5.5-6.5		6.5-7.5	>7.5

* Nutrient Disorder and Nutrient Management in Rice, IRRI

** Methods of Soil and Plant Analysis, Pradhan S.B.

After the data processing (edited, coded, classified, tabulated) they were analyzed using Microsoft excels for tabulation and simple calculation, and presentation of graphs for different comparisons. Basically, descriptive statistics of the variables were obtained from MS excel. Appropriate descriptive statistics and graphs/charts were used to present the data.

4. Results and Discussion

4.1 Impact of SSM activities on Soil Reaction (pH)

Seventy nine percent of the total soil samples analyzed are acidic in reaction of which 35 percent are strongly acidic (<5.5) and requires urgent management for sustainable and higher agriculture production. The percentage of strongly acidic soils is more in non-SSMP districts than in SSMP districts (table 3). Compared to 84% acidic soils of non-SSMP district SSMP district has 76% acidic soils.

The comparison between the non-participant farmers and participant farmers within the SSMP districts had no significant difference in soil acidity (table 4). The results indicate that the SSM activities promoted in the SSMP districts have significant and positive role in correction of soil acidity. The similarity in the percentage of acidic soil in participant and non-participant farmers may be due to adoption of the SSM activities by the non-participant farmers from their neighbours who participated and are adopting SSM activities.

The change in bench mark plot also showed increase in soil pH but the change is small. During the period of 7 years the average increase in soil pH is 0.3 unit (table 7). Although the pH change is small in unit however it will have significant role in management of plant nutrient and also in crop yield. Among different SSM activities collection of urine and improvement in quality of compost is widely adopted and has contributed most in soil fertility improvement and higher crop production. Similarly planting of grass and fodder tree contributed in the increase in biomass production (SSMP 2004).The study on bench mark plot showed slight increase in soil pH but did not show significant increase in the total amount of FYM/Compost used (table 7). SSMP (2004) reported that increase in collection of urine and improvement in quality of FYM has reduced the need of chemical fertilizer. On the other hand those who are using chemical fertilizer have started to use all major nutrients instead of using only urea or DAP as they used previously. The improvement in quality (well decomposed and high nutrient content) and the quick incorporation of FYM in soil and integrated and balanced application of chemical fertilizer might have contributed in increase of soil pH.

Table 3 pH status of SSMP and non-SSMP districts in western hills

	Number of Sample			% of Sample		
Acidity*	Total	SSMP	Non SSMP	Total	SSMP	Non SSMP
Acidic	266	138	117	35	28	49
SA	332	237	84	44	48	35
NN	129	98	26	17	20	11
Alk	25	21	11	3	4	5
Total	752	494	238	100	100	100

* Acidic = <= 5.5, SA = 5.6-6.5, NN = 6.6-7.5, Alk = >7.5

Table 4 pH status of the participant and non-participant farmers in SSMP districts.

Soil Acidity	Number of Farmers			% of farmers		
	Non-participant farmers	Participant farmers	Total	Non-participant farmers	Participant farmers	Total
Acidic	9	15	24	29	38	34
SA	16	17	33	52	44	47
NN	6	7	13	19	18	19
Alk	0	0	0	0	0	0
Total	31	39	70	100	100	100

* Acidic = <= 5.5, SA = 5.6-6.5, NN = 6.6-7.5, Alk = >7.5

4.2 Impact of SSM activities on Soil fertility N, P, K and OM status.

The main cause of low crop productivity in the mid hill is, increasing cropping intensity, soil erosion and low use of external input (Mudvari, 1998). This has lead to decline in soil fertility and crop productivity and soil fertility management is the key factor for increasing crop productivity Pandey (1995). In this study soil analysis data of the two fiscal year were included (2062/63 and 2063/64).

4.2.1 Soil Organic Matter (OM)

In total 756 samples were analysed for OM. In total 22 percent of the samples analysed had low organic matter content and 60 percent were medium. Incase of SSMP district the low OM soils were only 13 percent where as in case of non-SSMP district 30 percent of samples had low OM content (table 5). This clearly indicates that SSM activities had significant contribution in soil OM content. In case of participant and non-participant farmers, non-participant farmers had relatively higher organic matter in soil (table 6). In case of bench mark plot significant increase in soil organic matter was found (table 7).

In hill district FYM compost is the major source of plant nutrient. Application of quality FYM/Compost not only increase soil organic matter but also helps to improve soil physical, chemical and biological properties. Therefore increase in soil organic matter is very important for sustainable soil management and higher crop production. In non-SSMP districts also SSM activities are implemented by farmers but the efforts are not concentrated as in SSMP districts. Therefore, if SSM activities are promoted with priority, it can help to build up soil fertility and thereby help in increasing crop production and poverty alleviation in hilly region with low access to external input.

4.2.2 Total Noitrogen

In case of total soil nitrogen 14 percent of samples had low nitrogen, 43 percent had medium and 43 percent had high nitrogen content. In case of SSMP districts only 6 percent of soil samples analysed had low nitrogen where as in non-SSMP districts 27 percent had low nitrogen. In total only 46 percent of samples had low to medium nitrogen content but in non-SSM districts 80 percent of samples had [illegible] medium [illegible] content (table [illegible]). No significant difference was found in total nitrogen between participant and non-participant farmers. However a significant increase in total nitrogen was observed [illegible] The increase in total nitrogen in bench mark plot [illegible] difference [illegible] participant [illegible] and non-participant farmers indicate adoption of SSM activities by non-participant farmers in the project area.

The total nitrogen in soil is directly proportional to soil organic matter content. Therefore, use of high amount of quality FYM/Compost increase the total nitrogen in soil and nitrogen availability to crop plants. The increase in soil nitrogen content may be attributed to collection of urine and use of high quality FYM in SSMP districts.

4.2.3 Available Soil Phosphorus

Six hundred and fifty-eight samples were analysed for available P and K. Incase of phosphorus 14 percent of samples had low available P where as 11 and 75 percent of samples had medium and high P respectively (table 5). While comparing between SSMP and non-SSMP districts, SSMP districts had higher available P than in non-SSMP districts. No significant difference was observed between participant and non-participant farmers within SSMP districts (table 6). In case of bench mark plot significant increase in available P was observed (table 7). The data for available P in case of participant and non-participant farmers and bench mark plot were same as that of total nitrogen. The awareness for balanced fertilization might have encouraged farmers, in SSMP districts, to use DAP along with urea increasing the soil P. On the other hand the major change observed in SSMP project area is utilization of urine and improvement in quality of FYM (nitrogen content). Urine has more contribution in total nitrogen and has low effect in phosphorus. Therefore, although difference was found between SSMP and non-SSMP districts no significant difference was observed between participant and non-participant farmers within the SSMP district.

4.2.4 Available Soil Potassium

Incase of potassium 658 samples were analysed during study period. Of the total samples analysed 4, 30 and 66 percent samples had low, medium and high available K respectively (table 5). The samples having high available potassium were 73% in SSMP districts and 54 % in non-SSMP districts. In case of participant farmers 95 percent of samples analysed had high available compared to only 71% in non participant farmers. In case of bench mark plot also there was significant increase in available soil K. The total K in FYM and urine is high compared to phosphorus. Protection from rain and flood water reduces the leaching loss of potassium and increases the availability of K. Therefore, promotion of SSM activities specially utilization of urine and protection of FYM/Compost from rain and flood increases the K content and supply more K in soil.

Table 5 Soil fertility (OM, N, P and K) status of SSMP and non-SSMP districts in western hills

Nutrient Level *	Organic matter			Total Nitrogen			Available P			Available K		
	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP
Total No of Samples under different category												
L	169	62	62	93	29	48	92	48	41	24	11	10
M	456	298	116	281	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	116	[illegible]
H	131	[illegible]	72	28[illegible]	245	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	756	477	[illegible]	655	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Nutrient Level *	Organic matter Total	Organic matter SSMP	Organic matter non-SSMP	Total Nitrogen Total	Total Nitrogen SSMP	Total Nitrogen non-SSMP	Available P Total	Available P SSMP	Available P non-SSMP	Available K Total	Available K SSMP	Available K non-SSMP
	% of samples under different category											
L	22	13	30	14	6	27	14	11	22	4	2	5
M	60	62	55	43	40	53	11	10	14	30	24	41
H	17	25	15	43	54	20	75	80	64	66	73	54
Total	100	100	100	100	100	100	100	100	100	100	100	100

* L Low, M Medium, H High

Table 6 N, P, K and OM status of the participant and non-participant farmers in SSMP districts.

	Participant farmers								Non-participant farmers							
	Total N %		P_2O_5 Kg/ha		K_2O Kg/ha		OM %		Total N %		P_2O_5 Kg/ha		K_2O Kg/ha		OM %	
Level *	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%
L	0	0	6	15	0	0	0	0	0	0	5	16	1	3	0	0
M	12	31	3	8	2	5	21	54	10	32	2	6	8	26	20	65
H	27	69	30	77	37	95	18	46	21	68	24	77	22	71	11	35
Total	39	100	39	100	39	100	39	100	31	100	31	100	31	100	31	100

* L = Low, M = Medium, H = High

Table 7 Impact of SSM activities on soil fertility and crop yield of bench mark plot (Syangja).

Year	1999					2006				
Details	Rice yield *	Maize yield*	FYM **	Days to incorporate FYM	Fertilizer use*	Rice yield *	Maize yield*	FYM **	Days to incorporate FYM	Fertilizer use*
Average	113.3	76.4	16.4	12.8	2.0	155.8	96.3	16.7	3.5	4.0
Range	50-200	42-105	5-35	6-20	0-6	70-250	70-140	5-400	1-10	0-22
Year	1999					2006				
Details	pH	N %	P2O5 Kg/ha	K2O Kg/ha	OM %	pH	N %	P2O5 Kg/ha	K2O Kg/ha	OM %
Average	5.53	0.16	19.1	383.5	3.2	5.83	0.24	148.7	438.9	4.75
Range	4.7-6.9	0.08-0.24	2-52	96-648	1.4-4.8	4.8-7.0	0.13-0.31	10-491	118-1271	2.6-6.2

*kg/Ropani

** doko/Ropani

4.3 Impact of SSM activities on micronutrient status.

In total 187 soil samples were analysed for Zn, Fe and Cu of which 168 were form SSMP districts (Baglung-70, Syangja-86, and Myagdi-12) and 19 from non-SSMP districts (Kaski-6, Tanahun-9 and Mustang-4). Similarly 140 samples were analysed for Boron of which 119 were form SSMP districts (Baglung-46, Syangja-64, and Myagdi-9) and 21 from non-SSMP districts (Kaski-11, Tanahun-6 and Mustang-4). The soil test report indicate most of the soils analysed are sufficient for Fe, Zn and Cu with only 3, 6 and 16 percent samples in deficient range respectively. In case of Boron 51 percent of samples are in deficient range. Practical experience shows that Zinc deficiency is common in Rice and Citrus fruits. Similarly Boron deficiency is severe in cole crops and oilseed crops. Since the data are limited to only few districts and some districts have only few samples analysed the data may not represent the whole western development region but gives a bird eye view about micronutrient status in western development region. The deficiency and toxicity range for micronutrient differs according to crops and the threshold limit for deficiency and toxicity is also very close. Therefore special care should be taken for interpretation of soil test report and management of micronutrient for various crops. The deficiency is more pronounced in non-SSMP districts than in SSMP districts. Therefore, promotion of SSM activity might contribute also for management of micronutrient deficiency and hence for sustainability of soil fertility and crop production. Because of very small sample size the result of the study especially micronutrient status can only be used to see the trend not to generalize the result for western hills.

Table 8 Impact of SSM activities on micronutrient status

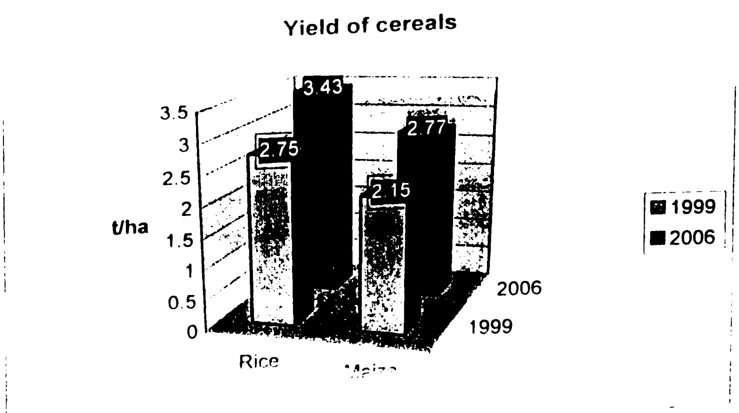
	Fe			Zn			Cu			B		
	Total no of samples											
Rating	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP	Total	SSMP	non-SSMP
D	5	1	4	11	5	6	29	18	11	72	55	17
S	182	167	15	176	163	13	158	150	8	68	64	4
Total	187	168	19	187	168	19	187	168	19	140	119	21
	% of samples											
Rating												
D	**3**	1	21	**6**	3	32	**16**	11	58	**51**	46	81
S	97	99	79	**94**	97	68	**85**	90	42	**49**	54	19
Total	**100**	100	100	**100**	100	100	**100**	100	100	**100**	100	100

* D – Deficient, S – Sufficient

4.4 Change in soil and crop management and Yield of major crops (Rice and Maize)

The production of cereals depends on several factors. One of the important factors for cereal production is soil fertility. A non-significant increase in the rice and maize yield was found due to intervention of SSMP activities during 5 years of period (table 7, figure 1). NORM consultancy reported 25 % yield increase in Baglung district by promotion and adoption of SSM activities in farm level.The data on table 7 indicate reduction in the days to incorporate FYM in soil. This might have helped in saving of nutrient by leaching loss and volatilization. At the same time promotion of balanced fertilization and increase in use of chemical fertilizer was also found (table 7). Thus balanced fertilization and increase in quality of compost, reduction in loss of nutrient by leaching and volatilization and improvement in quality of compost, reduction in loss of nutrient by leaching and volatilization and promotion of balanced fertilization might be the reason for increased crop production during the period of 1999 to 2006.

Figure 1 Effect of SSM activities on cereal production



Conclusions

- Soils are acidic to slightly acidic and may be the major point for Soil fertility management in western development region.
- 80 % of soil samples are medium to high in OM,N, P and 95 % of Samples are medium to high in soil K
- Implementation of SSM activities reduced problem of soil acidity increased soil organic matter (OM) and N, P and K in soil
- Increase in quantity of FYM, reduction in days to incorporate FYM in soil, increased the yield of maize and rice
- The less difference between participants and non-participant farmers within SSMP district than that of difference between SSMP and non-SSMP districts indicate dissemination of SSM technology in the vicinity of project area
- Promotion of SSM activities in inaccessible hilly area will improve soil fertility and crop productivity with less expenditure in external input.

LITERATURE CITED

APP.1995. Agricultural Prospective Plan Nepal. Main Document Agricultural Project Service Center, Kathmandu and John Meller Associates Inc, Washington, D.C.

Bhattarai, E.M.2000. Effect of long-term application of chemical fertilizer and manure on crop productivity and soil fertility under rice wheat system.Annual report, Regional Agricultural Resrarch Station Khajura, Nepaljunj.Pp 21-22

Brady, N.C. 1996. The Nature and Properties of Soil. 9th edition.Prentice-Hall.India.Pvt. Ltd. India.

CBS.1999. Statistical Pocket Book of Nepal. Central Bureau of Statistics, HMG/Nepal.

Fujimoto, T. 1998. Current Status of soil fertility in Nepal (Part 2). In: soil science programs at the glance. Annual report Ministry of Agriculture, Department agriculture, Crop Development Division, Soil Testing and Service Section, Lalitpur, Nepal.Pp 26-28

Kumar, A. and D.S. Yadav. 1993. Effect of long term fertilization on soil fertility and yield under rice wheat cropping system. J. Indian Soc. Soil Sci. 41(1): 178-180.

Mudwari, A.1998. Coordination report (1997/098). National Wheat Research Programme (NWRP). In: Proceeding of Wheat Research Papers Presented at National Winter Crops Research Workshop 28-30 October 1998, NWMP/NARC, Bhairahawa, Nepal. Pp 1-8

NARMA consltancy, 2006.Adoption and adaptation of SSM practices and its impacts on livelihoods of farmers.NARMA consultancy pvt.ltd.Nayabaneshowar, Nepal. p 31

Pandey,S.P.1995. Extension of Integrated Plant Nutrient Systems (IPNS) at farm level in Nepal. RAPA publications.

Pradhan, S.B.1995. Soil test manual.Secondary crops development project. ADB/N loan no964 Nep.Hariharbhawan, Kathmandu, Nepal.

RSTL Pokhara.2006. Annual Progress Report. Ministry of Agriculture and Cooperatives, Nepal.

Soil Management Directorate. 2006. Annual Report of Soil Management Directorate. Ministry of Agriculture and Cooperatives, DOA, Hariharbhawan, Lalitpur, Nepal.

Sustainable Soil Management Program.2007. Sustainable management of agricultural soils in the mid hills of Nepal, SSMP document No, 142, Lalitpur, Pulchowk.

SSMP, 2004. Assessment of Sustainable Soil Management Activities by Farmers and Collaborating Institutions: Experiences with Projects from 1999 to 2000. (SSMP document no 110)

SSMP 2006, Impact Evaluation of Integrated Plant Nutrient System (IPNS) and Farmers,s Field School (FFS). (SSMP document no 138)

Tripathi, B. P. and B. N. Suwal. 1999. Effect of organic and inorganic fertilizers on rice and wheat yields and soil properties in rice- wheat system in rained lowland ecosystem. Nepal Ag. Res. Journal 3:89-93

Sustainable Soil Management Programme (SSMP) – Outscaling the Successes

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Introduction

The hills of Nepal have been cultivated since many centuries and have provided food for generations. About 46% of Nepal's population live in these hills and many of them live in poverty. Their main staple, rice, is produced in intensively used areas in valley bottoms, on alluvial terraces and along river courses with the supply of irrigation water. In addition, farm households cultivate areas without supplementary irrigation on the slopes and along ridges. Many farm households depend exclusively on rainfed fields on moderate to steep slopes and have no access to the more productive irrigated areas. Normally they grow maize as staple during the monsoon season and wheat or mustard during the post-monsoon season and in the winter. Due to population pressure and increased poverty, cultivated areas have extended to marginal soils on steep slopes and far less favourable areas. Despite all the efforts and extended cultivated areas, many households of the hills are not food sufficient or live on very low incomes.

The farming systems in Nepalese hills are characterized by close integration of crop, livestock, forestry and grassland management. Pressure on these resources and competition amongst different users is continuously increasing in order to enhance productivity and improve livelihoods. As a result, soil fertility is increasingly becoming an issue in all cultivated areas and is continuously declining (Joshi et al., 1995). Jaishy (2000) identified that total nitrogen is low in about half of the total of about 9800 samples across the country. One third is low in the case of available phosphorous and potassium, while organic matter is low in about two third of the total samples. In the past the soil fertility of both irrigated and rainfed agricultural land was maintained applying locally produced organic fertilizers, mainly farmyard manure and compost. These organic fertilizers have been confirmed to be important for keeping soil productive, easy to plough and with good water holding capacity. In the recent past agricultural development in Nepal has introduced mineral fertilizers (mainly urea and di-ammonium phosphate), which competes with traditional methods and to a large extent replaces them. Mineral fertilizers are expensive for small households and have shown their adverse effect on local water resources (Merz et al., 2004). On the other hand, the traditional methods would not have been able to maintain soil fertility and productivity as simultaneously new seeds, new varieties and new crops were introduced as well as cropping intensity was increased which resulted in high nutrient demands on the soil and subsequent nutrient mining. Intensification mainly occurred on irrigated land so that most of the inputs (both local and external) are provided to these fields and rainfed agricultural land often is deprived from these inputs. In addition soil erosion and reduced quality of farmyard manure have declined soil fertility.

Table 1: Distribution of land, and population in Nepal by ecological

Land and population	High Hills (Mountains)	Mid Hills	Terai	Nepal
Land area (%)	35.2	**41.7**	23.1	100.0
Population	7.8	**45.5**	46.7	100.0
Arable Land				
% of national total arable	7.0	**37.5**	55.5	100.0
% of zonal/national arable	3.1	**14.2**	37.9	15.8
Average Land holding size (ha)	0.7	**0.8**	1.3	0.96

Source: Ojha 1999

In order to ensure balanced soil fertility and to avoid soil nutrient mining, sustainable soil management needs to be applied. Promising options appropriate for the local conditions need to be identified, tested and disseminated by or at least in close collaboration and under guidance of the end users, the farming community. The Sustainable Soil Management Programme (SSMP) attempts to support this quest with its innovative approaches.

SSMP and its approaches

SSMP is funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by Helvetas and Intercooperation, two Swiss NGOs active in development cooperation. The programme was initiated in 1999 with the objective to promote improved practices towards sustainable soil management. The programme builds on the interaction and partnership between farmers with their local knowledge, district based government organisations and civil societies, who have acquired knowledge through training programmes conducted by national resource organisations both from government and research. The activities are based on the participation and empowerment of farmers through on-farm testing of indigenous and improved technologies and farmer-led experimentation (FLE) on sustainable soil management innovations. Applying the concept of FLE technological options suitable for respective agro-ecological and socio-economic conditions at local level are identified. This concept also aims at strengthening the farmer's decision-making capacities through simple methodologies and tools. This can help the farming communities to continue the identification of suitable options themselves and ensure a local self-continuing system of technology testing and dissemination for sustainable soil management practices. Promising options are promoted through a farmer-to-farmer diffusion approach reaching a maximum number of farm households in the twelve hill districts of Nepal where the programme is active. So far the programme has worked with several ten thousands of farmers in its seven years of implementation. All promoted technologies are based on the improved use efficiency of local resources with the thinking that this will decrease farmer's outside dependencies and enhance the livelihoods of these families. A more formalized approach promoted by the project is the farmer field school approach mainly for the promotion of the integrated plant nutrient system concept.

The programme supports activities related to organic matter management, soil conservation, fodder cultivation, integration of herbaceous and tree legumes into the cropping systems and promotion of high values crops and vegetables in combination with sustainable soil management.

Some lessons learnt

The promoted technologies

In addition to the approaches above, that themselves are part of the lessons learnt, but have been reported in other fora and publications (e.g. Paudel et al., 2005, Paudel, 2007) the programme has made valuable experiences while implementing and promoting a number of simple and on local resources based sustainable soil management practices. These practices include (for each of the below mentioned technologies, fact sheets as shown in Figure 1 are available on request from ssmp@helvetas.org.np)

- Farmyard manure improvement
- Improved compost preparation
- Urine collection and application
- Legume integration
- Organic pest management
- Fodder and forage promotion
- Urine applied with drip irrigation

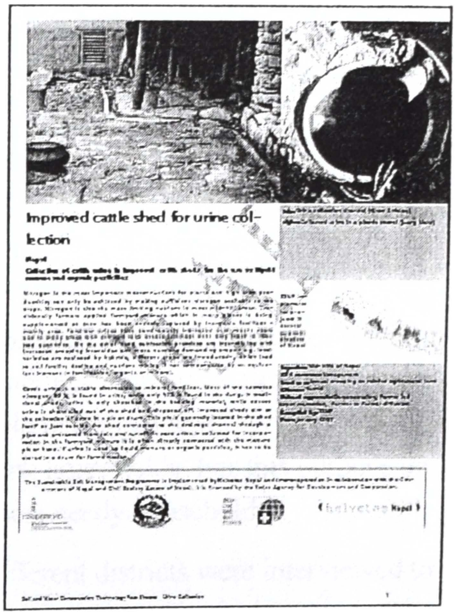

Improved cattle shed for urine collection

Figure 1: Technology fact sheet

The promoted technologies have shown to increase or at least maintain soil fertility. This increase in soil fertility and crop productivity was also observed by the participating farmers. A first indicator for this is the fact that 77% of the questioned 133 farmers indicated improved physical soil properties resulting in easier working of the soil and increased production. In addition, the use of mineral fertilizer was reduced amongst the participating farmers indicating their complete trust in the locally available resources and the promoted technologies.

Their adoption

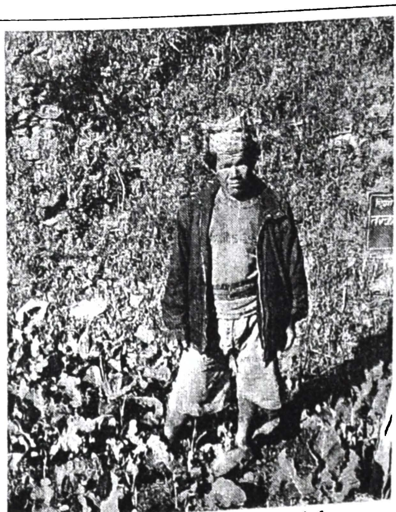
Though the technologies that are promoted are simple and largely based on local resources, adoption has been slow, but steady. Results from a midterm assessment suggest that a majority of farmers used an increased amount of improved farmyard manure. About 44% group farmers or 4248 farming families have adopted soil and water improvement technologies in the past three years. In general these farmers combined two to three SSM technologies that were promoted, mostly improved farmyard manure by means of practices such as heap method, pit method, covering FYM to protect from direct exposure to sunlight and rainwater and urine .collection in combination with vegetable production, fodder production or the promotion of cash crops. FYM improvement has shown positive effects on improving soil structure, reducing the application of chemical fertilizers, increasing crop productivity and interestingly improving gender relations in sharing workload through the reduced fertilizer requirements. The main disadvantages of the promoted technologies were felt to be increased time consumption, increased workload and labour shortage during peak cropping season for transportation of FYM. Non-adopters, who were only 16 out of 739, indicated that their reasons for not adopting were the lack of time and labour.

The technologies have also been adopted by few households that did not directly participate in the programme activities. In general it was observed that this occurred at the rate of about three non-participating per participating household. The more formal approach of organized farmer-to-farmer [illegible] more [illegible] farmers se[illegible] mentioned above.

Their impact

In order to assess the impact of the introduced activities and technologies and to learn from the experiences in the field, several external impact studies were conducted and synthesized. Results from earlier studies suggest that food sufficiency of the participating households could be drastically improved, i.e. the number of households with only 0 to 3 months food sufficiency decreased from 17 to 6%, the number of households with more than 12 months food sufficiency from 39 to 50%. Increased income from the sale of food grain, vegetables, cash crops, livestock and legumes was also reported. Even improved health and nutrition status was observed after the implementation of SSM activities, which may be a result of the consumption of more nutritious food such as legumes and vegetables. It was also shown that the programme had trouble reaching the most disadvantaged groups including the socially excluded and the economically weak households. For this purpose the programme initiated an extra programme directly targeting the most needy households.

In addition to the impact studies, several farmers from different districts were interviewed to assess the impact sustainable soil management had on their production practices and their livelihoods. The brief example of Mr. Buddhi Man Thami from Dolakha is shown in Figure 2 and representative for stories of several other farmers across the SSMP districts. In general the farmers indicated that they would nowadays apply chemical fertilizer and rely more on the locally available resources. This had an impact on the farm expenses. Most of the interviewed farmers that they shifted from kitchen gardening for their own vegetable consumption to a semi-commercial vegetable production, where they would sell some of their produce on the local market. A few of the interviewed farmers have become commercial farmers only producing vegetables and either buying staple or exchanging for example seed potato for staple. In households further away from markets it was often indicated that the menu had changed over the years with more fresh vegetables available now.



In collaboration with CEEPARD, Dolakha

Before I had to take loans to cover my costs, now I am able to provide loans to others and make some additional money like this.

Buddhi Man Thami is

- now cultivating a range of fresh vegetables, before only staple crops;
- self-sufficient now; before his family had only food for 3 months per year from their own [illegible]

[illegible]

Future activities

SSMP is now entering in its third phase where there will be emphasis on outscaling and promotion of the lessons learnt. The outscaling of the project's learning up to date mainly consisted of close ties with the farming community in the target districts, where the project has made a lot of efforts in training local staff of non-governmental and district line agency staff. In addition a farmer-to-farmer diffusion approach was adopted to disseminate the knowledge amongst the farmer community. The project however has put only little strategic importance to the dissemination through other channels. Ad-hoc radio interviews, occasional newspaper articles, the attempt to include sustainable soil management in the Bachelor of Science curriculum in agricultural education and the close collaboration with the mandated agencies in the Government of Nepal are some of the attempts. It was however realized that a more comprehensive dissemination strategy needs to be adopted to sustainably influence agricultural development towards sustainable soil management.

It is envisaged that the programme will follow a comprehensive dissemination strategy including the use of different media and through the collaboration with other development projects and actors. During the review of Phase 2 it was also realized the basket of options for sustainable agriculture is too limited at the moment. During Phase 3 efforts will be made to increase the number of options through active search of appropriate technologies in the field and in literature, their documentation and the promotion of suitable technologies. The search will also be expanded to other development actors and projects. For this reason SSMP has already forged an alliance with the International Centre for Integrated Mountain Development (ICIMOD) with headquarters in Kathmandu to initiate a loose and informal Network for Simple Technologies and Approaches for Rural Development in Nepal. The idea of this network is to share information on their experiences and innovations with different technologies and related approaches based on technology and approaches fact sheets. ICIMOD compiled 19 fact sheets in addition to the 11 fact sheets compiled by SSMP. The documented options also include farmer's innovations and technologies based on indigenous knowledge. The fact sheets support the efforts of rural development in Nepal and provide impetus and ideas for decision makers, development actors and land users. In addition to the folders, it is also planned to publish a CD-ROM including all fact sheets in softcopy. This facilitates the flexible use of the fact sheets: Print what you need and take it to the field or the meeting with a potential collaborator or donor.

An event is planned later in 2007 to launch the series of fact sheets and the CD-ROM. During this event other institutions and organizations will be invited to actively participate in the network. While it would be appreciated that all contributors would follow the same preferred format, fact sheets with different appearance will also be welcome. At a later stage, the translation of the fact sheets to Nepali is also considered.

During phase 3 the attempt will be made to integrate sustainable soil management in the curriculum of agricultural education both in governmental and private colleges. This will be attempted through joint field visits with related decision makers, workshops to develop a strategy on the integration of sustainable soil management in agricultural curricula and the joint implementation of the developed strategy with HICAST, IAAS and others related to agricultural education. Mainstreaming of sustainable soil management in the Government of

Nepal institutions mainly including the District Agricultural Development Offices will have high priority. The programme will continue to create space for sustainable soil management in existing Government of Nepal platforms. Joint field visits with related decision makers are foresees as are contributions to the development of sustainable soil management extension material. At policy level, the programme will contribute to policy initiatives to ensure that sustainable soil management becomes part of the rules and regulations in the agricultural sector.

Collaboration with related projects will play a major role in the outscaling of SSMPs efforts to other districts and untouched VDCs. For this purpose SSMP will offer and provide technical support in trainings/workshops of partner and interested organizations. Continued promotion of synergies with SDC/Helvetas projects will be as important as the synergies with Government of Nepal projects such as IPM/FAO or projects of NARC. In order to identify potential partners a "Tour of Projects" with face-to-face meetings will be conducted.

Conclusion

The promotion of simple technologies that are based largely on locally available resources has shown to be successful in combating soil fertility mining at local level in the hills of Nepal as well as combating poverty. In general adoption of the technologies was good to satisfactory and has shown first good impact in terms of food security, household income and subsequent improvement of livelihoods. The approach of devolving power to local civil society and district based government organisations in agricultural extension with direct farmer's participation have also shown promising outcome. The main challenge of the programme remains to institutionalize the proven approaches in the agricultural extension system and ensure that all parts of the society, including the 'unreached' disadvantaged groups receive their due share of the programme inputs. Outscaling of the successes will be a major challenge in Phase 3, but first ideas of how to address this challenge exist. The aim of the project has to remain that farmer's livelihoods, their food security and their income in particular, have improved through the sustainable management of their agricultural soils.

References

Jaishy, S.N. (2000) Components of integrated plant nutrients management for Nepal. Kathmandu: Soil Testing and Service Section/Department of Agriculture: 1 – 3.

Joshi, K.D.; Vaidya, A.; Subedi, P.P.; Bhatterai, S.P.; Subedi, K.D.; Rasali, D.P.; Suwal, M.R.S.; Tuladhar, J.K.; Phuyal, U.; Floyd, C.N. (1995) Soil fertility system analysis in relation to temperate fruit crops in high hills and inner Himalayan region of Western Nepal. LARC Working Paper No. 94/50. Kaski: Lumle Agricultural Research Centre.

Merz, J.; Nakarmi, G.; Shrestha, S.K.; Dahal, B.M.; Dongol, B.S.; Schaffner, M.; Shakya, S.; Sharma, S.; Weingartner, R. (2004) Public water sources in rural catchments of Nepal's middle mountains – Issues ad constraints. In Environmental Management, 34(1): 26 – 37.

Ojha E. R. (1999) Dynamics and Development of Highland Ecosystems: Highlight on Far-western Developmental Region of Nepal, Welden Book House, Kathmandu Nepal pp2-7

Paudel, C.P.; Regmi, B.D.; Schulz, S. (2005) Participatory innovation development: Experiences of the Sustainable Soil Management Programme in Nepal. In Kolff, A.; va Velduhiuzen, L.; Wettasinha, C. (eds.) Farmer centred innovation development – Experiences and challenges from South Asia. Intercooperation: 109 – 126.

Paudel, C.P. (2007) Farmer Led processes on Agriculture Development: Experience of the Sustainable Soil Management programme (SSM-P), Nepal. National Outreach Workshop 2007. Kathmandu: Nepal Agricultural Research Council.

Compilation of Group report presentation

Group A

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Topic: Prepare a list of sustainable soil management practices moving towards sustainability of Nepalese soils.

SSM Activties	Stimulating Factors	Recommendation for wider diffusion
1. FYM/Compost 2. Veg. Farming 3. Legume Promotion 4. IPNS-FFS 5. Farmers Led Experiment 6. Fodder/Forage 7. Micro Irrigation 8. Poor Support Program 9. F to F Diffusion	1.*Training/Exposure visit *Demonstration *Group Competition *Postering/ Pumplating *Radio Programme *Audio-Visual 2.-Market Management -Networking -Quality Seed -FLE 3. *Short Duration Crop *Market Demanded Cash Crop *Soil Structure Improved *Waste-Land Use *No Need of Much Fertilizer *Hygienic Crop 4 Learning Place (L-D) More Practical	Advanced Training For Staffs/LFs/ELFs Exposure Visit of SSM Success Areas Make Modal SSM Areas.

What was adopted?

-Use of Balanced fertilizer after soil testing (as per recommendation)

-Variety selection (Opportunity)

-Cattle Shed compost heap/FYM improvement.

-Urine collection and use

-Bio-mass utilization

-Vermicompost/EM/Gitimal

-Legume integration

Group B

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Rabindra Subedi	AEO , AED
Bharat Pd Devkota	CDO ,DOA
Raj Narayan Rai	SADO , Lalitpur
Bharat Pd Kandal	PO , DOA

Topic: Prepare a list of force for and against the DADO moving towards adoption / diffusion of SSM practices:

For

- Applicable / useful and locally manageable practices.
- Use of local resources
- Improvement of livestock health and production
- Diffusion press is faster due to the involvement of the local NGOs and CBOs.
- Chances to utilize available local knowledge and man power as well.
- Networking among the GOs/NGOs and CBOs is appreciative.

Against

- Not inoculated in the regular extension program of the gov.
- Appropriate norm to run the program has not yet been developed
- Responsibility is imposed to DADO (F-F) without resources.
- Extra burden to the technical staff to support NGO program.
- DADO office need to look after all the VDCs agri programs
- Incentive for extra work is not sufficient
- Market management of organic product.

Future Action Plan

- Incorporate SSM activities in GOs regular annual program
- Norms to be revised
- Soil Testing program to be privatized
- Establish mini soil testing lab with one export in each district
- Test of useful practices and provision of dissemination.
- Provision of community cattle shed for mass production of compost
- Analyze the ssm related products available in the market and circulate to district by the SMD.

Annex-1

Participants of National Workshop Sustainable Soil Management at Hariharbhawan. (2007/6/8)

S.N.	Name of Participant	Designation	Agency/Institution/Office
1	Suresh Kumar Barma	Joint Secratory	MOAC
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4	Bharat Pd Uphadya	DDG	DoA
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8	Janardan Khadka	Soil Scientist	FDD
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11	Arati Nepal	Soil Scientist	SMD
12	Shiva Sundar Ghimire	AEO	SMD
13	Ramesh Nath Regmi	Slurry coodinator	BSP
14	Krishna Bahadur Karki	Chief Soil Scientist	NARC
15	Bharat Bidari	AEO	DoA
16	Indra Bdr. Oli	Soil Scientist	SMD
17	Tej Bahadur Subedi	Soil Scientist	RSTL pokhara
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28	Basu Dev Regmi	Sc.Pro.Officer	SSMP
29	Nabin Hada	Sc.Pro.Officer	SSMP
30	Juerg Merz	International Program Officer	SSMP
31	Dhruba Dhakal	Soil Scientist	SMD
32	Aatmaram Lohani	SCDO	Post Harvest
33	Lakhanath Adhikari	SADO	DADO Myagdi
34	Iswar Pd Rijal	SADO	DADO Kavre
35	Niru Dahal Pandya	Chief	NICDP
36	Birendra Bahadur Hamal	SADO	DADO Syanja
37	Dandapani Khanal	SADO	DADO Dolkha
38	Basu Subedi	VDO	VDD
39	Shankar Bd Pradan	Expert	BSP
40	Bal Krishna Regmi	LDO	DLSO, Syanja
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S.N.	Name of Participant	Designation	Agency/Institution/Office
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64	Rajash choudary	Assistant	SMD
65	Sachet B Nepali	Pro Director	CDD
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Summary of the Recommendation

Amendment of norms of some programs, building proper monitoring system, scaling up of success SSM technology and capacity build up training for the staffs are some of the recommendations for improvement raised by the collaborative institute. These recommendations can be addressed by the joint effort of SMD and SSMP with proper coordination of DADO of program districts.