

## NARDF Technical Paper Series Report

### Abstract

The people in the proposed project area are being suffered by food deficit problems due to depletion and degradation of productivity of barilands and bari based cropping systems where people are largely poor farmers owning barilands alone. The productivity of the barilands could be enhanced through intervention of appropriate productivity enhancement technologies. In this endeavour, the project introduced and generated the appropriate technologies regarding IPNS for enhancement of productivity of barilands and widely disseminate among the farmers in the project area. The food insufficiency situation of 294 HH farmers through productivity enhancement of bari based cropping systems was revealed to have been reduced by 20-25% and the HH incomes of the project beneficiaries increased by 10-15% through promotion of high value vegetable crops. It was envisaged that the food security situation of 294 participating farming HHs improved by 50%. The methods like capacity building; introduction of new technology, participatory on the farm experimentation, demonstration, sustainable market linkage and development were employed to meet the purpose of this project. The results of the project included: (i) identification of appropriate IPNS technologies compatible to local situations, (ii) generation of location specific technologies regarding IPNS (iii) wider diffusion of new technologies regarding production and marketing of high value vegetable crops (iv) scaling up of new innovations in IPNS and promotion of high value vegetable crops through organized and sustainable marketing networks. These results supported the NARDF's focuses in increasing agricultural productivity of farming systems and generating additional household income by increasing inclusion of small farmers and women farmers in research and development activities. The results of this project was reported to wide ranges of end-users through training, stakeholders' workshop, travelling, seminar, publications, mass media broadcasting and so forth.

### Keyword

Bari based cropping systems, IPNS, High value vegetable, Market linkage

### 1. Introduction

Increasing food production to meet the needs of increasing population is a major challenge facing the country today. Crop production and population in Nepal have increased nearly parallel during the last 3 decades i.e. crop production and population were increased by 79% and 83% respectively Similarly, the cultivated land area was increased by 62%. The increased production is mostly due to the increment of land use intensity and expansion of land use (STSS, 2000). Almost all the marginal land has now been taken into cultivation and there is less chance to expand it in the future. So enhancement of soil productivity through maintenance of soil fertility is the only way to fill the gap between the crop production and its demand. Kavre is no exception regarding this.

Overwhelming majority of the population (89.61%) of Kavre earn their income from their own agricultural production and remaining 5.18% and 3.24% from off farm employment such as service and business & from miscellaneous subsistence activities respectively. The agricultural products of HHs in these areas are not sufficient enough even for 6 months. There seems to be food deficit problems. Given limited land base (0.8 hac)/HHs in the district, they have to increase production either through increasing productivity of land through IPNM or through agriculture diversification to more productive high value crops for increased income. Per unit productivity of the land in proposed VDCs is less than district and national figures. There seem acute problems of food security in the proposed VDCs. To cope up the food deficit problems in the area, the improvement of soil fertility for enhanced productivity through IPNS was seemed to be inevitable.

The people in the proposed project area were being suffered by food deficit problems due to depletion and degradation of productivity of barilands and bari based cropping systems where people were largely poor farmers owning barilands alone. The productivity of the barilands could be enhanced through intervention of appropriate productivity enhancement technologies. In this Endeavour, the project introduced and generated the appropriate technologies regarding IPNS for enhancement of productivity of barilands and widely disseminate among the farmers in the area.

The purpose of the project in Kavre was to ensure food availability situation and rural income generating opportunities to the rural poor by:

- Providing alternative opportunities to the project beneficiaries to be organized at the grass roots level to explore their potentiality for food availability and economic growth.
- Improving food unavailability (insufficiency) situation of the marginalized and poor resource base farmers through introduction of IPNS in barilands and bari based cropping systems in the project area.
- Providing alternative access to income generating opportunities through productivity enhancement of barilands and promotion of high value vegetable crops in the project area.

In general, the intended beneficiaries of the project were the disadvantaged groups of people and poor resource based small farmers in the area who were facing exclusion from normal service delivery on grounds such as inaccessibility, flaws in intervention process and approaches, disaggregated by gender, caste and ethnicity. Due to mass prevalence of food deficit problems of the rural HHs in the programme area, the following categories of the HHs were selected as the intended project beneficiaries.

- Farmers owning less than 0.5 hectares of cultivated land participated in the project activities for improved food security situation and additional HH incomes in the project area.
- Women, Dalit, ethnic minorities and poor resource base farmers were the direct beneficiaries of the project as these activities will be directly conducted by them

It is envisaged that the food insufficiency situation of 300HH farmers through productivity enhancement of bari based cropping systems would be reduced by 20-25% and the HH incomes of the project beneficiaries would also be increased at least by 10-15% through promotion of high value vegetable crops. The methods like capacity building; introduction of new technology, participatory on the farm experimentation, demonstration, sustainable market linkage and development were employed to meet the purpose of this project. The results anticipated from this project included: (i) identification of appropriate IPNS technologies compatible to local situations, (ii) generation of location specific technologies regarding IPNS (iii) wider diffusion of new technologies regarding production and marketing of high value vegetable crops (iv) scaling up of new innovations in IPNS and promotion of high value vegetable crops through organized and sustainable marketing networks. These results were envisaged to support NARDF's focuses in increasing agricultural productivity of farming systems and generating additional household income thereby increasing inclusion of small farmers and women farmers in research and development activities. The results of this project were reported to wide ranges of end-users through training, stakeholders' workshop, traveling, seminar, publications, mass media broadcasting and so forth.

## **2. Materials and methods (conceptual framework, data, model, methodology)1 ?**

The main concept of the project was to improve the food availability situation of marginal farmers by the enhancement of productivity of barilands and bari based cropping systems through introduction of IPNS in the project area. It was also linked with promotion and marketing of high value vegetable crops as an alternative access to income generating opportunities for economic enhancement, enhancing living conditions and supporting the food deficit problems of the project beneficiaries in the project area. The development objective of the program was to enhance the production of bari based cereal crops through IPNS for ensured food security situation of the project beneficiaries and the promotion of high value crops like vegetables as an alternative access to income generating opportunities on a self sustained basis. It was envisaged to fit with overarching theme of NARDF on grounds of "increased agricultural productivity of farming systems". The project was expected to help in up scaling; facilitating the growth of social capital, women advancement, environmental regeneration and social mobilization for enhanced productivity of barilands and bari based cropping systems for ensured food security situations in the project area. It was also expected to result in the production and marketing of high value vegetable crops as an alternative source of income generation, helping the economy and diversifying the agricultural production.

The project was implemented in group and participatory approach. Before organizing the farmer groups, a baseline survey was conducted among 294 HHs so as to identify the vulnerable conditions and identify the project beneficiaries in the project area. 15 farmer groups (FGs) disaggregated by gender, caste and ethnicity were formed and properly mobilized towards the project activities. Overwhelming majority of the FGs were homogenous women groups. In heterogeneous groups, the participation of women was more than 50%. Again, 15 leader farmers (LFs) one each from 15 groups was selected and properly mobilized in farmers to farmers technology diffusion process. Entire farmer groups were transformed into respective VDC level cooperatives. There are 4 such cooperatives one each in 4 program VDCs. These VDC level cooperatives were federated with district based cooperative office. Trainings to LFs on IPNS, SALT technology, agronomic practices, compost making, bokashimal, vermin-compost and green manuring practices were initially provided. The duration of such trainings was 3 days each. These trainings were provided at area levels. Having imparted these trainings, the respective leader farmers (LFs) were properly mobilized in delivering these trainings to their respective group members. The duration of such group level trainings was one day each.

An exposure visit to different agricultural stations such as IAAS, Rampur, Chitwan, Parwanipur, Janakpur, NARC, Khumaltar was organized by the effort of the project. Likewise inter CBOs/Groups exchange visits were also organized for sharing ideas & experiences, increasing mutual respect, trust and cooperation among the farmers in the project area. In initial phase of the project implementation, the soils of the participating farmers were tested so as to identify the fertility status of the soil. Again, this test was also made at the end of the project so as to measure the impact of project intervention. The second phase of soil test result have shown that the fertility status of the soil have been substantially accrued, the quality of soils of bari lands in the project area has been drastically improved.

Series of FLEs on IPNS and fresh vegetables (Normal, off season and organic) production

technology verification undertaken on selected farmers' fields. The verified IPNS and vegetable production technologies were promoted through farmers' field schools (FFSs). Direct supervision and on the spot guidance was provided by the PC, RA and LFs on FLEs and FFSs. SALT technology was introduced by the efforts of the project in the project area. Under this activity, living hedges in sloppy lands were promoted; undulated and steep lands were labelled for the improvement of the terraces, surface soil erosion of bari lands were controlled by the promotion of perennial plants in sloppy and steep lands, and contour farming was promoted. Further, the rain water harvest technology was introduced in Ryale VDCs in the project area. For this, a rain water harvest pond was constructed so as to harness the rain water and irrigate the bari land for enhancement of productivity of barilands and bari based cropping systems.

So as to improve the fertility status of the soils of barilands in the project area, legume integration was promoted. Legume integration (mixed cropping system) was promoted in existing cropping pattern. High value legumes like rajma bean, peas, French beans, soybean, black gram, horse gram etc were promoted as sole crops. This activity has greatly helped in maintaining the fertility status of the soils for enhanced production of main crops and providing additional HH incomes of the project beneficiaries through additional supply of nitrogen into the soils of bari lands. Similarly, leguminous forage grasses and fodder trees were promoted for maintaining the fertility status of the soil. The fertility status of the soils have been substantially accrued in the project area. In addition to this, the productivity of cattle, buffaloes, goat etc have also been enhanced through promotion of leguminous forage grasses and fodder trees.

Likewise, the better agronomic practices technologies were also introduced for enhancing the productivity of barilands and bari based cropping systems. The better agronomic practices included: proper crop variety selection, appropriate seed sowing and sapling/seedling transplantation, time and appropriate amount of fertilization, irrigation, time of weeding and intercultural operation, crop rotation, time of harvesting, insect pest management practices, row to row and plant to plant distances and so forth. In the same way, bio-intensive farming systems (BIFs)/Bio-secured farming systems were also promoted in the project area. While promoting the BIFs, the project beneficiaries were oriented and provided on the spot guidance in adopting the BIFs in all sorts of bari based cropping systems whether they are cereals, fruits, cash crops or vegetables. Besides this, the BIFs were promoted through participatory on farm demonstration and wider diffusion of the available technologies regarding BIFs.

The green manuring practices (incorporation of the nitrogen rich plant species into the soil) for additional supply of nitrogen in bari lands and bari based cropping systems was also promoted so as to enhance the productivity of barilands and bari based cropping systems. This activity was promoted through group orientations, participatory on farm demonstrations and wider diffusion of available technologies regarding green manuring practices. The sheds improvement packages were introduced in the project area for quality FYM production, proper utilization of liquid fertilizer like urine for enhanced productivity of bari lands and bari based cropping systems such as cereals, cash and vegetable crops for ensured food security and additional HH incomes in a self sustained way among the project beneficiaries in the project area. This activity was promoted through series of group orientations, participatory on farm demonstrations and backstopping supports like input supplies.

So as to promote the commercial vegetable farming and marketing activities, a 3 days' vegetable nursery raising and management training was provided to the LFs of respective

farmer groups. The trained LFs were then mobilized for delivering this training to their respective group farmers as per the farmers to farmers' technology transfer strategy. The same process was followed in delivering market development and networking, commercial vegetable production, off season vegetable production, plant protection trainings. The commercial vegetable farming and marketing activities were promoted through participatory on farm demonstrations, group orientations, trainings and back stopping supports like input supply such as improved varieties of seeds, plastic sheets & bags, equipments and so forth. Since the budget was not allocated for constructing the collection centre and micro irrigation schemes under infrastructure development activity, no such schemes were constructed. So as to promote the marketings of the fresh vegetables, market linkage and networking workshops were annually organized.

In the beginning, a project introductory workshop was held in participation, IA, collaborators, government line agencies, local government bodies and wide range of other stakeholders for informing the them about the project interventions. 3 stakeholders' workshops one each in 3 years' project period were organized at district headquarters. The project activities were followed up, monitored and evaluated in regular trimester bases. It greatly helped the project for sustainability and promoting the project outputs/ results. Trimester Review and Planning (TRP) workshops were regularly organized so as to review the progress and chart out the future planning in regular trimester bases.

For scaling up and wider dissemination of the technologies, participatory on farm demonstration activities were carried out at strategic locations in the project area. Numbers of extension materials like brochures, posters, pamphlets, booklets and leaflets about IPNS and vegetable production technologies were duly prepared and widely disseminated among wide ranges of relevant stakeholders in and around the project area. An audio-visual documentary was prepared about the project activities for wider dissemination. Mass awareness campaigns were carried out so as to aware and persuade the project beneficiaries and other wide ranges of stakeholders in the project area. A final technical report was duly prepared, published and widely disseminated.

### 3. Results

So as to identify the initial fertility status of the soils in the project, 15 tests of soils one each in 15 groups were done. The results of the initial soils test/research is presented below.

Farmer's Name	Farmer's Group Name	Farm Name	Soil pH		Nitrogen		Phosphorus		Potash		OM		Ag. lime recomm- ended (kg/R)
			Value	Category	%	Category	kg/ha	Category	kg/ha	Category	%	Category	
Sanukahcha Tamng	Srijanshil	Gairibari	5.2	A	0.2	M	20.14	L	249.5	M	3.25	M	218
Sukman	Lamadole	Thumki-danda	5.6	A	0.2	M	60.54	E	485.8	E	3.17	M	158
Saraswoti Tamang/Buddhi Tamang	Pragatishil	Lamcho bari	6.4	A	0.2	M	29.12	L	464.3	E	3.7	M	15
Mina Tamang	Phulchoki	Tallobari	6.5	N	0.2	M	87.46	E	478.7	E	3.83	M	0
Laxman Sapkota	Hariyali	Pallobari	6.3	A	0.2	M	249	E	958.5	E	3.77	M	40
Chandika	Abhiyan	Gharbari	5.5	A	0.1	L	87.46	E	192.2	M	2.91	M	170

Wagle													
Anju Sharma	Didibahini	Aagadibari	5.5	A	0.1	L	29.12	L	163.6	M	2.33	L	170
Ramita Bhujel/Sarmila Bhujel	Digo Mahila	Gharbari	4.9	A	0.2	M	177.2	E	213.7	M	3.51	M	252
Menuka Timilsina	Pragatishil	Bari	4.6	A	0.1	L	15.66	L	672	E	2.14	L	280
Suman Ghimire	Bhangeri	Tarbari	5.5	A	0.1	L	199.7	E	213.7	M	2.73	M	170
Rita Ghimire	Lilawoti	Gharbari	4.8	A	0.1	L	105.4	E	106.3	L	1.92	L	262
Sabitri Ghimire	Laganshil	Gharbari	5.1	A	0.2	M	195.2	E	177.9	M	3.01	M	228
Pabitra Humagain	Bagwani	Thulomunibari	6.5	N	0.1	L	20.14	L	364.1	E	1.89	L	0
Saraswoi Thapa	Bagwani Bikash	Pakhobari	6.4	A	0.1	L	42.58	M	185	M	2.1	L	15
Sita Humagain	Kolbhanjyang	Patobari	5.8	A	0.2	M	379.6	E	358.6	E	3.82	M	128

Source: Soil testing Report, 2007

Note: A: Acidic, N: Neutral, E: Excessive, M: Medium, L: Low

At the end of the project, the tests of soils of same farmers were done which are presented below.

Farmer's Name	Farmer's Group Name	Farm Name	Soil pH		Nitrogen		Phosphorus		Potash		OM	
			Value	Category	%	Category	kg/ha	Category	kg/ha	Category	%	Category
Sanukahcha Tamng	Srijanshil	Gairibari	5.5	A	0.25	M	188.9	E	473.1	E	3.29	M
Sukman	Lamadole	Thumki-danda	6	A	0.3	M	441.9	E	2226.5	E	3.77	M
Saraswoti Tamang/Buddhi Tamang	Pragatishil	Lamchobari	6.9	N	0.24	M	170.8	E	1145.7	E	3.75	M
Mina Tamang	Phulchoki	Tallobari	7	N	0.31	M	298.8	E	1037.5	E	6.19	E
Laxman Sapkota	Hariyali	Pallobari	6.5	N	0.90	M	260	M	968.5	E	3.87	M
Chandika Wagle	Abhiayan	Gharbari	6	A	0.16	M	97.46	E	1156.6	E	3.23	M
Anju Sharma	Didibahini	Aagadibari	6	A	0.18	M	80.4	E	431.1	E	3.56	M
Ramita Bhujel/Sarmila Bhujel	Digo Mahila	Gharbari	5	A	0.24	M	177.2	E	395.1	E	3.59	M
Menuka Timilsina	Pragatishil	Bari	5.5	A	0.17	M	57.8	M	431.1	E	3.32	M
Suman Ghimire	Bhangeri	Tarbari	6.5	N	0.18	M	381.6	E	1001.5	E	3.56	M
Rita Ghimire	Lilawoti	Gharbari	5.7	A	0.17	M	366.6	E	521.2	E	3.44	M
Sabitri Ghimire	Laganshil	Gharbari	5.9	A	0.25	M	374.1	E	491.1	M	3.71	M
Pabitra Humagain	Bagwani	Thulomunibari	7.5	N	0.17	M	359.0	E	2106.4	E	2.0	L

Saraswoi Thapa	Bagwani Bikash	Pakhobari	6.5	N	0.31	M	110.5	E	377.3	E	6.15	E
Sita Humagain	Kolbhanjyang	Patobari	6.0	A	0.21	M	389.6	E	773.4	E	3.84	M

Source: Soil testing Report, 2010

*Note: A: Acidic, N: Neutral, E: Excessive, M: Medium, L: Low*

#### 4. Discussion

As revealed by various studies, although the soil pH does not directly hamper the growth of the crops but it decreases the availability of plant nutrients to the crops species. It ultimately leads to diminished production of the crop species. Hence, there should be specific level of soil pH for the specific species of crops and crop varieties. So, the pH values of the soils needs to be identified for better yields of any crops in barilands and bari based cropping systems. The pH values of entire sample farmers were comparatively lower in the beginning i.e the soils of all farmers were acidic except Mina Tamang and Pabitra Humagain's soils. These soils were acidic in nature in the beginning because of parental sources (sources of origin of the soils), massive cultivation of barley, beans, cabbage, soybean etc that consume maximum amount of calcium and increase acidity into the soils, maximum use of acidic nature of chemical fertilizers like ammonium sulphate, urea etc that makes the soils more acidic (but DAP does not increase the acidity into the soil in that extent of ammonium sulphate and urea), precipitation during rainy season, decline and degradation of organic matters into the soils and so forth. But at the end of the project intervention, the pH values of entire sample farmers were found to have substantially increased which is mainly due to maximum use of organic fertilizers like FYM, urine, compost, vermi compost etc, use of agricultural lime and decreased trends of use of chemical fertilizers. For which farmer groups were trained, oriented, sheds improvement package programs were implemented, the earth worms were distributed.

Nitrogen is one of the major ingredients for the growth and development of plants. Hence the nitrogen contents of the soils of sample farmers were found having made soil tests in the soils laboratory. As revealed by the first lot's soil tests (in the beginning of the project implementation), the nitrogen contents of the sample soils were at lower and medium levels. Out of 15 soil samples, the contents of nitrogen of 7 samples were low i.e. 0.1% only whereas the contents of nitrogen of 8 samples were revealed to be medium i.e. 0.2%. In second round of soil tests, the contents of the soils of the sampled farms have been substantially increased which is due to legume integration, introduction of IPNS & SALT technologies, better agronomic practices, use of organic fertilizers like compost, bokashimal, vermi composting, green manuring practices, sheds improvement package programs and promotion of bio-intensive farming systems/ bio-secured farming systems. The increment in the contents of the soils of participating farmers have greatly contributed in desired production of bari based cropping systems in the project area.

Similarly, in comparison to 1<sup>st</sup> round of soil tests, the contents of the phosphorous in to the sample soils/farms were found to have been drastically increased which is certainly owing to the improvement in sheds, maximum use of organic manures like compost manure, vermi compost, use of bokashimal, use of phosphorous rich green manures like asuro, titepati, banmara, siris etc as a litter /bedding materials, use of phosphorous rich manures and fertilizers, less use of chemical fertilizers etc.

In the same way, the contents of potash in sample soils were also found to have been substantially increased which is because of maximum use of urines of cattle and buffaloes

which contains maximum amounts of potash (K), use of potash fertilizers at the time of seed sowing or transplanting, soil erosion control, use of ash (kharani), better agronomic practices, mulching, contour farming, relay cropping and so forth. Again, the organic matter contents of the ample soils have also been increased which is due to maximum use of organic fertilizers in the project area.

#### **5. Conclusion and implication**

Due to improvement in soil pH, contents of Nitrogen, Phosphorous, Potash and organic matters in the sample soils, we can conclude that the intervention of the project has greatly contributed in enhancing the productivity of barilands and bari based cropping systems so as to ensure the food availability situation through enhanced production and improve their vulnerable living conditions through promotion and marketing of high value vegetable crops in the project area. This project has been successful in achieving its goal and objectives in high degree of professional success. Since this project has played a pivotal role in improving the food availability situation of marginal farmers by enhancing the productivity of barilands and bari based cropping systems through introduction of integrated plant nutrient management system (IPNS), it is strongly recommended to be replicated in other areas and regions as well. Such project is very much cost effective, can be easily diffused among farmers, readily adoptable and can be implemented in a self sustained way.

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## 7. References

Bashu Dev Regmi, Kalidas Subedi, Tej Bahadur Karki, Naresh Ghimire and Ram Dular Yadav (2059), Kodobalika lagi yekikrit khadyanna bebasthapan margadarshak pustika.

Basu Dev Rgmi, Purussottam Dawadi and Tej Bahadur Subedi ( 2003), cauli bali ko lagi yekikrit khadyanna bebasthapan margadarshak pustika.

Basudev Regmi, Kalidas Subedi, Naresh Chandra Ghimire, Tej Bahadur Subedi and Ram Dular Yadav (2059), Gahubali ko lagi yekikrit khadyanna bebasthapan margadarshak pustika.

Bishnu Kumar Dhita, Kedar Budhathoki and et al (2062), Digo bhu bebasthapanmukhi tarkari kheti, Talim pustika.

Bishnu Kumar Dhital and Nara Hari Dhakal (2006), Digo bhu bebasthapanka lagi Sahabhagitamulak yojana tarjuma, anugaman tatha mulyangkan Talim pustika.

Bishnu Raj Kafle, Suresh Babu Tiwari and et. al (2000), Krishi prasar ka tarika haru (Talim pustika).

Chhabilal Paudyal, Bishnu Raj Kafle and Vijay Bajracharya (2059), Kisan-kisan krishi praar pranali, anubhabi aguwa krisak sewa sanchalan nirdeshika.

Dhruba Chitrakar, Nabin Hada and et al (2062), Krishak starma bazaar bebasthapan talim, Talim nirdeshika, 2064.

Jaishi Sadananda, Mandal Satya Narayan, Manadhr Ramita, Karki Tanka Bahadur and Maskey Kiranhari (2055). Matoko urbarashakti bebasthapan karya pustika, shree 5 ko sarkar, krishi bibhag, mato parikshen sewa sakha ra JICA, Nepal.

Kali Das Subedi, Basu Dev Regmi, Tej Bahadur Subedi, Naresh Chandra Ghimire, Ram Dular Yadav (2059), Makai bali ko lagi yekikrit khadyanna bebasthapan margadarshak pustika.

Kalidas Subedi, Basu Dev Regmi and George Webber (2059), Yekikrit khadya tattoo bebasthapan: yek parichaya pustika.

Kalidas Subedi, Dibhya Laxmi Bajracharya, Chhabi Lal Paudyal, Madhav Joshi, Bishombharnidhi Tiwari (2058), Koshebbali Prabardhan Talim Pustika.

Kalidas Subedi, Sadananda Jaishi, Tej Bahadur Subedi, Satya Narayan Mandal and Bishnu Kumar Dhital (2001), Gothemal tatha compostmal bebasthapan talim pustika

Kalidas Subedi, Tej Bahadur Subedi, Basu Dev Regmi, Naresh Ghimire, Ram Dular Yadav; (2059) Yekikrit khadya tattoo bebasthapan, barimato bebasthapan margadarshak pustika. Kalidas Subedi, Purnalal Maahrjan, Bhaba Prasad Tripathi and George Webber (2000), Digo mato bebasthapan talim pustika.

Maskey Kiranhari (2055), Mato ko namuna sankalan garne tarika, shree 5 ko sarkar, krishi bibhag, mato parikshen sewa sakha.

Ram Bhandari, Yubakdhoj GC, and et al (2062), Tarkari bari ma lagne mukkhe rog tatha kira haru ra tinko bebasthan, Talim pustika.

Sharma Govinda ra Koirala Rambabu (2055), Parma culture ma mato ra pani bebasthan, Nepal parma culture samuha, Kathmandu.

SSMP (1999), Different Training Materials for sustainable Soil Management Programme, GPO Box 688, Lalitpur, Nepal.

SSMP (1999), Tools for reflection on Soil Management, Sustainable soil Management Programm, GPO Box 688, Lalitpur, Nepal.

Subedi K.D (1993) Search of Indigenous Green Manuring Species in the Western Hills of Nepal. LARC Review Paper No. 93/2.

Vijay Bajracharya, Padnmasana Sakya and et al (2058); Digo krishi bikash ka lagi mahila-purush samanta bebaharik nirdeshika.

Weber G. (1998) Assessment of Nitrogen and Organic Matter Balances for Mid –hills Farming. Paper as part of a consultancy on " Sustainable soil Management" to PARDY P-ICIMOD and Helvetas.