SOCIO-ECONOMIC RESEARCH ON MANAGEMENT OF SOIL FERTILITY IN MID HILLS OF NEPAL

MAIN REPORT (VOLUME I)

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DECLARATION

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ABBREVIATIONS AND ACRONYMS

ADB/N	Agricultural Development Bank, Nepal
APP	Agricultural Perspective Plan
ARS	Agricultural Research Station
CBS	Central Bureau of Statistics
CF	Chemical Fertilisers
CV	Coefficient of Variation
DAP	Di-ammonium Phosphate
DFID	Department for International Development
DOI	Department of Irrigation
ECA	Extension Command Area
FYM	Farm Yard Manure
HH	Household
INGO	International Non-Government Organisation
JTs	Junior Technicians
JTAs	Junior Technical Assistants
KIS	Key Informant Survey
LARC/LAC	Lumle Agricultural Research Centre
masl	metres above sea level
MOA	Ministry of Agriculture
MOP	Murate of Potash
NARC	Nepal Agricultural Research Council
NGO	Non-Government Organisation
NK	Not Known
PAC	Pakhribas Agricultural Centre
PDDP	Participatory District Development Project
PRA	Participatory Rural Appraisal
RCA	Research Command Area
SFDP	Small Farmer Development Project
SFMP	Soil Fertility Management Project
SPIN	Special Programme in Nepal
SSP	Single Super Phosphate
t/ha	tons per hectare
TOR	Terms of Reference
TSP	Triple Super Phosphate
VDC	Village Development Committee
WDP	Women Development Project

CHAPTER 1

INTRODUCTION

1.1 Background

Being pre-dominantly an agricultural country, Nepal has to import substantial amounts of food grains from abroad (mainly from India) every year to feed the growing population. This food deficit situation is despite Nepal having a favourable agro-ecological condition, conducive climate and viable recommended technologies. The reasons for this situation are cited elsewhere but the efforts for combating the situation are not satisfactory (Mathema, 1996; Poudel, 1997; and Ninth PIan 1998). The analysis suggests that inadequate investment, diffusion of investment within the agricultural sector in the absence of proper prioritisation and insufficient availability of production materials in the market due to weak sectoral policies related to agriculture have mainly been responsible for the failure to significantly increase agricultural production and productivity (Ninth Plan, 1998). In addition, the difficult geographical setting, the compulsion to depend on the monsoon due to the lack of irrigation facilities and the traditional subsistence oriented a^{g}ricultural system have been the main problems for the development of the agricultural sector (Economic Survey, 1999).

The Ninth Plan highlights the importance of soil management to the country in the following way:

> "A system of soil testing at farmers' level for the proper application of chemical fertiliser has not been in vogue in Nepal. Enough attention has not been given to the mixed use of organic manure and chemical fertiliser. Therefore, there is considerable loss in soil fertility. Similarly, proper attention to cope with the depletion of soil fertility has not been paid. With the implementation of the Agricultural Perspective Plan (APP) and considering the increased use of fertiliser, there is a need to have soil management programme to maintain soil quality and fertility (Ninth Plan, 1998)."

Based on this, some measures are proposed under the agricultural extension programme to establish co-ordination between fertiliser use and soil management programme (Ninth Plan, 1998).

Clearly, the socio-economic survey on soil fertility management in mid-sills carried out in 16 Wards of four Village Development Committees (VDCs) of western and eastern regions of Nepal is timely. The results of the survey are discussed and interpreted in this report. Recommendations and policy implications are given which could be helpful for providing acceptable means of improving soil fertility, which will increase crop productivity and farmers' welfare.

1.2 Context

This study is conducted as a part of a collaborative project between the Agricultural Research Stations (ARS), Lumle and Pakhribas in Nepal and the University of Reading, UK entitled "Soil Fertility Management for Sustainable Hillside Farming Systems in Nepal". The project is funded by the Department for International Development (DFID) of the UK Government. The project's purpose is to determine those factors influencing the maintenance of soil fertility in the mid-hills of Nepal

and to develop better means of sustaining fertility through experimentation and the utilisation of existing knowledge gained in socio-economic surveys.

Gregory (1995) highlighted the need for research to address the pressing issues of soil fertility management in Nepal. He drew attention to the need to quantify current nutrient balances in specified farming systems and to derive management strategies that enhance the effectiveness of inputs and reduce losses (Gregory, 1996).

This study provides the project with an accurate socio-economic context and synthesises the existing local knowledge of hill farmers and their perception of soil fertility management both now and in the past, for various crops grown on different land types (that is, PakhoBari, Khet and Tar land) in the complex, diverse and risk prone mid-hill farming systems of Nepal.

An extensive socio-economic field survey was carried out in 16 Wards of four VDGs of three mid hill districts of the western and the eastern part of the country. The results derived from this surveys are important for the development of suitable soil fertility management packages based on needs of hill farmers and provides a bench mark study of farmers' concerns on the long-term sustainability of soil fertility in the mid-hills of the country.

1.3 Objectives

The main objective of this study was to assess farmers' perception of the status of soil fertility both now and in the past and to investigate their management practices.

The specific objectives are to:

1. Describe the existing situations of soil fertility in the surveyed sites;
2. Ascertain both past and present practices for the management of soil fertility on PakhoBari and Khet land and their relative importance by different categories of farmers;
3. Explore fanners' knowledge and perception towards the management of soil fertility;
4. ldentify socio-economic factors and their relationships which affect the management of soil fertility on both land types,
5. Determine how and where farmers decide to apply Farm Yard Manure (FYM) and chemical fertilisers;
6. Ascertain cropping patterns and practices on both land types and the major determinants;
7. ldentif}' farmers' constraints, reasons and solutions for adopting or not adopting various fertilisation practices;
8. Rank household income and expenditure in order of items sold and purchased and to show the relative position of chemical fertiliser within the ranking: and
9. Determine the gender differentiation between the activities identified above.

1.4 Organisation of the Report

This report has eight Chapters. Chapter 1 describes the general perspective and Ninth Plan's vision on soil management, the importance of socio-economic study on soil fertility management and the study's main and specific objectives. Chapter 2 reviews the literature on farmers as well as researchers' perception on soil fertility management. The field survey methods used to attain the objectives are discussed in Chapter 3. General information on the study area is presented in Chapter 4. The results of field surveys using the Key Informants Survey, Participatory Rural Appraisal (PRA) techniques and group discussion and the household survey are discussed and interpreted using tables, figures and maps in Chapter 5, 6 and 7 respectively. Finally, Chapter 8 contains the summary, conclusions, policy implications, recommendations and areas of further research.

CHAPTER 2

REVIEW OF LITERATURE

A review of the literature establishes the existing state of knowledge regarding the soil fertility issues as perceived by the farmers and researchers. In this chapter, the outcome of this review of the literature is presented in two parts with regards to the soil fertility, namely farmers' perception and researchers' perception.

2.1. Soil Fertility -Farmers' Perception

2.1.1 Classification of Soil

According to Maskey and Joshy (1991), farmers use a variety of criteria to classify soils but soil colour is the dominant criterion. The black colour group has soil characteristics (such as moisture retention, internal drainage and texture) and management practices, (such as labour, compost and fertiliser application and yield).

However, Tamang (1996) indicated that soil colour, texture, depth, consistence, internal drainage and moisture retention capacity, temperature regime, slope, aspect and elevation and management implications (source of water, labour requirement, compost and/or chemical fertiliser required and yield) were factors considered by farmers of Kavre, Sankhuwasabha, Syangja and Lamjung districts when classifying soils. She also pointed out that the physical aspect of the soil more or less determines the management re[g]ime. With sufficient amount of water, compost, labour, and a suitable climate and appropriate management, any soil can be made fertile and productive. The darker the soil the more organic material is present and the more fertile the soil is likely to be.

2.1.2 Soil Fertility and Factors Contributing to its Decline

There is a growing concern among researchers, development workers and planners that agriculture productivity is declining. Farmers themselves believe that soils are not as fertile as they once were and in general, cultivated lands are degraded. Soil fertility is considered to be the main constraint for increased production (Vaidya et. al, 1991). Declining soil fertility is a concern for the majority of farmers, regardless of land type (Turton et. al., 1995). In a group of villages, namely Navatola, Landruk, Deurali, Arman, Pany and Tanchok, the farmers reported a decline in soil fertility on PakhoBari land.

Kiff et. al., (1995) noted that crop yields are more stable on Khet land due to the availabilit. of irrigation water and thus underlying trends in soil fertility are more apparent.

Overall, Turton et. al., (1995) mentioned that soil erosion is the most important factor for declining soil fertility on PakhoBari land. This was followed by the closely interrelated factors of declining rates of FYM/compost application, degradation of forest resources and changes in the livestock management systems such as the decline in in-situ manuring practices. These factors affect soil fertility status at high altitudes. Only in Khet land, soil fertility decline was associated with low and/or declining FYM /compost application.

Based on the review of studies conducted by Kiff et.al. (1995) in the western and eastern hills, it appears that increased cropping intensities, declining livestock numbers, losses of fertile top soil and a reduction in the rate of FYMlcompost application have singly or in combination, contributed to a decline in soil productivity. Therefore, the major causes for soil fertility- decline were those mentioned above together with a shortage of fodder and grazing land leading to a decline in livestock numbers.

klowever, Tamang (1996) found that labour is the key component in the management of soils, and both its (that is, labourers) quality and quantity are important. In overall, there is a further decrease in a[g]ricultural productivity due to shortage of high quality labour. Kiff et. al. (1995) states that despite the labour shortage due to out migrations and schooling of children and forest product depletion reported in almost all locations, soil productivity was maintained in five villages through the maintenance of organic matter applications and the supplementary use of chemical fertilisers. The alternative source of constituents of organic manure was obtained through the collection of pine needles and other bedding materials from a distance.

Kiff et, al. (1995) further elaborates that there is strong and widespread message of a decreasing trend in crop yields on rainfed and irrigated land. This is often accompanied by an overall increase in productivity at the farm level due to an increase in cropping intensity on same land. Greater cropping intensity, particularly the use of improved varieties and cultivars of winter cereals on irrigated land has led to an increase in the amount of nutrients being extracted from the system.

Farmers perceive that soil fertility is declinin[g] in the maiority° of locations irrespective of land type (]oshy et. al., 1995). The major reasons reported to be responsible for this decline are the decline in manure output due to the shorta[g]e of green matter either for feeding or bedding material, crop intensification, decrease in grazing lands and closure of the community forest for collecting fodder, grasses and leaf litter as a result of which livestock are becoming more dependent on cultivated crops.

Because of these changes, the livestock management system is increasingly changing to a semi-extensive or stalls fed system around urban and peri-urban centres. Labour shortage due to out-migration and schooling of children is common. Loss of fertile top soil by rain water, reduction in in-situ manuring practices, irnbalanced use of chemical fertilisers in Khet land are the other reasons reported as being responsible for declinin soil fertility.

In some locations, the soil fertility is increasing because of an increased output of dung due to the adoption of a stall feeding system, incorporation of leaf litter on the farm and protection of top soil by orchard plantation.

2.1.3 Soil Fertility Management

In the mid hills. soil fertility is maintained largely by application of compost and manure (Riley, 1991). Pakho/Bari hand usually receives several times as much compost as does Khetland. A second method of maintaining soil fertility is through in-situ manuring. Farmers indicate that the urine and dung of buffalo tethered for several days in one location in a field axe equal to a heavy application of compost. Other methods of maintaining soil fertility are the trapping of flood water. cutting and camying natural green manure species into rice paddies and using grain legumes in rotation.

Turton et. al. (1995) indicates that increasing use of FYM compost on Khet land and application of chemical fertilisers has increased the overall supply of nutrients.

Relative importance of soil fertility management practices includes.

	Khet	Pakho/Bari
FYM/compost	√	√
Chemical fertiliser	√	√
Burning of trace	√	√
Legumes	√	√

In her study, Tamang (1996) mentioned that the farmers' soil fertility management svstem emphasises the overall improvement of soil structure and the provision of a source of plant nutrition. Improving the soil structure not only provides a better environment for plant growth; it also positively impacts water management and reduces labour requirements. The yield of potato in Pakbo/Bari in Kavre, using compost and chemical fertiliser together is higher than when one is used separately. Adding chemical fertiliser accelerates the decomposition of vegetation. The negative effects of fertiliser are reduced when compost is applied.

She further added that the compost made only from vegetation is useful for improving aeration and for regulating water percolation and for increasing moisture retention. Due to decreasing amount of available vegetation and lack of labour, this type of compost is no longer common. But farmers have found that chemical fertiliser alone is not sufficient to maintain production and good texture of the soil.

Sthapit et. al. (1988) focus on the fertility in cultivated land and reported that major source of maintaining fertility of land in triple cropping Khet and PakhoBari land in low altitudes include trapping flood water in the field, use of green manuring, FYM and compost, fertiliser, inclusion of legumes in rotation and practising short fallow. Similarly in Pakho/Bari land, application of FYM and compost, inclusion of legumes in crop rotation, recycling of crop residue and plant materials, growing of green manure plants and use of fertiliser are the common practices. The value of FYMicompost is well recognised by the farmers but this practice is limited by its requirement for labour and by its requirement for a fairly, fixed ratio of cropland, forest land and grazing land.

2.1.4 Reasons for Declining Animal Manure

Tamang (1996) indicates that the amount of compost available is insufficient for the following reasons:

a. A declined in preferred species;
b. Shortage of fodders ernsurinn fewer livestock;
c. An increased (amount) need for compost due to the introduction of'winter crops in some areas and continuous cultivation Nvhich does not allow for land to be left fallow: and
d. A shortage of labours (Most children nov attend school and free adults are no longer available. Young men have to go to urban areas to earn cash for school expenses, chemical fertiliser and food).

The study in mid hills by Riley (1991) shows that the farmers do not have sufficient compost for the followinᵍ reasons:

a. Decline in preferred species of soil and Kaivo leaf litter to make compost,
b. Conversion of some areas of forest into Khar bari or agricultural land;

c. Shortage of fodder leading to fewer livestock; and
d. Increased need for compost with the continuous cultivation (with no fallow land).

Likewise Sthapit et. aI. (1988) found the following reasons for decrease in amount of manure:

a. Intensification of cropping (reduction on communal grazing land);
b. Rapid deforestation; and
c. Schooling of children or manpower constraints for supervising livestock resulting small number of livestock population.

It is increasingly noticed that most school girls do not Iike to carry and handle compost and manure in the field.

2.1.5 Difference in Nutritive Value of Animal Manure

Ghani and Brown (1997) observe that the contribution of livestock to soil fertility management systems particularly in cultivated land in the western mountains of Nepal is vital despite the declining trend in the number of livestock, particularly cattle. Cattle account for over half of the total quantity of manure output from total farm animals in the country. Efforts to improve efficiency of FYM production, improve its quality and also conserve the manure resources could help to compensate for declining output from livestock.

Farmers recognise that various farm animal manures have different nutritive value and that some add little to the fertility of the soil (Tamang, 1996). Chicken manure has the hi[g]hest nutritive value and buffalo manure the lowest. However, chicken manure is not widely used.

However, Sthapit et. al. (1988) cites that the main source of manure seemed to be large animals such as cattle and buffalo. Sheep, goats and poultry are other important sources of animal manure. Buffalo/cattle manure is good for arable crops such as maize, potato, rice, wheat, millet and upland rice. Sheep and goat manure are good for rice and millet nurseries (after grinding only). Riley (1991) is of the opinion that great differences exist in the effectiveness of compost made from the manure of various livestock. Most effective is chicken, second goat, third cattle and fourth buffalo.

2.1.6. Division of Labour for Soil Fertility Management

Tamang (1996) cites that collection, processing, transportation and application of all the materials used for soil fertility management is women's work. Men are usually involved in using chemical fertiliser and pesticides. Construction, repairing and scrapping terraces making and maintainin[g] waterways and canals and everything concerned with water mana[g]ement is done by men.

Expressing a similar view, Turton et. al. (1995) emphasises that women play a major role in the carryin[g] of FYM/compost and bedding materials, cleaning the shed, spreading FYM/compost on the field and cutting and carrying of grasses. Men play a key role in trapping flood water, turning of FYM/compost heap and work related to both. The role of children has declined in recent years as the number attending school has increased.

2.1.7 Chemical Fertiliser

Application of chemical fertiliser is considered as essential to increase the crop productivity. However, the availability of the right kind of fertiliser seemed to be a matter of concern (Sthapit et. al., 1988). Most small farmers reported high cost of fertiliser as the reason for not using it. Some

farmers in Syangja district complained that continuous and overuse of chemical fertiliser caused the deterioration of soil structure, and posed difficulties for ploughing.

A large number of farmers emphasised the negative effects of chemical fertiliser on soil fertility of both Khet and PakhoBari land. The problem is more common on Khet land, where higher doses of fertiliser are used and FYM/compost application rates are lower.

Kiff et. at. (1995) indicates that the extensive use of urea might be attributed to relatively cheaper price of urea, owing to the government subsidy and limited choice of other fertiliser. Di-ammonium Phosphate (DAP), potash, Triple Super Phosphate (TSP) and Complexal were reported to be applied as basal dressing.

2.2 Soil Fertility - Researchers' Perception

A limited number of study findings are available to indicate researchers' perception on soil fertility

2.2.1 Classification of Soil

In the context of Nepal, Kiff et. al. (1995) states that the soils of Nepal are young and the underlying rock strata are steeply tilted, leading to variation in parent material within a few meters. This gives rise to considerable variation in soil texture, depth, colour and clay mineralogy over short distances.

The majority of hill soils have reasonable depth and good structure with little genetic development. The range of soils produced is of light to medium texture, easily worked, permeable and having a good water holding capacity. However, they are likely to be inherently infertile because clay contents are low and cation exchange capacity of the clay produced from the siliceous parent material is also low. In the absence of organic matter to increase the cation exchange capacity, there is potential a rapid loss of nutrients through leaching.

Based on researchers' classification of soil, Kiff et. al. (1995) mentioned that almost all of the cultivated soils in the hills belong to one of four orders: Inceptisols, Entisols, Alfisols and Utisols, with the majority belonging to Inceptisols.

Ghani and Brown (1997) indicates that soil fertility includes the study of organic carbon, total nitrogen, total sulphur, and cation exchange capacity, exchangeable potassium and soil pH. In general, soil fertility is poor in most of the field sites monitored in the Special Programme in Nepal (SPIN). In particular, levels of exchan[g]eable K and S are very low. Out of nine monitoring sites, eight sites had hi[g]h amounts of non-exchangeable K, which means that in the short to medium term, these soils will be able to meet plant K needs adequately. Sulphur reserve in soils is generally poor.

Organic matter and total N levels are also low. Organic matters need to be improved b[y], incorporating some of the straw and non-edible plant residue back into the soil. Soil pH levels in the western sites appeared to be satisfactory compared to the eastern region soils (both from hills and terai). Applying some lime to increase the pH can increase fertiliser responses further.

Tripathi (1997), in his study, in the locations of the Extension Command Area (ECA) and the Research Command Area (RCA) of Lumle Agricultural Research Centre (LARC) showed soil properties like pH, organic carbon, C/N ratio, total N, available P and exchangeable K. About 85 percent of samples were low to medium in total N, C/N ratios are relatively high indicating the organic matter is relatively low in N content. Available P level is at a medium to high. Sixty percent of

exchangeable K values are in range of low to medium in the soil. The study also shows that Khet land had significantly lower (P = 0.05) levels of P, organic carbon, total N, available P and exchangeable K indicating that Khet land is usually less fertile than Pak-ho/Bari land.

2.2.2 Soil Fertility Decline and their Management

Important factors contributing to soil fertility decline in low and mid altitudes are the use of improved varieties and the diversion of FYNVcompost away from Pakho/Bari land to meet the increasing fertility requirements of Khet land. A crop cut survey and associated data suggest that Pakho.Bari soils are relatively fertile because they receive the majority of applied FYNVcompost (Tripathi, 1997).

Tripathi (1998) in another study shows that after four years of trials, 10 tons of FYM per hectare in each rice and wheat gave similar yield to that of balanced NPK. However, application of such a large amounts of FYM is not practical for farmers. So, only 50 percent N should be provided through organic matter and the rest should come from chemical fertilisers.

Tripathi, (1996) further emphasised that a combination of organic and inorganic fertiliser could be better for maintaining and improving soil fertility, as well as for increasing crop productivity in the long term.

CHAPTER 3

METHODOLOGY

The information were collected mainly from the key informants and the household (HH) heads on the basis of the Terms of Reference (TOR) of the Consultant and the objectives of the study. A set of criteria, which are listed below were used in selecting the Wards of four VDCs within three districts representing eastern and western mid hill regions of Nepal. After selection of these Wards, Key Informant Surveys (KIS), Participatory Rural Appraisal (PRA) techniques and group discussion with farmers, and Household (HH) surveys were employed to collect the necessary information related to socio-economic aspects on the management of soil fertility in the mid hills of the country.

3.1 Selection of Study Area

Pakuwa VDC of Parbat district (in western hill region), Bhanu VDC of Tanahu district (in western hill region), Pakhribas and Murtidhunga VDCs of Dhankuta district (in eastern hill region) were purposely selected for this study. These areas were initially identified by the joint mission of the Agricultural Research Stations (ARS), Lumle and Pakhribas/Nepal Agricultural Research Council (NARC)/the University of Reading for the implementation of the project entitled "Soil Fertility Management for Sustainable Hillside Farming Systems in Nepal". The goal of the project is to improve the sustainability of commodity production systems through enhanced soil fertility. To meet the goal, the purpose of this project is to determine those factors influencing the maintenance of soil fertility in the mid hills of Nepal and to develop better means of sustaining soil fertility through on-farm experimentation and the utilization of existing farmers' knowledge gained in field surveys.

Four Wards from each VDC were selected which represent the respective VDC in terms of geographic location. In selecting the Wards, the local people, locally hired enumerators, ARS, Lumle and Pakhribas sites based staffs were closeiv consulted and their advices were taken into consideration. In addition, the following criteria were taken into account in the process of selecting the Wards.

(i) Households representing all four food self-sufficiency categories, that is, food sufficiency for less than or equal to 3 months, 6 months , 9 months and more than or equal to 12 months*:
(ii) Households representing all of the major ethnic groups of local importance:
(iii) Existing Khet, Pakho/Bari, and Tar land with the pre-dominant cropping patterns of (a) rice-wheat (Khet); (b) maize and finger millet (PakhoBari); and (c) upland rice and blackgram (Tar);
(iv) Wards «ith on-farm soil fertility management trials being conducted and other nearby Wards:
(v) Accessibility of markets for products;
(vi) Availability of crop technologies;

*If a farm family has adequate food to feed family for 12 months or more by production from their farm, such family of a household is defined as self-sufficient in food.

(vii)Farmers' willingness to participate in the future soil fertility and production programme; and
(vii) Areas under ARS, Lumle and Pakhribas out-reach command area.

3.2 Sampling Procedure

Each VDC has nine Wards, out of which, four Wards were selected from each pre-identified district. Hence, from three districts and four VDCs, altogether 16 Wards were selected for the field survey. They were as follows:

Table 3.1: Sixteen selected Wards from four VDCs of three districts for field survey, 1999.

PARBAT DISTRICT		TANAHU DISTRICT		DHANKUTA DISTRICT			
Pakuwa VDC	Ward Nos.	Bhanu VDC	Ward Nos.	Pakhribas VDC	Ward Nos.	Murtidhunga VDC	Ward Nos.
	1		1		3		1
	4		4		6		2
	5		7		7		5
	6		8		8		9

These Wards were purposely selected for the field survey to fulfill the purpose of the study.

3.2.1 Key Informant Survey

For KIS, two knowledgeable farmers from the group in each Ward (one male and one female) were selected for interviews. The group members also recommended these respondents.

3.2.2 PRA and Group Discussion

The participants of PRA and group discussion were the villagers who had been informed previously by the Ward Chairman of each Ward. The numbers of participants in PRA and group discussion varied for each Ward with representation of both male and female. Information gathered through PRA techniques and by group discussion was based on the members who attended the group discussion.

Tables 3. 2 and 3.3 show the number of participants in group discussion at surveyed Wards.

Table 3.2: Total number of participants in group discussion at surveyed Wards of Pakuwa VDC, Parbat District and Bhanu VDC, Tanahu District, Western Region, 1999.

S.NO.	VDC	WARD NO.	PARTICIPANT IN GROUP		
			Male	Female	Total
1	Pakuwa	1	11(79%)	3(21%)	14
		4	4(57%)	3(43%)	7
		5	7 (64%)	4(36%)	11
		6	8(62%)	5(38%)	13
2	Bhanu	1	16(67%)	8(33%)	24
		4	7(70%)	3(30%)	10
		7	13(59%)	9(41%)	22
		8	12(71%)	5(29%)	17

* Figures in parentheses are a percentage.

Table 3.3: Total number of participants in group discussion at surveyed Wards of Pakhribas and Murtidhunga VDCs, Dhankuta District, Eastern Region, 1999.

S.NO.	VDC	WARD NOS.	PARTICIPANT IN GROUP		
			Male	Female	Total
3	Pakhribas	3	11(69%)	5(31%)	16
		6	7(64%)	4(36%)	11
		7	12(67%)	6(33%)	18
		8	10(62%)	6(38%)	16
4	Murtidhunga	1	6(40%)	9(60%)	15
		2	15(75%)	5(25%)	20
		5	7(64%)	4(36%)	11
		9	14(70%)	6(30%)	20

* Figures in parentheses are a percentage.

Except in Ward no. 4 of Pakuwa VDC, ten or more participants attended the group discussions. At least, three females were involved in the group discussion. Female representation ranged from 21 to 60 percent of the total group members but was 35 percent on average.

The persons who were recommended by the groups drew the agro-enterprise maps.

3.2.3 Household Survey

A systematic sampling procedure was followed for the household survey. A two stages purposive sampling method had been adapted as the sample design for the HH study. First, the sampling of Wards from pre-identified VDCs was carried out and then the sampling of respondents from within the Wards was performed. Four Wards, that best represented the particular VDC in terms of geographic location and also based on knowledgeable key informants were selected for household survey. From each of these Wards, 32 respondents (that is, 16 males and 16 females) were interviewed thus making the total sample size of 512. These 32 respondents were selected random]}, from each Ward. A name list of the HH heads was obtained from the group discussion and from the Ward Chairman, after allocating the households into four food self-sufficiency categories, eight respondents were selected at random from within a category. Half of the interviewers were female who were purposively selected to assess the perception of female farmers in relation to soil fertility management practices in their respective Ward. In each Ward, four categories of farmer respondents were identified on the basis of their food self-sufficiency level. Four levels of food self sufficiency ranking employed during the field survey include the households with food sufficiency for (i) less or equal to 3 months (ii) 6 months (iii) 9 months, and (iv) 12 months or more.
The sample size is presented below in Table 3.4.

Table 3.4: Sample size for household survey at four Wards of four VDCs, 1999.

S.N	VDC	SAMPLE NO.	FOOD SELF-SUFFICIENCY FOR				
			≤3 months	6 months		9 months ; ≥12 months	
1	Pakuwa 4 Wards	128					
	Male		64	16	16	16	16
	(Female		64	16	16	16	16
2	Bhanu (4 Wards)	128					
	(Male	I	64	16	16	16	16
	Female		64	16	16	16	16
3	Murtidhunga 4 Wards	128					
	Male		64	16	16	16	16
	Female		64	16	16	16	16
4	Pakhribas 4 Wards	128					
	(Male		64	16	16	16	16
	Female		64	16	16	16	16
	Total		512	128	128	128	128

3.3 Sources and Methods of Data Collection

3.3.1 Key Informant Survey

Based on the feedback given by local people, local enumerators and site based ARS's Lumle and Pakhribas staff, the knowledgeable male and the knowledgeable female key informants were selected for interviews from those participants who attended the group discussion. The questionnaire on KIS was prepared before going to the field. It was designed to find the trends in soil fertility on both PakholBari (Upland), Khet (Lowland) and Tar land to identify the reasons for this, and to gauge the relative importance of these reasons. A sample of the KIS questionnaire is given in Annex 1. The following information was collected using this questionnaire.

(i) General information about the Ward;
(ii) Farmers' perception on soil fertility in PakhoBari, Khet and Tar land;
(iii) Soil management practices in PakhoBari, Khet and Tar land;
(iv) Practices followed by farmers in compost making, FYM, green manuring, and chemical fertiliser application;
(v) Constraints in soil management practices;
(vi) Ranking of different organic and inorganic fertilisers in terms of fertility and their quality.
(vii) Types, doses and uses of chemical fertilisers;
(viii) Credit;
(ix) Markets;
(x) Land types and area; and
(xi) Food self-sufficiency.

A number of steps were followed during KIS. After deciding the Ward numbers of each VDC to be surveyed, and after selecting both key informants (one male and one female) of each Ward, a brief introduction was given to the key informants about the objective of the survey. Members of the Consultant Team including the Team Leader interviewed the selected key informants. In most cases, the selected key informants were old, experienced and knowledgeable villagers. After completing the interviews with the key informants of each Ward, the information gathered from two Kev Informants were compiled to make it one. Some discrepancies and biases found were checked in the field to minimise errors.

Altogether, 16 males and 16 females key informants were interviewed from 16 Wards of four VDCs of three districts. Each interview took about two hours. The results of KIS are presented in chapter 5.

3.3.2 PRA tools

The following PKA techniques were employed to generate a detailed picture of the villages. The techniques used were (i) Time Line, (ii) Agro-enterprise Maps, and (iii) Well-being Ranking

3.3.2.1 Time Line

This approach was a good "icebreaker" at the group discussion for buildin[g] rapport with the farmers of the village and showing an interest in the area and their lives. It involved a general discussion with the farmers of the community about significant events and activities that took place at the village in the past. The group members were allowed to discuss among themselves to recall dates for every important event that occurred in the village.

3.3.2.2 Agro-enterprise Map

The aim of mapping was to allow villagers to express their perception of location, cropping patterns and available local resources or facilities. The farmers of each selected Ward drew agroenterprise maps showing various enterprises available at the village. Major enterprises were generally crops, animals, fish and orchards. Non-agricultural enterprises such as houses, village roads etc. were also drawn in these maps.

33.2.3 Well-being Ranking

Well-being ranking was used for finding out the relative economic status of different members in a group by interviewing key informants of the group for identifying criteria for each economic sub-groups and for classifying the community accordingly. Food self-sufficiency for the whole year was an indicator of well-being in the village community. If a family has adequate food to feed family members for the whole year or more by production from their farm, such family is self-sufficient in food. For the purpose of this study, well-being ranking was done with the group of farmers to classify the farmers of the village in the following four categories:

a) Farm families with food self-sufficiency for less than or equal to 3 months from their own farm;

b) Farm families with food self-sufficiency for 6 months from their own farm;

c) Farm families with food self-sufficiency for 9 months from their own farm: and

d) Farm families having adequate food produced from their own farm for 12 months or more;

First of all, a list of HHs with the names of HH heads was prepared in close consultation with the group members. After having a complete list of HHs of each Ward, the farmers who attended the group discussion were requested to categorize them into above four categories. In some Wards, the names of the HH heads were available beforehand from the Ward Chairman. With the access from him, those lists were used for well-being ranking in some Wards to categorise the total HHs in above four cate[g]ories.

3.3.3 Group Discussion

Group discussions with farmers of all selected Wards of four VDCs were held at the villages. The importance has been attached to group discussions for identifying the various socio-economic aspects related to local soil fertility and the management practices followed by the farmers from different villa[g]es. The approach was participatory in the sense that the villagers who attended

group discussions were given ample opportunities to express their opinion on soil fertility and management, their related problems and solutions.

There was no set rules in selecting the members for group discussions except the representatives should be both male and female farmers. It was initially anticipated the attendance of at least six male farmers and six female farmers for group discussions at each selected Ward. Hence, an official letter written by the Station Chiefs of both the Agricultural Research Stations, Lumle and Pakhribas was handed to the respective Ward Chairman a day before to gather at least 12 farmers (6 males and 6 females) for discussion on soil fertility and management issues. Despite of variations on representation of expected numbers and anticipated equal male and female farmers, there was no problem encountered in gathering the farmers and in conducting the group discussion. In each group discussion, the purpose of gathering was first explained in brief and a short descriptive circular letter about the objectives of discussion was handed to the participants. They were requested to answer the questions from their perception. The checklist and unstructured questionnaire were used during group discussions. There were interactions on various issues and information gathered out of discussions was noted down.

All group discussions were found useful in gathering information related to various issues of soil fertility and management aspects. In many cases, the participants of the group were encouraged to discuss among themselves to answer the questions. It took about one to one and half-hour to complete the group discussion process. There were sixteen group discussions held at sixteen selected Wards and their results are presented in chapter 6.

3.3.4 Household Survey

The household survey had been conducted by interviewing the sample respondents using structured questionnaire. The questionnaire was first prepared in English and then translated into Nepali. The questionnaire thus prepared was pre-tested in Lele village of Lalitpur district to make sure that the respondents really understand the designed questions and could answer them to our level of expectation. The questionnaire was finalized after making necessary corrections based on pre-test results. A sample of the HH questionnaire is given in Annex II.

The survey team interviewed both male and female respondents representing four food self-sufficiency categories. The respondents also represented diversed ethnic groups including unprivileged classes.

The required enumerators for the household surveys were recruited locally at all surveyed VDCs. Their educational background varied from high school to graduate level. However. the qualifications along with their previous work experience in similar work were the criteria followed while recruiting the enumerators for the survey.

The training for the enumerators in the art of interviewing and the completion of the questionnaire were organized in the field itself prior to their engagement in assigned duties of inten~iewina. The training was given on the objective of the study. practical methods of interviewing, data collection and data conversion methods, and more importantly in the explanation of terminology and questions used in the questionnaire.

In total, 12 enumerators per VDC (6 males and 6 females) were deputed in the field supervised by two experts who ensured that they correctly collected information in an efficient manner. The quality of data collection by each enumerator was maintained by checking the completed questionnaires, shortcomings were explained to them to avoid repeated mistakes.

All questionnaires were cleaned and edited and local units, particularly, hal, muri, pathi etc. were converted into the standard ones. The information was then coded appropriately before entering them into the computer.

3.3.5 Secondary Sources

Secondary data have also been sought relating to soil fertility and its management. They have been particularly useful in identifying initial questions or hypotheses to be tested using the results of the surveys in this study. Land use maps, soil maps, agro-climatic or rainfall type maps, elevation or topographic maps and aerial photos are good sources of secondary data. Other sources of useful secondary information include weather stations, agricultural census, population census, government and project records, previous field trials, research records etc. In the process of this study, some secondary sources of data were population census data by Ward and by VDC, ARS Lumle and Pakhribas research records and occasional papers, field trials information of the sites and population records from the Ward Chairman. Secondary sources also included some important general information related to the issue which were extracted from various reports, proceedings and personal communication with scientists and farmers. The chapter 2 has more details of it.

3.4 Methods of Data Analysis

The steps taken in analysis of data were as follows.

3.4.1 Analysis of Key Informant Survey Data

The responses to the KIS questionnaire were checked, cleaned and edited before being processed. The information gathered from both male and female key informants was cross checked and compiled for tabulation.

Based on the KIS questionnaire, the dummy tables were prepared. Some qualitative and quantitative information was directly transferred from the questionnaires to those tables. Some new tables were also created particularly on reasons given by the respondents about the soil fertility trend and their ranking. The hand calculator was used to make the calculations on percentages, proportions etc. and the results are presented in numbers of tables.

3.4.2 Analysis of PRA information

Information generated through the time line approach was compiled with dates and major events for each VDC, by the amalgamation of data from the four surveyed Wards. The dates were presented chronologicaIIv with corresponding events for each Ward in the form of tables. Each table is self-explanatory. The major event-occurring in the past in each Ward indicate the historical scenario. Interestingly, the farmers were able to recall dates related to major events. The events like drought, hailstorm, heavy rainfall, use of improved seeds and chemical fertilisers, death of animals due to diseases etc. were of particular importance for future agricultural planning.

The a^{g}ro-enterprise maps drawn by the selected farmers were reduced to A4 size paper with inclusion of all boundaries, major enterprises and non-enterprises. The maps of all Wards were

prepared by copying from the chart paper and various colours were used to make them more attractive.

The members of group discussions were asked to group households into four categories for well- being ranking using already prepared list. After repeated verification of the validity of categorisation, a random sample of HHs was drawn in proposition to the size of the group. In some Wards, size of groups for each category were unevenly distributed thereby making difficulty for random sampling of respondents for household surveys. As anticipated, 50 percent- of male respondents and 50 percent of female respondents were selected and both trained male and female enumerators were used for interviewing them.

A table is created showing the number and percentage of HHs for each category, which explains the distribution of HHs in each category and it is presented in chapter 6.

3.4.3. Analysis of Information of Group Discussion

Mostly qualitative data, which were gathered through group discussions, were compiled for each Ward. Initially, a separate group discussion and appraisal was planned for male and female respondents. However, this was not possible because in most surveyed Wards fewer females that anticipated participated in the discussion.

All information noted down in the diary and tapes were reviewed on Ward basis. This information was divided into qualitative and quantitative groups. The qualitative information was presented in sentences based on information gathered through group discussion. They include present practices, improvement of soil fertility, use of chemical fertilisers, FYM, compost, green manuring, farmers' perception, changes in cropping practices and income and expenditure and their ranking. Some quantitative information such as types and doses of chemical fertilisers used per unit of land and doses of FYM used per unit of land were tabulated to give structure to the data.

3.4.4 Analysis of Household Survey Data

The collected field data were entered into the computer using software package "FoxPro" for data processing. However, the tables were produced using the "Microsoft Excel" format so that further analysis can be performed conveniently.

After completing the data entry. checking of data were done repeatedly to ensure that entered figures were correct. For example, code number other than I (for male) and 2 for (female) and figures outside yield range (that is. yield of rice more than 5 tonstha) were checked. Dummy tables were developed for processing the results from the questionnaires. These dummy tables were then saved in Microsoft Excel workbooks in different sheets.

Simple statistical tools such as mean, mode, standard deviation, coefficient of variation (CV) percentage and frequency were calculated during data analysis. The analysis was also performed through cross tabulation to explore the relation between different variables. In mane instances, the figures were also presented in the form of histograms and pie-diagrams.

The scoring method was applied particularly for the question seeking more than one answer in priority basis. Such questions related to household survey were source of expenditures and source of income. The employed scoring method is explained in Annex III with an example related to source of income.

CHAPTER 4

DESCRIPTION OF STUDY AREA

This chapter contains the general description of the study area which includes a description of the location, climate, topography, area and population of the district, and then a more detailed description of the sampled Wards within a particular VDC. This includes a description of the crops and cropping patterns, farmers' existing soil fertility management practices and resources available for maintaining soil fertility.

4.1 Western Hill-Parbat District

Parbat district of Dhaulagiri Zone in the Western Development Region of Nepal was purposely chosen for this study. It comprises 54 VDCs. Based on 1991 population census, Parbat district has the population of 66,572 males and 76,975 females with total population of 143,547 (CBS, 1997).

Parbat is one of the districts under ARS, Lumle out-reach command area. Its climate ranges from tropical to sub-tropical and temperate. The Pokhara-Baglung highway passes through the district. The required inputs and basic commodities are obtainable from nearby markets specifically in Kusma, which is the headquarters of Parbat district.

The important indicators of Parbat district are given, in Table 4.1.

Table 4.1: General information on Parbat district, 1999.

S.N.	INDICATORS	BASE YEAR	UNIT	LEVEL
1	Village Development Committee (VDC)	1991	No.	54
2	Total Population	1991	No.	143,547
	I Male		No.	66,572
	II Female		No.	76,975
3	Total households HHs	1991	No.	27,973
4	Economical active population	1991	No.	66,064
5	Average family size per HH	1991	No.	5.13
6	Total area	1991	Ha.	28,350
7	Total area under arable land cultivable land	1991	Ha.	13,312
8	Total irrigated area sub-set of 7	1991	Ha.	3,494
9	Average arable land holding per HH	1991	Ha.	0.47
10	Educated People	1991		
	i Total	1991		1,18,074
	ii Literate	1991		61,091
	iii Illiterate	1991		56,629
	Iv Not stated	1991		354

Sources: "Statistical Year Book of Nepal, 1997", Central Bureau of Statistics (CBS), Kathmandu,1997; "Population of Nepal", CBS, Kathmandu, 1994; and "Trends and Challenges in the Department of Irrigation", Paper presented by Dr. N.K. Lal at DOI, R & D Branch Seminar, DOI, Kathmandu, 1999.

The major crops grown in Parbat district are rice, wheat, maize, millet, potato, barley and oilseeds. The area under sugarcane in the district is small. The total area, production and productivity of these food grains and cash crops from 1988-99 to 1997-98 are presented in Table 4.2.

Table 4.2: Total area, production and productivity of food graitis and casli crops in Parbat District, 1999

CROP	AREA (A) in hectare PRODUCTION (P) in t/ha PRODUCTIVITY PIA Uha	YEAR									
		1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Rice	A	6330	6250	6210	6160	6050	7000	7000	8790	8790	8800
	P	12690	12530	11580	11450	9440	15430	12690	17570	17600	17580
	P/A	2.00	2.00	1.85	1.85	1.56	2.20	1.81	1.99	2.00	2.00
VVheat	A	6800	5600	5620	5530	5300	5350	5860	4570	4572	4410
	P	8160	7280	7310	6580	6620	6980	7020	7400	7400	7160
	P/A	1.20	1.30	1.30	1.18	1.24	1.30	1.19	1.61	1.62	1.62
Wze	A	7500	10600	11500	11700	11750	10500	10690	10560	10580	10640
	P	11850	15240	18740	19660	19980	16800	17940	17100	16920	17810
	P/A	1.58	1.43	1.62	1.68	1.70	1.60	1.67	1.61	1.60	1.63
Millet	A	3560	5000	9000	9000	9010	8460	8000	9040	8800	8860
	P	3200	5750	10500	10510	10800	9160	8500	9040	8800	8780
	P/A	0.89	1.15	1.16	1.16	1.19	1.08	1.06	1.00	1.00	0.99
Sa!e	A	300	320	330	310	310	250	260	290	288	300
	P	250	260	320	290	280	240	250	290	286	310
	P/A	0.83	0.81	0.96	0.93	0.90	0.96	0.96	1.00	1.00	1.03
Suprcane	A		10	10	10	10	10	20	10	10	10
	P		150	150	160	150	200	410	170	170	140
	P/A		15.00	15.00	16.00	15.00	20.00	20.50	17.00	17.0	14.0
Oilseed	A	270	300	320	290	170	260	260	180	180	210
	P	180	240	280	170	120	220	230	110	106	160
	P/A	0.66	0.80	0.87	0.58	0.70	0.70	0.88	0.61	0.59	0.76
Potato	A	610	600	600	620	630	650	640	900	900	890
	P	4330	4380	4380	4650	4730	5660	5680	5850	5850	6500
	PIA	7.09	7.30	7.30	7.50	7.50	8.70	8.87	6.50	6.50	7.30

Sources: "Statistical Year Book of Nepal.1997 CBS, Kathmandu 1997, “Statistical Information on Nepalese Agriculture 1996,197", Agriculture Statistics Division, MOA, Kathmandu, 1997 and "Agricultural Statistics of Nepal", CBS, Katlunandu, I998

4.1.1 Pakuwa VDC of Parbat District

Pakuwa VDC lies in the low and mid hills of Parbat district in Dhaulagiri Zone of Nepal. Pakuwa village is located about three km from the Pokhara-Baglung highway. This VDC lies in height from 600 to 1200 metres above sea level (mast) and thus enjoys tropical to sub-topical and temperate climate.

Based on population census of 1991, Pakuwa VDC has the total population of 2,343 (that is, 1,118 males and 1,225 females). A total of 481 HHs were settled in this VDC in 1991.

Kusma, the headquarters of Parbat district, is about 8 km from Pakuwa village (Ward No. 5) and takes about one and half hours by foot. It is the main market for all the villa&ers. Dobilla, which is located in the highway, is also treated as thew second market and takes about 45 minutes to reach by foot. No temporary market exists in the area.

The sources of credit for farmers are Agricultural Development Bank, Nepal (ADBlN, Kusma), Small Farmer Development Project (SFDP), Women Development Programme (VV'DP), Participatory District Development Programme (PDDP) and local merchants.

Ward Nos.l, 4, 5 and 6 of Pakuwa VDC were selected for field survey based on the reasons mentioned in Chapter 3. On the basis of information gathered through KIS, the general information related to household number, population, farm size and total area by Ward are given in Table 4.3. It shows that Ward No. 1 has the highest number of HI-ls with average of 4.9 persons per HH. Whereas, Ward No. 6 has least number of HHs with average of 5.5 persons per household. Ward No.4 has the total area of 101.73 ha of rainfed low land which was greater than in the other Wards. It also has 22.89 ha of rainfed upland.

With regards to ethnicity, Ward No. 1 has Brahmin, Chhetri, and Sarki followed by Brahmin, Chhetri, Sarki and Sunwar in Ward No. 4; Brahmin, Chhetri, Kami, Thakuri and Sarki in Ward No.5 and Bhramin, Chhetri and Thakuri in Ward No. 6. The most common ethnic groups are Brahmins and Chhetris.

Table 4.3: General characteristics of sampled Wards, Pak iwa VDC, Parbat district _ 1999.

S.N	CHARACTERISTICS	PAKUWA VDC			
		Ward No. 1	Ward No. 4	Ward No. 5	Ward No.6
1	Name of the villages	Mandanda, Silme	Kavle	Pipaltari, Lamake, Lamaadya,	Pakuwa
2	No. of Households	103	91	59	53
3	Total Population no.	500	400	400	290
	1) Male	240	250	190	120
	Il Female	260	150	210	170
4	Persons per household av.no.	4.9	4.4	6.8	5.5
5	Total area (hectares)				
	l Upland (Rainfed)	NK	22.89	12.72	NK
	II Low land (Rainfed)	NK	101.73	0	NK
	111) Low land (irrigated that is, access of perennial irrigation	0	0	12.72	0

Source: SFMP Key Informant Survey, 1999. NK = NK. unplies not Known. Key informants of Ward Nos. I and 6 could not provide the estimates of land area.

Farmers' Existing Practices to Maintain Soil Fertility

All key informants of the four sampled Wards had mentioned that FYM and chemical fertilisers were the major sources for maintaining soil fertility. In addition, they also mentioned that green leaves, green grasses from both upland and lowland, green manure (such as Asuro, Dhaincha. Chilaune, Pate, Ghursur etc.), manure of goats and poultry were other available resources for farmers to maintain soil fertility.

Few farmers leave land fallow in winter to have better crop production in summer. Some farmers plant lentil. Collection of green leaves and branches of trees from the forest has been prohibited. Thus, farmers were not in a position to prepare more FYM for application. In Ward No. 4, some farmers even had to buy both fodder to feed their animals and FYM to apply to their fields.

Soil Management Practices in PakhoBari (Up land)

When FYM becomes ready to apply, all farmers use as much FYM in PakhoBari as they can. Use of FYM in Pak-ho/Bari has been the traditional practice to make land more fertile and productive. FYM is mostly used in maize and millet.

Soil Management Practices in Khet (Low land)

As reported by the key informants, the land preparation practice has changed. The number of times the land is ploughed has increased from one to three times in order to break the clods and make the soil more powdery. In most Wards, chemical fertilisers rather than FYM are used on Khet land whereas the application of FYM is little. This implies the reverse situation as compared to PakhoBari. The management of the irrigation system is considered by farmers to be the other important input to improving crop productivity. Farmers use more chemical fertilisers, particularly urea, in rice and wheat. Some farmers have been practising crop rotation, that is, instead of growing wheat, they grow potatoes, maize, mustard etc. in winter.

Existing Cropping Patterns

The cropping pattems for Pak-ho/Bari Iand in surveyed Wards of Pakuwa VDC were as follows:

i) maize/millet - fallow;
ii) maize/millet - wheat;
iii) maize - oilseeds; and
iv) maize - blackgram

Maize./millet - fallo x was the predominant pattern followed by maize/millet - wheat. In

Khet land, the cropping patterns found in this VDC were as follows:

i) rice - wheat:
ii) rice - fallow;
iii) rice - maize;
iv) rice - wheat -maize; and
v) rice -wheat - oilseeds

The first two patterns were the major ones followed by rice-maize pattern.

4.2 Western Hill-Tanahu District

Tanahu district of Gandaki Zone in the Western Development Region of Nepal was purposely chosen for this study. The district is composed of valleys and hills. It comprises 45 VDCs with one municipality declared in 1991. According to 1991 census, Tanahu district has the population of 127,312 males and 140,761 females with the total of 268,073.

The altitude of the district ranges between 350 to 1,830 masl. Within this range lie three different climatic zones namely the alpine region, cool temperate region and warm temperate region. The annual average rainfall and temperature vary year to year.

The district headquarters, Damauli is accessible through the Kathmandu-Pokhara highway. Due to the presence of motorable road, inputs and markets are accessible. Tanahu district is also under ARS, Lumle out-reach command area.

Table 4.4 illustrates the main indicators of Tanahu district.

Table 4.4 General Information on Tanahu district, 1997

S.No.	INDICATORS	BASE YEAR	UNIT	LEVEL
1	Village Development Committee (VDC)	1991	no.	45 VDCs, (1 municipality after 1991
2	Total Population	1991	no.	268,073
	1) Male		no.	127,312
	II) Female		no.	140,761
3	Total households (HHs)	1991	no.	49,805
4	Economically active population	1991	no.	113,594
5	Average family size per HH	1991	no.	5.38
6	Total area	1991	ha.	33,901.30
7	Total area under arable land (cultivable land	1991	ha.	31,961.80
8	Total irrigated area (subset of 7)	1991	ha.	2,873.00
9	Average arable land holding per HH	1991	ha,	0.64
10	Educated People			
	1) Total	1991	no.	220,755
	ii) Literate	1991	no.	110,302
	iii) Illiterate	1991	no.	108,616
	Iv) Not stated	1991	no.	1,837.00

Sources: "Statistical Year Book of Nepal, 1997", Central Burcau of Statistics (CBS), Kathmandu, 1997; "Population of Nepal", CBS, Kathmandu. 1994; and "Trends and Challenges in the Department of Irrigation", Paper presented by Dr. N.K. Lai at DOI, R & D Branch Seminar, Kathmandu, 1999.

The major crops grown in the district are rice, wheat, maize, millet, oilseeds and potato. Sugarcane is also grown in small area. Table 4.5 shows the total area, production and productivity of major food grains and cash crops in the district and the table is self-explanatory.

Table 4.5 Total area, production and productivity of food grains and cash crops in Tanabu District, 1999.

CROP	AREA (A) - in hectare (PRODUCTION (P) - in t/ha PRODUCTIVITY P/A - t/ha	YEAR									
		1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Rice	A	14750	13450	14200	12600	12650	13000	12500	14100	14320	14330
	P	32950	30840	34430	33880	25810	25300	21810	30480	32940	31430
	P/A	2.23	2.29	2.42	2.68	2.04	1.94	1.74	2.16	2.30	2.20
Wheat	A	3490	3600	3580	3560	2850	3000	3210	2850	2850	2750
	P	4890	5330	5360	5300	5400	4220	4520	5290	4703	5310
	P/A	1.40	1.48	1.49	1.48	1.89	1.40	1.40	1.85	1.65	1.93
Maize	A	19980	20420	20030	20000	22220	21080	21500	19700	20000	20110
	P	32880	36210	36040	36000	37590	36040	38480	33490	32000	34730
	P/A	1.64	1.77	1.79	1.80	1.69	1.70	1.78	1.70	1.60	1.73
Millet	A	7500	7550	7500	7500	6130	6130	5790	7100	7100	7150
	P	7120	9350	9280	9290	7970	7040	6900	9810	9850	9830
	P/A	0.94	1.23	1.23	1.23	1.30	1.14	1.19	1.38	1.39	1.37
Earle	A	60	70	80	70	50	40	40	10	14	10
	P	50	60	80	70	50	40	40	10	11	10
	P/A	0.83	0.85	1.0	1.0	1.0	1.0	1.0	1.0	0.79	1.00
Su area ,	A	20	20	10	10	10	20	20	10	10	10
	P	380	340	170	180	170	340	350	220	220	180
	P/A	19.0	17.0	17.0	18.0	17.0	17.0	17.50	22.0	22.00	18.00
Oilseed	A	500	500	300	350	350	1050	1090	650	543	620
	P	360	360	150	150	240	680	690	650	323	410
	P/A	0.72	0.72	0.50	0.42	0.68	0.64	0.63	1.00	0.60	0.66
Potato	A	250	450	460	460	480	490	500	480	476	510
	P	2000	3200	3200	3300	3350	3460	3480	2190	3250	4270
	P/A	_	7.11	6.95	7.71	6.97	7.06	6.96	4.56	6.80	8.37

Sources: "Statistical Year Book of Nepal, 1997", CBS, Kathmandu, 1997; "Statistical Information on Nepalese Agriculture, 1996/97" Agricultural Statistics Division, MOA, Kathmandu; and "Agricultural Statistics of Nepal, 1997/98", CBS, Kathmandu, Nepal

4.2.1 Bhanu VDC of Tanahu District

Bhanu VDC has the recommendation domain with river basin and low hills 400 to 550 masl and has tropical, sub-tropical and temperate climate. Chambas, where ARS Lumle Office is located, lies about 8 km north from Dumre Bazaar. A motorable road passes through Bhanu VDC from Dumre to Beshisahar

Based on population census of 1991. Bhanu VDC had the total population of 10,550 (that is, 4,923 males and 5,627 females) with 2,080 M s . Damauli, the headquarters of Tanahu district, is 28 km away from Chambas (Ward No. 8) and takes about half an hour to reach there by bus. Dumre is treated as the main market centre and Turture as the second market, which are 8 km and 2 km from Chambas respectively. Temporary markets do not exist in the area.

The sources of credit for farmers are ADB/N (DamauIi), Rural Development Bank, SFDP, WDP, Nepal Bank Ltd, Co-operative and local merchants.

Ward Nos. 1, 4, 7 and 8 of Bhanu VDC were chosen for field survey based on the reasons mentioned in Chapter 3. Based on the respondents of the key informant survey, the major characteristics of sampled Wards of Bhanu VDC are illustrated in Table 4.6. The population, both males and females, is highest in Ward No. 8, whereas the family size per household is 7.0 in Ward No. 4. In Ward No. 7, there is more rainfed up land as compared to other three Wards. Whereas, there is little difference among sampled Wards with respect to total area under irrigated low land.

In these four surveyed Wards, the major ethnic groups are Gurung, Brahmins, Chhetri, Newar, Tamang, Magar, Sunar, Kumal, Kami, Gaine and Sarki. The most common ethnic groups are Brahmins and Chettris.

Table 4.6: General characteristics of sampled Wards, Bhanu VDC, Tanahu district, 1999.

S.No.	CHARACTERISTICS	BHANU VDC			
		Ward No. 1	Ward No. 4	Ward No. 7	Ward No. 8
1	Name of the villages	Khahare	Khatithok Bensi, Chundi	Bhakunthok Bensi	Chambas
2	No. of Households	175	200	170	450
3	Total Population no.	800	1400	900	2000
	I Male	300	700	400	1400
	II Female	500	700	500	1600
4	Persons per household	4.6	7.0	5.3	4.4
	Total area hectares				
	1) Up land Rainfed	NK	27.97	152.59	40.69
	11) Low land (Rainfed	NK	0	15.25	0
	111) Low land (Irrigated with access of perennial irrigation)	NK	38.14	35.60	20.34

Source: SFMP Key Informant Survey, 1999. NK= NK implies not known. Key informants of Ward No. I could not provide the estimates of land area.

Farmers' Existing Practices to Maintain Soil Fertility

Most farmers were following the traditional practice in order to maintain soil fertility in both Pakho/Bari and Khet land. The respondents of KIS of all selected Wards reported that more use of FYM and chemical fertilisers are the major resources available to them to maintain soil fertility. Particularly, also the farmers of Ward Nos. 1 and 8 were using green manure such as Asuro. Khirro. Pati. Padke etc. to maintain soil fertility. The respondents reported that Asuro is not available adequately in Ward No. 8. It has to be collected from the banks of streams. In earlier days. Asuro was abundantly available in the forest.

Some of the fanners of Ward No. 7 were using waste materials from biogas plant in their fields. The biogas plants were supplied by ADB/N on loan basis. The preparation and use of compost is virtually nil. However, a few farmers of Ward No. 8, who received training from ARS, Lumle, had- knowledge of compost preparation. However, they were not making compost. Application of the technical knowledge on compost making and an understanding of advantages attendant upon its use were lacking among the villagers of the Ward. Some farmers, particularly in Ward No. 1, followed crop rotation to maintain the soil fertility. There was a strong belief among the respondents that a greater use of FYM makes soil loose, and it can then be used for any crop without harm.

Soil Management Practices in PakhoBari (Up land)

In the past, there was a traditional practice of making the small huts in the field for drying branches of different trees brought after cutting from the forest and leaves that were collected from the ground. The leaves were fed to the animals and the branches and manure (locally it is called Ghaseta) were spread in the field with the belief that soil fertility would be improved. Sometimes, Ghaseta was burnt and the ashes from it were spread in the field. At present, this practice has been almost disappeared.

More use of FYM and chemical fertilisers for most of the crops was the general practice in PakholBari land. The major change in the practice during the last few years was ploughing the land repeatedly, at least three times, to make the soil more powdery. The farmers strongly believed that increase in number of ploughing would make soil finer and help to get better production. FYM, which are spread over the field, is generally covered by the soil during the land preparation. Farmers of Ward No. 7 indicated the lack of irrigation water as one of the reasons for less fertility in the soil.

Soil Management Practices in Khet land (Low land)

The applications of FYM and chemical fertiliser in the field were the common practice followed in- the field. Asuro was used to cover rice seedbed. The rate of use of chemical fertiliser varied across Wards. In N and No. 4, farmers reported that they use less chemical fertilisers so that the soil fertility xvill still be maintained.

Like in Pakho,Bari land. particularly the key informants of Ward Nos. 1 and 7 mentioned that the farmers plough two or three times, sometimes even more, before cultivation to make the soil better for a good harvest. However. they stressed that irrigation, proper weedin[g] and digging are also important. In Ward No. 4, close to ARS, LAC soil fertility trial area, the cropping pattern of rice wheat-maize had been practiced. Whereas, in other areas, rice-wheat cropping pattern was common.

Existing Cropping Patterns

In PakhoBari land of Bhanu VDC, the following cropping patterns were found.

i) upland rice - blackgram;
ii) upland rice - maize;
iii) maize - blackgram;
iv) maize/millet - fallow; and
v) maize - oilseeds

Among them, first two patterns were predominant followed by maize - blackgram pattern. In

Khet land; the following patterns were found.

i) rice - wheat - maize;
ii) rice - fallow;
iii) rice - maize; and
iv) rice - wheat

First two patterns were the major ones followed by rice. 4.3

Eastern Hill-Dhankuta District

Dhankuta is one of 1 l out-reach command districts under ARS, Pakhribas. It is located in Koshi zone of eastern hills of Nepal. The district is composed of 35 VDCs and one municipality. Dhankuta municipality is the regional headquarters of eastern region.

Based on 1991 population census, Dhankuta district has the total population of 146,386 with 72,080 males and 74,306 females. The total number of households was 27,425 (CBS, 1997).

Out of l 1 out-reach command districts under ARS, Pakhribas. Dhankuta is one of them. Dhankuta Bazar is located at the elevation of 1,445 mast Annual rainfall varied at the range of 700 to 1510 mm. for the period 1987 to 1996.

The Dharan-Basantapur highway passes through the district headquarters of Dhankuta. Most required inputs and basic commodities are available in Dhankuta. The major indicators of Dhankuta district are given in Table 4.7.

Table 4.7 General Information on Dhankuta district, 1999

S.No.	INDICATORS	BASE YEAR	UNIT	LEVEL
1	Village	1991	No.	35 VDCs, I Municipality
2	Total Population	1991	No.	146,386
	1) Male		No.	72,080
	II) Female		No.	74,306
3	Number of total households (HHs)	1991	No.	27,425
4	Economically active population	1991	No.	74,521
5	Average family size per HH			5.34
6	Total area	1991	Ha.	27,753
7	Total area under arable land (cultivable land	1991	Ha.	23,966
8	Total irrigated area (subset of 7)	1998	Ha.	4,521
9	Average land holding per HH	1991	Ha.	1.01
10	Educated People			
	1) Total	1991	No.	121,892
	li) Literate	1991	No.	59,693
	Iii) Illiterate	1991	no	60,718
	Iv) Not stated	1991	no.	1,481

Sources: "Statistical Year Book of Nepal, 1997", CBS, Kathmandu, 1997: "Population of Nepal", CBS, Kathmandu, 1994; and "Trends and Challenges in the Department of Irrigation". Paper presented by Dr. N.K. Lai at R R. D Branch Seminar, DOI. Kathmandu 1999.

Maize, rice, wheat, millet and potato are the main field crops grown in the district. In addition, oilseeds, some barley and sugarcane are also grown. The total area, production and productivity of these crops are shown in Table 4.8.

Table 4.8 Total area. Product/on and productivity of food grains and cash crops in Dhankuta District, 1999

CROP	AREA (A) - in ha PRODUCTION (P) - in t/ha PRODUCTIVITY P/A – in t/ha	YEAR									
		1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Rice	A	9800	8330	9250	9610	9310	9000	8700	9630	9640	9750
	P	20600	17810	22280	22780	19680	16900	15100	22280	22280	22420
	P/A	2.10	2,14	2.41	2.37	2.11	1.88	1.74	2.31	2.31	2.30
Wheat	A	2230	2800	2750	2730	1400	1500	1440	2770	2775	3120
	P	3120	3890	3910	3550	1890	2010	2070	4990	4986	5500
	P/A	1.40	1.39	1.42	1.30	1.35	1.34	1.44	1.80	1.80	1.76
Maize	A	19230	19150	19090	19000	16500	16200	16500	16670	17000	17280
	P	27560	29700	30410	30310	31350	25270	26980	29900	28300	29180
	P/A	1.43	1.55	1.59	1.60	1.90	1.56	1.64	1.79	1.67	1.69
Millet	A	7000	7150	7000	6980	7010	7300	7150	8100	7800	7850
	P	7000	7910	7030	7000	7710	7300	7290	8100	9100	9020
	P/A	1.00	1.11	1.00	1.00	1.10	1.00	1.02	1.00	1.17	1.15
Barley	A	40	30	40	40	40	40	40	20	20	30
	P	40	30	50	50	40	30	30	20	21	30
	P/A	1.00	1.00	1.25	1.25	1.00	0.75	0.75	1.00	1.05	1.00
Sugarane	A	20	60	60	60	60	60	60	60	60	50
	P	320	840	840	860	870	890	320	480	1080	980
	P/A	16.00	14.00	14.00	14.00	14.50	14.83	5.33	8.00	18.00	19.60
Oilseed	A	580	510	530	520	600	770	790	980	928	1000
	P	350	370	380	270	300	390	440	200	788	820
	P/A	0.00	0.72	0.71	0.51	0.50	0.50	0.55	0.20	0.85	0.80
Potato	A	1110	1200	1200	1200	1220	1300	1540	1610	1610	1700
	P	8570	9910	9910	9450	9700	10400	15260	10370	14490	15100
	P/A	7.72	8.25	8.25	7.87	7.95	8.00	9.90	6.44	9.00	8.88

Sources: "Statistical Year Book of Nepal, 1997", CI3S, Kathmandu, 1997; "Statistical Information on Nepalese Agriculture, 1996197", Agricultural Statistics Division, MOA, Kathmandu, 1997 and "Agricultural Statistics of Nepal, 1997/98", CBS, Kathmandu, 1998.

4.3.1 Pakhribas VDC of Dhankuta district

Pakhribas VDC lies in the mid hills of Dhankuta district of Koshi Zone of Nepal. Pakhribas Bazaar is located about 5 km. from Hite through which the Dharan-Basantapur road passes. Recently, a new motorable road has been constructed which passes through Pakhribas Bazaar. The elevation of Pakhribas VDC ranges from 900 to 1700 mast. ARS, Pakhribas is about half an hour walk from the Bazaar.

Pakhribas VDC had the total population of 4,508 and 2,214 males and 2,294 females with 890 HHs which is based on 1991 population census (CBS, 1997). Dhankuta, the headquarters of Dhankuta district, is 11 km from Pakhribas (Ward No. 3). Hite is treated as the main market. There exist three temporan markets of Shanibare, Budhabare and Bihibare which take place in Saturday, Wednesday, and Thursday.

The sources of credit for farmers are ADB/N, Commercial Bank, WDP, Co-operative and merchants.

Based on KIS, the general characteristics of selected Wards are shown in Table 4.9. The population and familh- size were highest in Ward No. 3 among four Wards. The area under rainfed low land was highest in Ward No. 3. Only in Ward No. 6, there was both irrigated and rainfed low land.

With regards to ethnicity, Ward No. 3 has Bhramins, Chhetri, Gurung, Rai, Limbu, Newar, Damai, Kami, Sunar and Sarki followed by Chhetri, Tamang, Magar and Kami in Ward No. 6; Chettri, Tamang, Gurung, Magar, Rai, Limbu and Sherpa in Ward No. 7 and Chhetri, Bhramins, Newar, Rai, Limbu and Damai in Ward No. 8. Fifty percent of people in Ward No. 8 were Chettris.

Table 4.9: General characteristics of sampled Wards, Pakhribas VDC, Dhankuta district, 1999.

S.No.	CHARACTERISTICS	PAKHRIBAS VDC			
		Ward No. 3	Ward No. 6	Ward No. 7	Ward No. 8
1	Name of the villages	Pakhribas, Niraula Gaun	Bokre	Pakhribas Farm Phanduwa Jordhara	Budhabare Phaunda Pakhribas
2	No, of Households no.	250	52	120	134
3	Total Population no.	1800	350	650	725
	1 Male	800	150	300	435
	II Female	1000	200	350	290
4	Persons per household (av no)	7.20	6.73	5.41	5.41
5	Total area hectares				
	I) Land Rainfed	20.34	203.45	NK	NK
	II) Low land Rainfed	50.86	17.80	NK	NK
	111) Low land (Irrigated with access of perennial irrigation)	0	7.62	0	0

Source: SFMP Key Informant Survey, 1999. NK = NK implies not known and ker informants of Ward Nos. 7 and 8 could not provide the estimates of land area.

Farmers' Existing Practices to Maintain Soil Fertility

The available resources to the farmers to maintain the soil fertility were FYM and chemical fertilisers. The uses of FYM and chemical fertilisers were the common practice in all Wards. It was reported by the key informants of Ward No. 3 that in making FYM, **it** is always better to mix leaves of forages with animal dung to protect it from washing away during hea[v]y rainfall. Hence, mixing green wet forage and fodder with animal dung in the heap of FYM were practised. FYM is used at the time of ploughing. Ploughing is mostly done two to three times.

Both urea and DAP were mostly available for use. They are used at the time of planting and weeding. Particularly in Khet land of Ward No. 8, the slicing of risers for green grasses was practised with the belief that the fertility increases due to decay of grasses in the field. It is done in May/July (that is, after ploughing).

The manure of goats and poultry were also available and used to some extent to maintain soil fertility.

They also suggested that keeping land fallow for some periods makes the soil better for cultivation of next crop. The farmers of Ward No. 6 had the experience of using green manure in the field and also growing leguminous crops.

The farmers strongly believe that these operations keep the soil better for cultivation and for good crop harvest.

Soil Management Practices in PakhoBari (Up land)

It was the general consensus of the respondents of KIS of all Wards that the major practices and needs of farmers to manage the soil for better production were the use of FYM and chemical fertilisers, in-situ manuring practice in winter, slicing of raisers and terraces, ploughing more number of times to break clods and to make soil more powdery, not to encourage intensive cultivation (that is, continuous cultivation of three crops per year), to plant more fodder trees on own land and to keep more animals were the major practices and needs of farmers to manage soil for better production. It is interesting to note that in all Wards, farmers stressed to plough more number of times (that is, at least.. two to three times) to break the clods and make soil more powdery. In addition, deep ploughing was encouraged with the belief that this practice makes soil more loose and fert ile.

Soil Management Practices in Khet land (Low land)

The soil management practice in Khet land was not different from Pakho" Sari land. The major practices followed in all Wards were use of FYM and chemical fertilisers, in-situ manuring practice in winter, slicing of raisers and more number of ploughings (that is, at least two to three times) to make soil powdery. It was the belief of the respondents of ward No. 3 that with greater number of plou[g]hings after rice harvest, the land will be exposed to free sunshine, fresh air and rainfall. As a result, soil becomes loose and better for more production. The respondents of Ward No. A suggested that with a single crop of rice grown in Khet land in a year, the soil is improved and the productivity of rice increased.

Existing Cropping Patterns of Pakhribas

The cropping patterns prevailed in PakhoBari land of Pakhribas VDC were as follows.

i) maize/millet - fallow;
ii) maize - fallow;
iii) maize - oilseeds;
iv) maize - wheat; and
v) maize - vegetables or potatoes.

The pre-dominant cropping patterns were first two followed by maize - oilseeds.

In Khet land, the pre-dominant cropping patterns were rice - wheat and rice - fallow.

4.3.2 Murtidhunga VDC of Dhankuta district

Murtidhunga is another VDC purposely selected for field survey in Dhankuta district. Sidhuwa, which is the main market, is located on the main road from Hile to Basantapur, and is 5 km away from Murtidhunga VDC (Ward No. 5). Most inputs and basic requirements are available at Sidhuwa.

Murtidhunga VDC had the total population of 5,037 (that is, 2,501 males and 2,536 females) with 920 HHs which is based on 1991 population census (CBS, 1997).

The sources of credit for farmers are ADB/N, WDP, Co-operative and merchants.

Based on information reported by the key informants, the general characteristics of these Wards are given in Table 4.10. The population and family size were highest in Ward No. 2 and they were lowest in Ward No. 9. The area under rainfed upland was biggest in Ward Nos. 1 and 5 and the lowest in Ward No. 9. Ward No. 5 has biggest area under irrigated lowland.

Table 4.10: General characteristics of sampled Wards, Murtidhunga VDC, Dhankuta district, 1999.

S.No.	CHARACTERISTICS	MURTIDHUNGA VDC			
		Ward No. 1	Ward No. 2	Ward No. 5	Ward No. 9
1	Name of the villages	Nigale, Gairigaun, Sepiri	Aahale, Bichtol	Aahale, Ganeshtar	Nigale
2	No. of Households	86	110	106	61
3	Total Population no.	550	850	460	350
	I Male	300	350	260	200
	11 Female	250	500	200	150
4	Persons per household av.no.	6.39	7.72	6.69	5.73
5	Total area hectares				
	I)Upland Rainfed	228.90	50.86	228.90	5.08
	11) Low land (Irrigated with access of perennial	0	35.60	0	45.77
	111)Low land (Rainfed)	5.08	0	75.27	40.69
	IV)Low land (Irrigated with access of perennial irri ation	0	1.01	127.16	10.17

Source: SFMP Key Informant Survey, 1999.

Ethnic groups such as Bhramin, Chettri, Jaisi, Tamang, Magar, Kami and Damai were found in Ward No. I followed by Bhramin, Chhetri, Tamang, Magar, Limbu, Ne'vvar and Dami in Ward No. 2; Bhaamin, Chhetri, Limbu, Rai. Tamang, Newar, Gharti, Kauri, Damai and Sarki in Ward No. 5 and Bhramin, Chhetri, Gharti, Magar, Damai and Kami in Ward No. 9. The major ethnic groups were Brahmins and Chettris.

Resources available to Maintain Soil Fertility

As in other Wards of different VDCs, the main resources available to the farmers for maintaining the soil fertility were FYM and chemical fertilisers. Some farmers of Ward Nos. 2 and 9 had been collecting and using Titepate, Kharuki etc. as green manure which are generally available in the forests. They are now slowly disappearing and its use has been minimised at present. They also mix green leaves of these plants and other fodder trees with animal dung and urine to make good FYM. In particular, the leaves of fodder trees are spread in animal shed. It has a dual purpose. It is used as livestock fodder as well as for making FYM. The key informants of Ward No. 2 reported that some

farmers make ash out of firewood and left over wood of forage trees and spread them in the field to maintain soil fertility. The manure of cows, buffaloes and goats were generally used.

According to the female respondent of Ward No. 1, use of chemical fertilisers has been common since last few years. But, due to a rapid increase in the price of chemical fertilisers, most farmers are discouraged and no longer able to use them.

Farmers' Existing Practices to Maintain Soil Fertility

Use of FYM and chemical fertilisers is the common existing practice in all Wards to maintain soil fertility. Among chemical fertilisers, use of urea and DAP were more often used. Use of FYM is the traditional practice. Green leaves and grasses were spread in the animal shed for bedding. All waste materials including animal dung, urine and leaves were heaped in a place close to homestead, which could be in a pit or in a sloppy place. The farmers carry those heaped manure in a bamboo basket (that is, in doko) and leave in the field. At the time of land preparation, these small heaps of FYM are spread throughout the field, and the land is ploughed.

The respondents of Ward Nos. I and 5 stressed the increased frequency of proper ploughings to make soil powdery for better crop production. It is interesting to note that the respondents of Ward No. I explained the requirement of more labourers than earlier to make the land level and to obtain loose soil.

Soil Management Practices in PakhoBari (Upland)

As indicated earlier, the farmers reported that the use of FYM and chemical fertilisers in PakhoBari land was the common practice. They explained that the use of FYM was dependent on its availability which had direct relationship with access of green leaves, grasses, fodder trees and with number of animals owned. The preparation of FYM and the way it was used, was not different from other VDCs. Among the chemical fertilisers, urea and DAP had been used in all Wards.

The respondents of the key informants had reported that the majority of the farmers ploughed two to three times or even more. The farmers had the strong belief that with more ploughing and by breaking the clods, the soil becomes loose. Such soil is thought to be good for better crop production.

Soil Management Practices in Khet Land (Low land)

The respondents of KIS reported that FYM and chemical fertilisers were used in Khet land for better production. FYM was spread in the field followed by two to three ploughings. The clods were turned into fine particles by repeated plou[g]hing and planking. Urea was top dressed after 22 to 30 days of crop plantation. Irrigation was compulsory to all crops per season based on types of crops grown.

Existing Cropping Patterns

The cropping patterns prevailed in PakhoBari land of Murtidhunga VDC were as follows.

i) maize + potato - cabbage;
ii) maize/millet - fallow;
iii) maize/millet - wheat;

iv) maize - vegetables or potatoes.

The first two were pre-dominant patterns followed by maize/millet - wheat and maize - vegetables or potatoes.
In Khet land, the cropping patterns were as follows.

i) rice - fallow;
ii) rice - wheat;
iii) rice - maize; and
iv) rice - wheat or oilseeds.

The first three were the pre-dominant cropping patterns followed by rice - wheat or oilseeds.

CHAPTER 5

RESULTS OF KEY INFORMANT SURVEY

5.1 Key Informant Survey

As described in Chapter 3, the key informant survey (KIS) was employed as one of the methods in this study to gather some qualitative data. The results described in this section are based on responses provided by thirty two key informants (16 males and 16 females) who represent 16 Wards of four VDCs in the eastern and western regions of the country.

5.1.1 Results of Key Informant Survey

5.1.1.1 Soil fertility Status: During KIS, they were asked to judge the fertility of soil in their respective area. The following are the results of four VDCs surveyed.

Farmers' criteria on soil fertility status: Table 5.1 illustrates some important characteristics of soil by which farmers make distinction between more fertile and less fertile. These findings are based on the perception of the key informants.

Table 5.1: Farmers criteria on soil fertility status, sixteen Wards of four sampled VDCs, 1999.

S.N.	*NAMES* VDCs	WAR NUMB	SOIL CHARACTERISTICS	
			More Fertile	Less Fertile
1	Pakuwa	1, 4, 5, 6	Black, Sandy, Loose, Soft, Mixed manure, Access of irrigation, production, Below the forest area canal, Close to river bank, Khet Levelled, Easy to plough and dig	Red, Yellow, Clay, North Lack of irrigation, Pak-ho Land under forest trees, clods, Coarse, Less Sloppy land. Difficult to plough
2	Bhanu	1, 4,	Black, Loose, Sandy, Land sufficient water for irrigation, *easy* to plough, More production, which can be flooded through the of forest during rainy season	Red, Clay. No irrigation, Coarse, stones and difficult to Less production, Rainfed
3	Pakhriba	3, 6,	Black, Loose, Light, Silty, Land access of natural spring water closeto the river bank or Levelled land, More Access of irrigation, Easy to plough	Red, Coarse. Yellow, Grey. more stones. Less access of irrigation, Sloppy
4	Murtidh	1, 2,	Black, Clay, Silt-, More production, With more Easy to plough	Red, Yellow, Sandy with Hard soil with stones Sloppy land, Less Less use of FYM. Difficult lo

5.1.1.2 Changes in soil fertility status

Pakho/Bari land. Key informants were asked to describe the soil fertility status in Pakho/Bari land at three time intervals namely (a) At present (b) Five years ago and (c) Ten years ago.

Based on the responses of key informants of 16 Wards of four VDCs, the sail is less fertile at present, was more fertile in five years a-o and most fertile ten years ago. Both male and female key informants made similar responses.

Reasons for this trend were explored and they were asked to rank the reasons in order of priority.
Table 5.2 illustrates the results of their reasons. -

Khet land: The some questions were also proposed concerning the changes in soil fertility in Khet land. The key informants reported that the answers were no different from Pakho/Bari land. In other words, the key informants reported that soil is less fertile at present, was more fertile five years ago and most fertile in ten years ago.

They also gave reasons for the land being less fertile at present and more fertile five to ten years ago. These they ranked on the basis of priorities. 'Table 5.3 reveals the reasons for change in soil fertility status based on key informants' priorities.

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Table 5.2: Farmers' Criteria to classify PakhoBari land, 1999

	CRITERIA									
VDC	Leve 1Productivity	Soil Colour	Soil Structure	Soil	Size of land	Shade	Use of FYM	Irrigation Land with access	Monsoon Water	Land Shape
Pakuwa	1. More fertile with high oroductivity level	1. Black	1. Sandy	1. Harder				1. Land with access of Irrigation		
	2. Less fertile less productivity level	2. Brown	2. Silty	2.Coarse				2. Land without access of irrigation		
		3. Red	3. Clay	3. Loose						
	i	4. Yellow	4. Loam	4. Soft						
		5. White	5. Sandy loam	5. Mixture of stones (stony)						
Bhanu	1. More fertile with high productivity level	1. Black	1. Sandy	1. Harder			L Soil with adequate FYM		1. Land with monsoon water	1. Levelled land
	2. Less fertile with level	2. Brown	2. Silly	2.Coarse			2. Soil without FYM		2. Land without monsoon Ovate:	2. Sloppy terrace land
		3. Red	3. Clay	3. Loose						3. Land slide Tone land
		4. Yellow	4. Loam	4. Soft						
		5. White	5. Sandy loam	S. Mixture of stones (stony)						
Pakhribas	1. More fertile with high productivity level	1. Black	1. Sandy	I . Harder		1. With shade	1. Soil with adequate FYM	1. Land with access of Irrigation		1. Leveled land
	1 Less fertile with Less level	2. Brown	2. Silty	2.Coarsc		2. Without shade	1 Soil without FYM	2. Land without access of irrigation		2. Sloppy terrace land
		3. Red	3. Clay	3. Loose						3. Land slide cone land
		14. Yellow	4. Loan	4. Soft						
		5. White	S. Sandy loam	5. Mixture of stones (stony)						
Murtidhunga	1. More fertile with high productivity	1. Black	1. Sandy	1. Harder	1. Bigger size with easy to lou[g]h			1. Land with access of Irrigation		1. Leveled land
	2. Less fertile less productivit-level	2. Brown	2. Siltv	2.Coarse	2. Smaller size with uneasy to lough			2. Land without access of irrigation		2. Sloppy terrace land
		3. Red	3. Clav	3. Loose						3. Land slide pone land
		4. Yellow	4. Loam	4. Soft						
	▮	5. While	5. Sandy loam	5. Mixture of stones (stony)						

Table 5 3 : Farmers' criteria to classify Khet land, 1999

VDC	Irrigation	Productivity	Soil structure	Distance from homestead	Soil Texture	Colour	Use of FYM
Pakuwa	1. Land with access of perennial irrigation 2. Land which is rained	1. More fertile with high productivity 2. Less fertile with less productivity	1. Sandy 2. Clay	1. Nearer parcels 2. Far parcels			
Bhanu	1. Land with access of perennial irrigation 2. Land which is rained		1. Sandy 2. Clay		1. Coarse 2. Sticky 3. Hard 4. Clods	1. Black 2. Yellow 3. Red	1. Decomposed FYM without flooding out. 2. Undecomposed FYM with flooding out.
Pakhribas	1. Land with access of perennial irrigation 2. Land which is rained	1. More fertile with high productivity 2. Less fertile with less productivity	1. Silty 2. Sandy 3. Clay		1. More stones 2. Coarse	1. Brown 2. White 3. Black 4. Grey	
Murtidhunga	1. Land with access of perennial irrigation 2. Land which is rained	1. More fertile with high productivity 2. Less fertile with less productivity	1. Clay 2. Sandy		1. Coarse	I. Black 2. Brown 3. White 4. Red	

5.1.1.3 Reasons and ranking of soil fertility

The key informants were asked to provide reasons and to rank these reasons for the change in fertility of different land types, that is, PakhoBari and Khet land during the last ten years. Based on their perception, the responses and the ranking varied between Wards and VDCs. Tables 5.4 to 5.11 show the reasons and ranking by Ward and land type.

Table 5.4: Ranking of reasons for increase in soil fertility status in PakhoBari land over the last five to ten years, Pakuwa and Bhanu VDCs, Western region, 1999.

VDC	WARD NO. I		WARD NO. 4		WARD NO. 5		WARD NO. 6	
	Reasons	Rank	Reasons	Rank	Reasons	Rant:	Reasons	**Rank**
Pakuwa	i. More use of FYM	1	i. Continuous hard working	1	i. More use of FYM	1	i. Continuous hard working	1
			ii. More use of FYM	2	ii. More animal population	2	ii. More number of trees	2
			iii. Less use of chemical fertiliser	3	iii. Dense forest for green leaves and fodder	3	iii. Dense forest	3
			iv. Larger number of animals	4			iv. Good FYM preparation with more forage and dry leaves.	4
			v. In-situ practice of manuring	5				
			vi. Green leaves and fodder easily accessible from the forest.	6				

VDC	WARD NO. 1		WARD NO. 4		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	I Reasons	Rank
Bhanu	i. More animals	1	i. More animals	1	i. Continuous hard work	1	i. Single crop per year	1
	ii. Availability of sufficient grass and fodder	2	ii. More use of FYM	2	ii. More animals	2	ii. More use of FYM	2
	iii. Free grazing for animals	3	iii. No use of chemical fertiliser	3	iii. More use of FYM	3	iii. No use of chemical fertiliser	3
	iv. Single crop per year	4			iv. Girls also involved in farming due to lack of schools	4	iv. Availability of sufficient green grasses and fodder	4
	v. Application of chemical fertiliser	5			v. More use of green leaves and fodder for making FYM	5	v. Practice of use of Breen manuring	5
	vi. More rice straw to feed animals	6					vi. Flooded water from forest to farmland	6
	vii. In-situ practice of manurin[g]	7					vii. More forage decomposed	7

Table 5.5: Ranking of reasons for increase in soil fertility status in PakhoBari land over the last five to ten years, Pakhribas and Murtidhunga VDCs, Eastern region, 1999.

VDC	WARD NO. 3		WARD N0. 6		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rank:	Reasons	Rank
Pakhribas	i. More animals	1	i. More animals	1	i. More good top soil	1	i. Single crop per year	l
	ii. More use of FYM	2	ii. More use of FYM	2	ii. More use of FYM	?	ii. More weeding	2
	iii. Larger area under dense forest	3	iii. In-situ practice of manuring	3	iii. No use of chemical fertiliser	3	iii. Use of more FYM	3
	iv. No use of chemical fertiliser	4	iv. More free grazing land	4			iv. Use of quality chemical fertilisers	4
			v. More availability of green grasses and fodder	5			v. More animals	5
							vi. More grazing land	6
VDC	WARD NO.1		WARD NO. 2		WARD N0. 5		WARD NO. 9	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
	i. More use of FYM	1	i. Single crop per year	I	i. Continuous hard work	1	i. Single crop per year	1
	ii. More ploughing	2	ii. More forest area without restriction and	2	ii. Single crop per year	2	ii. More fallow= land	2
	iii. Availability of more trees and fodder trees	3	practise of slash and bum		iii. Practice of free grazing	3	iii. Practice of free grazing	3
	iv. More animals	4	iii. More use of FYM	3	iv. No use of chemical fertiliser	4		

Table 5.6. Ranking of reasons for decline in soil fertility status in PakhoBari land over the last five to ten years, Pakuwa and Bhanu VDCs, Western Region, 1999.

VDC	WARD NO. 1		WARD NO. 4		WARD NO. 5		WARD NO. 6	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank:
Pakuwa	i. Use of FYM mostly in maize	1	i. Lack of irrigation	1	i. Lack of labour to work in the field (because of schooling of the children)	1	i. Less animals	1
			ii. More use of chemical fertiliser	2			ii. Less use of FYM	2
			iii. Less use of FYM	3			iii. Less working in the field	3
VDC	WARD NO. 1		WARD NO. 4		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Bhanu	i. Less animals	1	i. Less animals	1	i. Less hard work	I	i.More area under more than one crop per year	I
	ii. Less use of FYM	2	ii. Less use of FYM	2	ii. More use of chemical fertiliser	2	ii. Less use of FYM	2
	iii. More use of chemical fertiliser	3	iii. Lack of adequate forest area	3	iii. Lack of irrigation facility	3	iii. More use of chemical fertiliser	3
	iv. Practice of stall feeding for animals	4	iv. Absence of practice of slash and burn	4	iv. Less animals	4	iv. Less use of green manure (availability of less Asuro)	4
	v. More area under more than one crop per year	5	v. Top soil washed down by flood and erosion	5				
	vi. Harder soil without any silt	6						

Table 5.7: Ranking of reasons for decline in soil fertility status in PakhoBari land over the last five to ten years, Pakhribas and Murtidhunga VDCs, Eastern Region, 1999.

VDC	WARD No. 3		WARD NO. 6		WARD NO. 7		WARD NO. S	
	Reasons	Rank	Reasons	Rank	Reasons	Rank ,	Reasons	Rank
Pakhribas	i.Use of chemical fertilisers	1	i. Less use of FYM	1	i. Top soil washed down	I	i. Less animals	I
	ii. Less animals	2	ii. More use of chemical fertiliser	2	ii. Less use of FYM	2	ii. Less use of FYM	2
	iii. Less use of FYM	3			iii. More use of chemical fertilisers	3	iii. Less weeding	3
	iv. Lack of adequate green leaves and forest area	4			iv. Lack of adequate labour for better land preparation	4	iv. Lack of grazing land	4
							v. More area under more than one crop per year	5
							vi. More use of chemical fertilisers	6
							vii. Lack of irrigation water	7
VDC	WARD NO. I		WARD No. 2		WARD NO. 5		WARD NO. 9	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Murtidhunga	i. Lack of more weeding	1	i. More area under more than one crop per year	I	i. Lack of continuous hard work	1	i. Washed down of top soil due to flood	I
	ii. Lack of adequate forest area	2	ii. Washed down of top soil due to heavy rainfall	2	ii. More area under more than one crop per year	2	ii. Less use of FYM	2
	iii. Less cultivated area with more than one crop per year	3	iii. Use of more chemical fertiliser	3	iii. Lack of free grazing of animals	3	iii. Disappearance of in-situ manuring practice	3
	iv. Top soil washed down	4	iv. Less use of FYM	4	iv. More use of chemical fertilisers	4		
	. Lack of improved breeds of animals	5						
	vi. Lack of adequate grasses	6						

Table 5.8: Ranking of reasons for increase in soil fertility status in Khet land over the last five to ten years, Pakuwa and Bhanu VDCs, Western region, 1999.

VDC	WARD NO. 1		WARD NO.4		WARD No. 5		WARD NO.6	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Pakuwa	i. More use of FYM	1	i. Continuous hard work	1	i. More animals	1	i. Continuous hard work	1
	ii. Free grazing of animals	2	ii. More use of FYM	2	ii. In-situ manuring practice	2	ii. More animals	2
	iii. Single crop per year	3	iii. Less use of chemical fertilisers	3	iii. More area and dense forest	3	iii. Practice of slash and bum and floods allow to enter the fields	3
			iv. More animals	4	iv. Allowed to collect green leaves and fodder from forest	4	iv. Single crop per year	4
							v. Large and dense forest	5
							vi. Use of more FYM	6
VDC	WARD NO. 1		WARD NO. 4		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank:	Reasons	Rank	Reasons	Rank
Bhanu	i. Free grazing of animals	i	i. Practice of slash and burn and floods allow to enter the fields	1	i. Single crop per year	1	i. Single crop per year	1
	ii. Leaving more land fallow for next crop	2	ii. Single crop per year	2	ii. More use of FYM	2	ii. Practice of free grazing	2
	iii. Less use of chemical fertiliser	3	iii. Free grazing system	3	iii. No use of chemical fertilisers	3	iii. More use of FYM	3
							iv. Less use of chemical fertilisers	4
							v. Practice of slash and burn and floods allow to enter the field	5

Table 5.9: Ranking of reasons for increase in soil fertility status in Khet land over the last five to ten years, Pakhribas and Murtidhunga VDCs, Eastern Region, 1999.

VDC	WARD No. 3		WARD NO. 6		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rant:	Reasons	Rank
Pakhribas	i. More animals	I	i. Less use of chemical fertilisers	1	i. Better top soil	I	i. Practice of slash and burn and floods allow to enter the field	I
	ii. More use of manures	2			ii. Use of more FYM	2	ii. Use of more FYM	2
	iii. No use of chemical fertilisers	3			iii. No use of chemical fertilisers	3	iii. Less use of chemical fertilisers	3
	iv. Large area under dense forest	4					iv. Single crop per year	4
							v. Use of more labour in farming	5
							vi. Less population	6
VDC	WARD NO. I		WARD NO. 2		WARD NO. 5		WARD NO. 9	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Mureidhunga	i. Better top soil	1	i. More use of FYM	1	i. Single crop per vear	I	i. Continuous hard work	1
	ii. More use of FYM	2	ii. Single crop per year	2	ii. Free grazing of animals	2	ii. Use of more labour in farming	2
	iii. More weeding	3	iii. Use of ash as manure by burning waste dry leaves and fire - wood in the fields	3	iii. Less use of chemical fertilisers	3	iii. Single crop per year	3
								I

Table 5.10: Ranking of reasons for decline in soil fertility status in Khet land over the last five to ten years, Pakuwa and Bhanu VDCs, Western Region, 1999.

VDC	WARD NO. 1		WARD NO. 4		WARD NO. 5		WARD No. 6	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Pakuwa	i. Single crop per year	1	i. Lack of irrigation facility	1	i. Children feel lazy in working at farm	1	i. Lack of hard work	1
	ii. Less use of FYM	2	ii. Application of more chemical fertilisers	2			ii. More area under more than one crop per year	2
	iii. Application of more chemical fertilisers	3	iii. Soil becoming more acidic	3			iii. Less use of FYM	3
	iv. Stall feeding for animals	4					iv. More use of chemical fertilisers	4
							v. Lack of adequate fodder for feeding animals	5
VDC	WARD NO. I		WARD NO. 4		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Bhanu	i. Less use of FYM	1	i. Continuous use of chemical fertilisers	1	i. More area under more than one crop per year	1	i. Use of chemical fertilisers	1
	ii. More area under more than one crop per year	2	ii. Less use of FYM	2	ii. Lack of irrigation	2	ii. More area under more than one crop per year	2
	iii. Intensive cultivation without leaving land fallow	3	iii. Less animal numbers	3	iii. Less animals	3	iii. Less animals	3
	iv. More use of chemical fertiliser	4	iv. Decrease trend of slash and burn	4			iv. Less use of FYM	4

Table 5.11: Ranking of reasons for decline in soil fertility status in Khet land over the last five to ten years, Pakhribas and Murtidhunga VDC, Eastern Region, 1999.

VDC	WARD NO. 3		WARD NO. 6		WARD NO. 7		WARD NO. 8	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Pakhribas	i. More Use of chemical fertilisers	1	i. More use of chemical fertilisers	]	i. Top soil washed down	1	i. Less animals	1
	ii. Lack of free grazing land	2	ii. Less use of FYM	2	ii. Less use of FYM	2	ii. Less use of FYM iii. Less weeding	2 3
	iii. Less animals	3			iii. More use of chemical fertilisers	3	iv. Lack of grazing places	4
	iv. Less use of FYM	4					v. More area under more than one crop per year	5
	v. Decreasing trend of in-situ manuring practice	5					vi. More use of lower quality chemical fertilisers	6
	vi. Lack of irrigation	6					vii. Lack of irrigation water	7
	vii. Shortage of labourers to work in the field	7						
	viii. Children are lazy and do not work hard in the field	8						
VDC	WARD NO. 1		WARD NO. 2		WARD NO. 5		WARD NO. 9	
	Reasons	Rank	Reasons	Rank	Reasons	Rank	Reasons	Rank
Mur idhung[g]a	i. Top soil washed away	1	i. Less use of FYM	1	i. More area under more than one crop per year	1	i. Lack of use of FYM in Khet land	1
	ii. Lack of adequate irrigation	2	ii. More use of chemical fertilisers	2	ii. Stall feeding of animals	2		
	iii. Less use of FYM	3	iii. Shortage of green leaves and fodder due to lack of forest	3	iii. Use of more chemical fertilisers	3		
	iv. Less weeding	4						

5.1.1.4 Farm Yard Manure

FYM is considered to be the most important source of nutrient for the major crops in all surveyed Wards of four VDCs. In all Wards, farmers were applying FYM to maize, mustard, upland rice, potato, rice, wheat and vegetables. Without FYM, farming of these areas will be risky. Because of its' importance in fanning, most farmers keep at least a few animals, including cows, buffaloes, goats, sheep, pigs and poultry. The dung collected from these animals is used to make FYM, which is applied, to soil to increase crop productivity. The animals need green grasses and fodder to eat which the farmers either collect from their own private farm or from the forest. Hence. FYM has an important role in the complex and diverse farming systems of the surveyed areas.

Farm Yard Manure making practice

FYM making practices in Nepal follow very traditional practices which have not changed significantly with the generations.

The key informants of four Wards of Pakuwa VDC were asked to explain the practice of FYM making by the farmers in the area. The procedure is as follows and is similar to Ward Nos. 1, 4, 5 and 6.

First, green leaves, fodder and grasses are collected either from private tree plantation or from the forest. Those who have fallow land, also collect grasses from such land. Fodder, green leaves and grasses are given either as feed to animals or used for bedding in the animal shed. Everyday, the shed is cleaned and dung, urine, left over of leaves, fodder and grasses are collected and heaped inside a pit for about six months. Mid way through this six months period, some farmers turn the heap upside down but others do not. When the deposited heap turns black, the farmers consider that FYM is ripe and should be used in the field for crop cultivation. It is mostly women who fill the bamboo basket doko with FYM and carry it to the field where it is left for sometime. At the day of planting, the small heaps of FYM in the fields are spread followed by ploughing. FYM is used in both PakhoBari and Khet land, but mostly in PakhoBari land.

Similar procedures are followed in all Wards of Bhanu VDC of western region.

In the eastern region, the key informants interviewed in four Wards of Pakhribas VDC and in the four Wards of Murtidhunga VDC also reported a similar procedure for making FYM, as explained above.

The only difference was found in Ward Nos. 2 and 9 of Murtidhunga where hco pits were made. for preparing good FYM. For the first four months, the litter is kept in the first pit and then it is transferred to the second pit. It is again kept for four more months in the second pit where it decomposes and produces "good" FYM.

Changes in FYM making practice

The key informants of a majority of Wards reported that there had been no change in FYM making practices during the last ten years. In a few Wards. the followin[g] changes were mentioned.

The key informants of Ward No. 7 of Bhanu explained that in past, more dung was used in making FYM because more animals were owned. At present, more leaves, grasses and fodder are mixed with less dung to make FYM.

The key informants of Ward No. 6 of Pakhribas added that in the past, the farmers hardly collected leaves and forages to make FYM. Now, the farmers family members have to spend time collecting green leaves and grasses to make FYM.

Another difference was pointed out by the key informant of Ward No. 5 of Murtidhunga VDC that at present, only good, mature and well decomposed FYM is taken out from the pit and spread in the field. Remaining portion is left until it gets decomposed.

It was mentioned in Ward No. I of Murtidhunga VDC that most males had left home to find jobs in towns and cities. Hence, females have to do more work including FYM making.

Involvement of family members in FYM activities

In all Wards surveyed, both male and female farmers are involved in making FYM. Sometimes, the children also take part in some activities. Table 5.12 illustrates the results from the compilation of activities performed by the members of the households of all sampled Wards of four VDCs and is presented in summary.

Table 5.12: Involvement of family members in making FYM.

S.N	ACTIVITIES	MALE	FEMALE	CHILDREN
1	Collection of green leaves, fodder and grasses for feed	√	√(mostly)	√
2	Bedding in animal shed	√	√	
3	Digging the pit for litter collection	√		
4	Clearing and collecting the litter from the shed and putting in heap inside the pit	√	√ (mostly)	√ (some times)
5	Turning the heap upside down	√		
6	Carrying FYM to the field	√	√	
7	Spreading FYM in the field	√	√ (mostly)	

Constraints of making FYM

A number of constraints in making FYM were identified as the result of the key informant survey. The reasons for these constraints and possible solutions are given in Table 5.13*).*

Most of the responses given by the thirty two key informants were similar and they are compiled and presented in Table. 5.13.

Table 5.13: Constraints to making FYM, their reasons and solutions.

S.N.	CONSTRAINTS	REASONS	SOLUTIONS
1	Lack of adequate green leaves, fodder and green grasses	Lack of forest and restriction to collect leaves from the forest	Need to plant trees in own private land
2	Less number of animals owned	Lack of money to increase no. of animals	Requires Bank to get loan
3	Less dung available	Few number of animals	Kee improved breeds
4	Restriction of entering forest area for collection of green leaves and Fodder	Rules and regulations imposed	No solution
5	Not adequate place for free Grazing	Not adequate fallow land	Tree plantation in own waste land to provide fodder
6	Lack of technical knowledge to prepare good FYM	Lack of training	Provide training
7	Lack of practice to dig pits.	Lack of training	Provide trainin[g]
8	Unavailability of adequate FYM	Few animals and less forest	Replace by chemical fertilisers
9	Shortage of labourers	Schooling of Children and male leaving villa[g]es for jobs	No solution

5.1.1.5 Chemical fertiliser

Farmers` practice in chemical fertiliser application

The farmers of surveyed Wards were using urea and DAP and a very little quantity of potash. Other fertilisers like SSP and TSP were not used.

Pakuwa. Chemical fertilisers are used in various crops in all four Wards. In Ward No. 1, urea is used in rice, wheat and maize, whereas DAP is used only in wheat. The farmers estimate the amount of fertiliser required by a crop and broadcast it by hand. The farmers in general do not know the quality and quantity of fertilisers required for each crop.

According to some experienced farmers of Ward No. 4, they use two thirds of DAP and one third of urea for wheat before broadcasting seeds. The rest is used for top dressing at a different time period (mostly within one month after broadcasting seed). Similar practices are followed in Ward No. 5 in wheat. In maize, a mixture of urea and DAP is applied after weeding. A mixture of urea, DAP and FYM is used in mustard. If Khet land is infertile, a mixture of urea and DAP is used in rice one month after transplantation.

The practice of applyin[g] chemical fertilisers in Ward No. 6 is slightly different compared to the other three Wards. For wheat and mustard. seeds are broadcasted that followed by broadcasting a mixture of urea and DAP. Then both seeds and fertilisers are covered by ploughing and planking the field.

Bhants: The key informants of Ward No. 1 explained that both urea and DAP are mixed and applied to the field after puddling but before rice transplantation. However, in PakhoBari land, DAP is used before planting and urea is generally used after planting of upland rice. A few farmers also use potash.

In Ward No. 4 of Bhanu VDC, most farmers could not judge the quality and quantity of fertilisers for each crop. Hence. on their judgement, the fertilisers are mostly applied in rice and wheat in Khet land. In most cases, the fertiliser is used before transplantation of rice and before broadcasting wheat seeds. Similar practices as mentioned in Ward Nos. I and 4 are followed in the adjoining Wards. 8.

Table Nos. 5.14 and 5.15 show the amount of chemical fertiliser applied by farmers in different crops to PakhoBari and Khet land in Pakuwa and Bhanu VDCs.

Table 5.14: Average application of chemical fertilisers to PakhoBari land in Pakuwa and Bhanu VDCs, Western Region, 1999.

Unit: (Kg/ha)

VDC	WARD NO.	MAIZE		UPLAND RICE		WHEAT		POTATO		MUSTARD	
		Urea	DAP	Urea	DAP	Urea	DAP	Urea	DAP	Urea	DAP
Pakuwa	1	59	59	59	59						
	4	49						197	10		
	5			30	16						
	6										
Overall average of users		54	59	44.5	37.5			197	10		
Bhanu	1	39		79							
	4										
	7			61	89					39	
	8	49	49	49	89						
Overall average users		44	49	63	89					39	

Note: Values missing in cells represent no application of fertiliser.

Table 5.15: Average application of chemical fertilisers to Khet land in Pakuwa and Bhanu VDCs, Western Region, 1999.

Unit: (Kg/ha)

VDC	WARD No.	RICE		WHE		POTATO	
		Urea	DAP	Urea	DAP	Urea	DAP
Pakuwa	1	98	98	118	118	89	89
	4	66	66	98	69		
	7	49	49			59	
	b	49	89	89		49	
Overall average of users		65.5	75.5	101.7	9 3.5	65.7	89
Bhanu	1	98	98	118	118	89	89
	4	66	69	98	69		
	7	49	49	59			
	8	49	49	89		49	
Overall average of users		65.5	66.3	91	93.5	69	89

Note: Values massing in cells represent no application or tertiliser.

Pakhribas: In Ward No. 3 of Pakhribas VDC, chemical fertilisers are used in most of the major crops. Before transplanting rice, urea is broadcasted in the field. If rice does not look green and the growth is poor, then urea is also top dressed in the rice field. Urea is applied one month after planting wheat. After the first weeding of maize, about a teaspoonful of urea is applied near the root around each plant. A similar practice is followed for mustard as for wheat. Before planting potato seeds,

urea is placed in a hole made in the side of the main hole and then covered by soil from top after the plantation of seeds. These practices are similar to those in Ward No. 6.

In both Ward Nos. 7 and 8, the key informants stated that the majority of farmers were unaware of the exact doses of fertilisers to be applied to each crop. So, the applications of chemical fertilisers for different crops were on approximation. In rice, mustard and wheat, urea is applied after the first irrigation or after first rainfall. In maize, a teaspoonful of urea is applied after first weeding close to the root of each plant. In most cases, the fertilisers are applied twice per season for crop, first at planting time and second at weeding time.

Murtidhunga: On the basis of KIS, the farmers in Wards Nos. I and 2 were unaware of the exact dose of chemical fertilisers (CF) to be applied for various crops. In most cases, the amount of CF used on a crop is guessed. In rice, DAP is applied before transplanting and then top dressed after the first irrigation. A teaspoonful of urea is applied close to the roots of each maize plant after first weeding.

The key informants of Ward Nos. 5 and 9 also reported that the farmers were unaware of the dose of CF to be applied to each crop. They had no training in the application of CF to various crops. So, the amount of CF applied per unit of land for each crop is guessed. In maize, urea is used after the first weeding. CF is applied in rice and sometimes in millet 30 days after planting, to make the plants green.

Table Nos. 5.16 and 5.17 show the amount of chemical fertilisers applied by farmers in different crops to PakhoBari and Khet land in Pakhribas and Murtidhunga VDCs.

Table 5.16: Average application of chemical fertiliser to PakhoBari land in Pakhribas and Murtidhunga VDCs, Eastern Region, 1999.

Unit: (Kg/ha)

VDC	WARD NO.	MAIZE		UPLAND RICE		WHEAT		POTATO		MUSTARD		CAULIFLOWER	
		Urea	DAP	Urea	DAP	Urea	DAP	Urea	DAP	Urea	DAP	Urea	DAP
Pakhribas	3	59	39	59	39.3					59	39		
	6	20	20					20	20	2 0	20		
	7	49				69		128	59	59			
	8	30				151							
Overall average of users		39.5	29.5	59	39.3	110		74	39.5	46	29.5		
Murtidhunua	1	79		79									
	2			39	20								
	5	99	79					78	78			118	79
	9												
Overall average of users		88.5	79	59	20			78	78			118	79

Notes Values missing in cells represent no application of fertiliser.

Table 5.17: Average application of chemical fertilisers to Khet land in Pakhribas and Murtidhunga VDCs, Eastern Region, 1999.

I Tnit• **(V o/hn)**

VDC	WARD NO.	RICE		W H		POTATO	
		Urea	DAP	Urea	DAP	Urea	DAP
Pakhribas	3	59	39	59	39	59	20
(	6	10		10			
l	7	59		69		49	
	8	49	30	49	30		
Overall average of users		44.25	34.5	46.75	34.5	54	20
Murtidhunga	1						
	2						
(	5	39		79			
	9						
Overall averag of users		39		79			

Note: Values missing in cells represent no application of fertiliser.

Involvement of family in purchase and application of chemical fertilisers

In response to the question of who in the household goes to the market to purchase CF, the key informants of all Wards reported that both males and females go to the market to purchase CF. Whoever is free, that person is the one who goes to the market to get the fertiliser.

The key informants reported that either male head or female head or both are involved in the purchase and application of CF in all selected 16 Wards of four VDCs. The results of respondents are compiled and presented in Table 5.18.

Table 5.18: Involvement of family in fertiliser application.

S.NO.	ACTIVITIES	MALE	FEMALE
1	Purchase of CF in the market and bring back to home.	√	√
2	First application of CF in the field .	√	√
3	Second application of CF in the field.	√	√

Changes in application of chemical fertilisers

The key informants of Pakuwa VDC reported that there were changes in both the quantity and quality of chemical fertilisers and in their use as compared to the last five to ten years. At present_ the quality of CF is poor. It is used more to crops, but the soil is getting harder. Ten years ago, the situation was reverse of this. It was also reported that within the past two years, the use of urea and DAP has increased substantially, and land is becoming harder. Consequently, it is now difficult to plough the fields, particularly for wheat cultivation.

Only the key informants of Ward No. 1 of Bhanu VDC noted change in fertiliser use. In the past, (that is, ten years ago), only one type of fertiliser was used (that is, Ammonium Sulphate). At

present. two types of fertilisers are mixed before the application (that is, urea and DAP). The quality of CF was better earlier.

In Pakhribas, the key informants of Ward Nos. 6, 7 and 8 stated the following changes in its use of CF during the last 10 years. These changes are mainly an increase in price, deterioration in quality and the mixing of urea and DAP before application.

The key informants of Ward Nos. 2 and 9 of Murtidhunga VDC reported that in the past, farmers used to get good quality fertiliser for a low price. At present, the price of DAP has increased substantially and farmers hardly use DAP in the area. Instead, farmers prefer to use urea.

Trends of application of chemical fertilisers

Pakho/Bari land: The key informants of Pakuwa VDC reported that uses of urea and DAP have increased in Ward Nos. 1, 2 and 5 during the past five to ten years. In Ward No. 8, all PakhoBari land is grassland for grazing. So the fertiliser is not applied.

In Bhanu VDC, the key informants stated that the use of urea has increased in Ward Nos. 1 and 8, and it has remained constant in Ward No. 7 during the last five to ten years. In Wand No. 4, there is no application of CF to PakhoBari land. Some farmers of Ward Nos. 7 and 8 are not applying DAP because of the increase in price and so its use is decreasing.

The key informants of Pakhribas VDC reported that the use of urea has increased in all four of the sampled Wards during the last five to ten years. But in Ward Nos. 6, 7 and 8, the use of DAP is decreasing mainly due to the increase in price.

Both urea and DAP are used by the farmers of Ward Nos. 1, 2, 5 and 9 of Murtidhunga VDC. As reported by the key informants, the use of urea in all four Wards is increasing. The use of DAP is increasing in Ward Nos. 1 and 5 and decreasing in Ward Nos. 2 and 9.

Based on the key informants' responses, Tables Nos. 5.14 to 5.17 illustrate the approximate rate of application of CF to different crops by Wards and VDCs to PakhoBari land and Khet land.

Khet land: Based on the response of the key informants of Pakuwa VDC, the use of both urea and DAP has increased at all four Wards during the last five to ten years.

The use of urea is increasing in all four Wards of Bhanu VDC, but the use of DAP is decreasing.

The key informants of four sampled Wards of Pakhribas VDC reported that during the last five to ten vicars the use of urea is increasing in all Wards while the use of DAP is also increasing in Ward No. 3. Its use in Ward Nos. 6, 7 and 8 has declined, mainly due to its' increase in price.

In MurtidhunE!a VDC, the farmers' use of urea is increasing in Ward Nos. 1, 5 and 9 and it is decreasing in Ward No. 2. As reported by the key informants, use of DAP is increasing in 'Gard No. 1 and decreasinn in the other three Wards.

Farmers' Perception on deterioration of soil due to use of chemical fertilisers

Pakuwa: The key informants of four Wards of Pakuwa mentioned that with the use of chemical fertilisers (CF), the soil was deteriorating thereby lowering fertility and reducing production. The major reasons cited for this cause were as follow.

i. CF make the soil harder and weak.;
ii. CF decrease the quality of crops, especially rice;
iii. CF destroy the fertility status of soil thus making soil unfertile;
iv. CF make the land difficult to plough, dig and to break clods;
v. Animals have difficulty to plough as the result of hard soil;
vi. Land is becoming infertile, resulting in the decline in crop productivity;
vii. As there is no alternative to replace CF, farmers have to use it.

Bhanu: The key informants of Bhanu VDC gave the following reactions to the use of CF.

i. With the continuous use of CF in the last few years the soil is much harder. This makes the land difficult to plough and dig;
ii With use of CF, soil is becoming sticky and the soil is made infertile;
iii. Even with the use of CF, the productivity has been declined.

Pakhribas: The key informants of Pakhribas VDC had the following responses to the use of CF.

i. CF make the soil hard and so difficult to plough and dig;
ii. Due to a lack of knowledge in the proper application of CF, the soil is deteriorating with the use of CF;
iii. With the use of CF alone (that is, without FYM), crop productivites are declining;
iv. Because of hardness of soil due to continuous use of CF, more labourers are required for ploughing and digging the land;
v. With lack of adequate knowledge of using CF properly, plants become weak and they sometimes lodge in the ground. This evidence implies that the soil fertility has been declining due to use of CF;
vi. Attacks of insects and diseases are more, clue to use of CF.

Murtidhunga: The responses of the key informants in Murtidhunga were as follows.

i. Use of CF makes soils acidic, The soil becomes harder making it difficult to plough and dig;
ii. With use of CF only, the soil becomes weaker and deteriorates resultin[g] in lower productivity;
iii. Soil is getting harder and drier with more clods;
iv. The users do not have adequate knowledge and they guess the amount of CF to use; the farmers have realised that use of CF alone does not make soil good. FYM is not adequate to apply.

Farmers' Responses on advantages of applying chemical fertilisers

Despite the weaknesses associated with CF, the following are the advanta[g]es of applying chemical fertiliscrs mentioned by the key informants.

Pakuwa•

i. CF is easy to carry and apply with less labour;
ii. With the use of balanced CF, it increases the productivity of crops. With its' use, the plants become green and grows fast. Its' use in past substantially increased the productivity of crops. Because of lack of adequate FYM in the villages, CF is the only alternative and farmers are compelled to use it.

Bhanu:

i. CFs are easy to carry from the market, easy to apply and need less labour for its application.
ii. CFs make the plants green, grow fast, produce a good crop stand, increase production of grain and straw.
iii. In the early days, the productivities of crops increased substantially with the use of CF. However, the production from a known area of land is now lower with the same input of CF. So farmers are reducing their use of CF.

Pakhribas:

i. With use of CF, the plants become green (also turns yellow plants to green), grow fast, mature earlier and produce more in a shorter period.
ii. CF is easy to carry from the market and faster in application.

Murtidhunga:

i. Due to use of CF, the crops can be harvested earlier (tentatively one month earlier than regular harvest).
ii. CFs make plants green, grow fast, increase the numbers of panicles and grains per plant and give better harvests.
iii. With its' use, three crops per year become possible due to early maturity of major crops and thereby increasing production.
iv. DAP is preferable to urea, because urea only makes plants green, whereas DAP makes better grains and increases production.

5.1.1.6 Green Manure:

Green manuring used to be a common farming practice to increase the fertility of soil. Farmers had identified some plants, such as Titepate. Asuro. Ghuswro. Siro. Padke. Mudauro, Chilanune. Dhaincha. Sir-is. Uttis. Khirro, Pati and legumes which were used formerly for green manuring in the study area. Latin names of these green manure plants and fodder trees are given in Annex VI. They were easily available in PakhoBari land, on risers of Khet land, on fallow and waste land and in the forest. These plants have slowly disappeared during the last fey years and the green manuring practices are slowly disappearing. Availability of chemical fertilisers also reduces the practice of green manuring. However, some farmers of the study area are still practicing green manuring.

Farmers practice in green manuring

In Ward Nos. I and 6 of Pakuwa VDC, the branches and green leaves of Asuro, Ghursul, Titepat and Chilaune were collected and used in rice seed bed and also during rice cultivation. The leaves of those plants were buried in the rice field before rice transplantation. Asuro is used in veaetables cultivation. Asuro is spread in vegetable garden and the buried during land preparation where it

decomposes, after sometime. As reported by the key informants, some legumes like lentils, cowpeas, blackgram and soyabean are grown, and they also are treated as green manures.

Based on key informants' report, green manuring practice is followed by some farmers in Ward Nos. 1. 4, 7 and 8 of Bhanu VDC. In Ward No. 1, the branches of Padke are collected and they are first used in the field to make the roof of small hut. After, they dry, the leaves are spread in the field and then ploughed into the soil, where they decompose.

In Ward Nos. 4 and 7, the leaves and branches of Titepate and Asuro are collected from the forest and the banks of the stream and cut into smaller pieces. Then, they are spread and covered by the soil after ploughing. The seeds are planted in the same field. These plants are also used to cover the seedbed of rice and millet. Leguminous crops are also grown in these Wards.

The practice of green manuring in Pakhribas and Murtidhunga is not substantially different from Pakuwa and Bhanu VDCs. The plants used for green manuring are the same. There exists the practice of spreading Titepati in the animal shed and then decompose it in a pit. However, Titepate are used to cover seedbeds of rice and millet. Leguminous crops are grown by most of the farmers in their fields, but on a small scale.

Changes in green manuring practice

The majority of key informants reported that there had been no change in green manuring practice in the recent past. Nevertheless, a few changes reported by the key informants of different Wards are as follows:

i. Due to shortage of materials required for green manuring, the use of chemical fertiliser is increasing (Ward No. 1 of Bhanu).
ii. In past (that is, 10 years ago), most farmers did not plant leguminous crops. At present, due to awareness of legumes as soil fertility promoter and its benefits, most farmers have planted leguminous crops (Ward No. 6 of Pakhribas).
iii. In past, Titepate was not used to cover seedbeds of rice and millet. Now, most farmers are following this practice (Ward No. 5 of Murtidhunga).

Involvement of family members in green manuring activities

Table 5.19 shows the involvement of male, female and children in various activities for green manuring in surveyed Wards of four VDCs.

Table 5.19: Involvement of family members in green manuring activities.

S.N.	ACTIVITIES	*MALE*	FEMALE	CHILDREN
1	Collection of branches of green manure plants	√	√ (mostly)	√(sometimes)
2	To cut them into pieces	√	√ (mostly)	
3	spread them in the field		√	
4	To plough and cover by soil to decompose	√		
5	To cover seedbed of rice and millet	√	√	
6	To spread in animal shed	√	√	

Constraints to applying green manures

The farmers of the surveyed Wards have only a limited awareness of benefits of using green manures. Those farmers who have been using green manuring can say simply that they are useful plants for crop cultivation. They have very little knowledge of the nutritive value of green manure.

The constraints to applying green manure, the reasons for this and possible solutions reported by the key informants of the surveyed Wards are given in Table 5.20.

Table 5.20 : Constraints, their reasons and solutions in applying green manures.

S.NO.	C O N S T R A I N T S	R E A S O N S	S O L U T I O N S
1	Collection of adequate materials (green manure plants).	Protected forest and little fallow land	Necessary to plant in the private land
2	Unavailability of Dhaincha seeds	No idea for the source of seed	Seeds should be provided by concerned authorities
3	Lack of knowledge about Dhaincha plantation	Unknown	Training needs to be organised.
4	Lack of knowledge on when and how to plant green manure trees.	Unknown	Training needs to be organised.
5	Practice of green manuring is disappearing	Shortage of manpower and laziness	Farmers should be active and require cash for hiring labourers
6	Lack of awareness about its importance	Lack of knowledge	Needs training
7	Unaware about the importance of leguminous crops as green manure	Nobody informed	Needs Training

5.1.1.7 Compost making practice

The key informants reported that the practice of compost making was not common in Ward Nos. 1 and 2 of Pakuwa VDC. But, some farmers of Ward Nos. 5 and 6 had received trainin[g] in compost making at ARS, Lumle. However, the compost making is not practised in these areas. The respondents explained the way compost was prepared. The farmers go to the forest and collect green leaves and fodder and spread them in the animal shed. Dung and urine are mixed with waste materials and put aside in a ready pit. Some water and urea are spread on the top. In past, in absence of urea. they used to spread ammonium sulphate with some water. After one and half months, the manure is turned upside down. Again, same activity is followed for three months. A lon[g] raw green stick with its' bark is generally put in the middle of the pit in depth from ven- beginning (that is, before loading the waste materials inside the pit. Between four to six months later, the stick is pulled out of the pit to test whether the compost is well prepared or not. While puffing the stick, if the outer cover (bark) is left inside the pit, then the compost is considered mature and ready for use. If the compost is decomposed well and looks black, then farmers consider it as good compost. The compost was mostly used in potatoes in the past. Now a days, this practice is disappearing.

Only in Ward No. 7 of Bhanu VDC, compost is prepared and used. In Ward No. 7, some female farmers received training in compost making through Women Development Branch of the District Office. The procedure for making compost is the same as mentioned above.

The farmers of Ward Nos. 7 and 8 of Pakhribas VDC are unaware of compost preparation, its' uses and benefits. A few farmers of Ward Nos. 3 and 6 had received training on compost making at ARS, Pakhribas but not used at present. Only a few farmers of Ward Nos. 3 and 6, who are employees of ARS, Pakhribas prepare compost and use it in potato and vegetables production. The procedure of making compost is the same as explained earlier.

Except in Ward No. 2, in Murtidhunga VDC, the farmers have no knowledge about compost making. All farmers of Ward Nos. 1, 5 and 9 demanded technical training in compost making. Some farmers of Ward No. 2 had received training in compost making at ARS, Pakhribas. A few are preparing compost and applying it to their farmland, but majority of them are not. The procedure of making compost is the same as explained earlier.

As stated above, compost making and its' use is not a common practice in most Wards of four VDCs. Hence, none of the family members are involved in this practice, except in a few Wards, where both males and females are involved in different activities of compost making. Those few farmers, who have been making and applying compost to their farmland, explained that there has been no change in compost making during the last ten years.

Involvement of family members in compost making

As stated earlier, compost making is not a common practice except in a few Wards. The key informants, who were aware of compost making and had themselves received training, explained the involvement of both men and women in compost making activities. The key informants of Ward Nos. 5 and 6 of Pakuwa VDC, Ward No. 3 of Pakhribas VDC and Ward No. 2 of Murtidhunga VDC reported the division of work as shown in Table 5.21.

Table 5.21: Involvement of family members in compost making

S.NO.	ACTIVITIES	MALE	FEMALE	CHILDREN
I	Collection of green leaves and fodder		√	√ (sometimes)
2	Digging the pits	√		
3	Mixing dung with green leaves and fodder and put in the pits	√	√	
4	Mixing urea, ash and spreading water	√	√	
5	Turning compost	√		
6	Shifting compost from pit to pit	√		
7	Carrying to the field	√	√	
8	Spreading in the field	√	√	

Constraints in making compost, their reasons and solutions:

Most of the responses given by the key informants were similar and they are compiled in Table 5.22 to present some of the constraints in making compost , their reasons and solutions.

Table 5. 22: Constraints, reasons and solutions in making compost.

VDC & WARD NO.	CONSTRAINTS	REASONS	SOLUTIONS
Paku 5	i.Difficult and uneasy	i. Needed three pits to dig	i. Making FYM easy and better than compost
Pakuwa 6	i. Unavailability of green leaves For compost	i. Lack of manpower	i. To plant more number of trees in private land nearly homestead
	ii. Restriction to cut branches of trees in the forest for green leaves	ii. Lack of green leaves	ii. Making FYM easy and better than compost
	iii. Making pits is difficult and uneasy job	iii. Requires more manpower	iii. Malt or wage paid labour should be used
	iv. Difficulty of mixing leaves and dung due to shortage	iv. Laziness	iv. To be active
Pakhribas 3	i. Lack of time to snake compost	i. Unwillingness	i. Create willingness
	ii. More children going to school	ii. Schooling	ii. No solution
	iii. Lack of technical knowledge	iii. Lack of training	iii. Plan training
	iv. Not in practice	iv. Unawareness	iv. Convince to use
Pakhribas 6	i. Not in practice since past	i. Nobody inform to use	i. Convince and demonstrate its use and benefits
	ii. Lack of technical	ii. Lack of training	ii. Plan training
Pakhribas 7	i. Unawareness	i. Due to use of chemical fertilisers	i. Requirement of training
	ii. Carelessness	ii. Laziness	ii. Avoid laziness
Pakhribas 7	i. Lack of green grasses and leaves	i. Protected forest	i. Necessary to plant trees on farmers' own private waste land
	ii. Lack of knowledge in making compost	ii. Lack: of training	ii. Requires training as well as resources.
Murtidhunga 1	i. Not in practice since past	i. Nobody- tried and practised	i. Convince its' uses and benefits

Continued Table 5.22

VDC & WARD NO.	CONSTRAINTS	REASONS	SOLUTIONS
	ii. Lack of technical knowledge	ii. Lack of training	ii. Requirement of training
Murtidhunga 2	i. Lack of green leaves	i. Protection of forest	i. Necessary to plant trees in private land
	ii. Lack of technical knowledge	ii. Lack of training	ii. Requirement of training
Murtidhun[g]a 5	i. Unawareness and lack of knowledge	i. Unknown	i. Requirement of training
	ii. Not in practice since past	ii. Unaware and nobody told	ii. Needs to convince its' uses and benefits
	iii. Lack of green trees	iii. Protected forest	iii. Necessary to plant trees in private land

5.1.1.8 Leguminous crops

Blackgram and lentils are grown in Pakho/Bari land of surveyed Wards of Pakuwa VDC. Other leguminous crops such as soyabeans and cowpeas are also grown to some extent.

In Bhanu VDC, blackgram, soyabeans, beans, lentil and cowpeas are gro«n in Pakho/Bari land in most of the surveyed Wards. But, it is commonly grown in Ward No. 1. Blackgram and cowpeas are also grown in Khet land of Ward Nos. 1, 4 and 7.

In Pakhribas VDC, soyabean, lentils and masvana are grown in Pakho/Bari land of Ward Nos.3, 7 and 8. They are also grown in Khet land mostly in Ward Nos. 3 and 7.

Green peas, blackgram, soyabeans, beans and masvana are grown in all Wards of Murtidhunga VDC. Leguminous crops are mostly grown at the risers Ali) of terraces.

However, there is plenty of scope and potential to promote leguminous crops in the surveyed areas.

5.1.1.9 Ranking of manures and chemical fertilisers in terms of their quality and fertility

The keN informants of all 16 Wards of four VDCs were asked to rank different types of amendment to improve soil fertility on the basis of their qualities to improve the fertility of soil. In most cases, there are similar answers of four selected Wards of each VDC. While ranking. they gave reasons to justiA! why *one is* better *than* another. Table 5.23 provides the ranking of amendments to improve soil fertilirv *in each* Ward *of* four VDCs.

Table 5.23: Ranking of amendment to improve soil fertility by Ward in four VDCs in Eastern and Western Region, 1999.

S.N.	TYPES OF FERTILISERS	PAKUWA				BHANU				PAKI-IRIBAS				MURTIDHUNGA			
		Ward no.				Ward no.				Ward no.				Ward no.			
		1	4	5	6	1	4	7	8	3	6	7	8	1	2	5	9
1.	Compost	NK	NK	4	1	2	6	2	3	3	4	6	6	NK	2	3	4
2.	FYM	3	1	2	6	6	1	3	1	2	2	2	2	1	3	1	1
3.	Chemical fertiliser	2	2	3	3	5	4	4	4	4	5	5	5	3	5	4	2
4.	Green manuring	4	5	5	4	3	3	5	5	5	3	3	4	NK	4	5	6
5.	FYM - fertiliser	1	3	1	2	1	2	1	2	1	1	1	1	2	1	2	3
6.	Legumes	5	4	NK	5	4	5	6	6	6	6	4	3	4	6	6	5

Note: i. NK implies not known and used.
ii. Ranking 1 is highest preferred and 6 is lowest preferred.

5.1.1.10 Ranking of organic and inorganic fertiliser with respect to various crops.

Key informants of each Ward were asked to rank the importance of each type of amendment for each particular crop, such as rice, wheat, maize, upland rice, millet, potato, black-gram, soyabean, lentil and mustard.

In some cases, the responses of the key informants remained same rank for an amendment. For example, FYM was ranked first (that is, 1) for both maize and potato by the key informants of Ward No. 1 of Pakuwa VDC followed by other crops with rank 3, 4 and so on. Hence, rank 2 is missing in this example

Tables 5.24 - 5.27 provide the details of ranking by type of amendment and by crop type.

Table 5.24: Ranking of amendment to improve soil fertility with respect to different crops, Pakuwa VDC, 1999.

Ward 1

S.N.	ITEMS	CROPS FOR RANK.								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	3	6	1	3	1	7	7	7	3
3	Green manuring	NK	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	2	1	5	5	2	7	7	7	4
5	FYM+ fertiliser	9	3	2	3	1	3	3	3	3

Ward 4

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	4	4	1	1	3	NK	NK	NK	6
3	Green manuring	NK	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	4	1	2	2	5	NK	NK	NK	6
5	FYM+ fertiliser	NK	1	3	3	1	NK	NK	NK	NK

Ward 5

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Lentil	Mustard
I	Compost	NK	NK	NK	NK	N T K	NK	NK	NK	NK
2	FYM	1	NK	1	NK	1	4	NK	NK	4
3	Green manuring	NK	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	NK	1	NK	NK	2	NK	NK	4	3
5	FYM+ fertiliser	1	3	NK	NK	1	NK	N"K.	NK	NK

Ward 6

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Lentil	Mustard
i	Compost	1	1	1	NK	4	NK	NK	NK	NK
2	FYM	←			→	Not	Used	←		
3	Green manuring	1	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	2	1	NK	NK	3	NK	NK	NK	3
5	FYM+ fertiliser	NK	2	1	NK	NK	NK	NK	NK	NK

Note: i. NK implies not known or used.
ii. Rank I is most used for the respective crop, and 9 is least used for the respective crop.

Table 5.25: Ranking of amendment to improve soil fertility with respect to different crops, Bhanu VDC, 1999.

Ward 1

S.N.	ITEMS	CROPS FOR RAND									
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Upland Rice	Mustard l	Lentil
1	Compost	1	1	1	1	1	1	1	1	1	1
2	FYM	4	5	2	5	5	NK	NK	1	2	NK
3	Green manuring	NK	NK	2	NK	NK	NK	NK	1	NK	NK
4	Chemical fertiliser	1	2		NK	NK	NK	NK	5	3	NK
5	FYM+ fertiliser	NK	4	1	NK	1	NK	NK	1	5	NK

Ward 4

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soya bean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	1	1	1	1	1	1	1	1	1
3	Green manuring	1	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	1	2	NK	NK	NK	NK	NK	NK	NK
5	FYM+ fertiliser	2	1	NK	NK	NK	NK	NK	NK	NK

Ward 7

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Upland rice	Lentil	Mustard
1	Compost	I	1	1	1	1	1	1	1	1
2	FYM	1	1	1	NK	1	5	NK	NK	5
3	Green manuring	1	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	1	2	3	NK	4	NK	NK	NK	5
5	FYM+ fertiliser	NK	NK	1	3	1	NK	NK	NK	3

Ward 8

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize [1]	Upland rice	Potato	Black Gram	Sovabean	Lentil	Mustard
1	Compost	1	1	I	1	1	NK	NK	NK	NK
2	FYM	I	NK	1	NK	3	NK	NK	NK	4
3	Green manuring	1	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	2	1	4	NK	NK	NK	NK	NK	2
5	FYM+ fertiliser	3	1	4	2	5	NK	NK	NK	NK

Note: i. NK implies not known and used.
ii. Rank 1 is most used for the respective crop, and 9 is least used for the respective crop.

Table 5.26: **Ranking of amendment to improve** soil fertility with respect to different crops, Pakhribas VDC, 1999.

Ward 1

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Masyan	So abean	Lentil	Mustard
I	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	5	5	2	2	1	NK	6	7	2
3	Green manuring	1	NK	NK	1	NK	NK	NK	NK	NK
4	Chemical fertiliser	2	1	2	2	5	NK	6	8	6
5	FYM+ fertiliser	1	1	1	5	6	NK	6	8	4

Ward 4

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Mas ang	So abean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	NK	4	1	NK	3	NK	NK	NK	1
3	Green manuring	1	NK	NK	I	NK	NK	NK	NK	NK
4	Chemical fertiliser	5	3	1	5	2	NK	NK	NK	3
5	FYM+ fertiliser	NK	3	1	3	1	NK	NK	NK	3

Ward 7

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Masan	So abean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	4	3	1	1	1	NK	5	NK	4
3	Green manuring	1	NK	NK	1	NK	NK	NK	NK	NK
4	Chemical fertiliser	5	1	1	5	1	NK	NK	NK	1
5	FYM+ fertiliser	2	2	1	1	1	NK	2	NK	2

Ward 8

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Sovabean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	1	2	1	1	1	NK	NK	1	1
3	Green manuring	NK	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	1	5	2	2	2	NK	NK	NK	6
5	FYM-- fertiliser	1	4	2	NK	5	NK	2	NK	5

Note: i. NK implies not known and used.
ii. Rank 1 is most used for the respective crop, and 9 is least used for the respective crop.

Table 5.27: Ranking of amendment to improve soil fertility with (respect to different crops, Murtidhunga VDC, 1999.

Ward 1

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet:	Potato	Black Gram	Sovabean	Lentil	Mustard
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK.
2	FYM	9	8	1	7	1	3	3	3	3
3	Green manuring	NK	NK	NK	NK	NK	NK	NK	NK	NK
4	Chemical fertiliser	2	2	1	2	2	6	6	6	6
5	FYM+ fertiliser	2	8	1	2	9	2	2	2	2

Ward 2

S.N.	ITEMS	CROPS FOR, RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soyabean	Lentil	Mustard
1	Compost	I	1	I	1	1	NK	NK	NK	1
2	FYM	2	5	2	2	1	7	7	NK	6
3	Green rnanurinfl	I	NK	NK	NK	NK	NK	NK	NK	1
4	Chemical fertiliser	3	1	2	3	3	3	3	NK	3
5	FYM+ fertiliser	7	6	1	1	1	1	1	NK	7

Ward 5

S.N.	ITEMS	CROPS FOR RANK									
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Sava bean	Lentil	Mustard	Cauli flower
1	Compost	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
2	FYM	6	6	1	NK	I	I	NK	6	5	1
3	Green manuring	I	NK	NK	NK	NK	NK	NK	NK	i	NK
4	Chemical fertiliser	8	3	6	8	1	3	NK	3	6	1
5	*FYM*+ fertiliser	8	4	3	4	1	4	NK	4	4	1

Ward 9

S.N.	ITEMS	CROPS FOR RANK								
		Rice	Wheat	Maize	Millet	Potato	Black Gram	Soyabean	Lentil	Mustard
1	Compost	4	2	1	6	2	NK	NK	NK	4
2	FYM	2	2	1	NK	2	NK	NK	NK	5
3	Green manuring	1	NK	NK	1	NK	NK	NK	NK	NK
4	Chemical fertiliser	3	1	1	3	5	NK	NK	N`K	NK
5	FYM+ fertiliser	NK	2	1	NK	3	NK	NK	NK	NK

Note: i. NK implies not known and used.
ii. Rank 1 is most used for the respective crop, and 9 is least used for the respective crop.

5.1.1.11 Sources and Adequacy of Credit Availability

As mentioned in Chapter 4, the major sources of credit to the farmers are the Agricultural Development Bank, Nepal (ADB/N), Small Farmers Development Project (SFDP), Nepal Commercial Bank, Women Development Branch of District Office, Co-operatives, Rural Development Bank, Nepal Bank Limited, Dairy Development Corporation, local merchants and a few development oriented International Non-Government Organisations (INGOs) and Non-Government Organisations (NGOs).

All key informants of four Wards of Pakuwa VDC believed that credit availability was adequate and that farmers could get production loan in the package, which includes seeds, fertilisers etc. Farmers mostly use the available credit for purchase of animals, to buy seeds and fertilisers, to develop poultry farming and to purchase biogas plant. Some farmers use loan money for purchase of daily needs, land and clothes and some also use it for social events.

Some farmers use credit for purchase of CF, but most complain that they are not in a position to repay the loan because of reduced income.

Due to high interest rates and greater travel costs involved in getting a loan from the Bank, some farmers prefer to take loans from the local merchants.

In Bhanu VDC, the key informants reported that the farmers of Ward Nos. 1, 4 and 8 have adequate credit. But the farmers of Ward No. 7 mentioned that they don't have enough credit facilities. The key informants mentioned that the farmers of Ward Nos. 1, 4 and 7 use credit for purchase of seeds and CF whereas the farmers of Ward No. 8 do not use credit for the purchase of CF.

The farmers of Ward No. 8 complain that credit is not that easily available from the Bank. They trust on local merchants and they use some loan for purchase of CF.

The credit is used by the farmers mainly to purchase animals, to dig tube wells to pump water for irrigation, and for cultivation of ginger, sugarcane and vegetables. Some farmers use credit for business, education of children and in marriage ceremonies.

Except Ward No. 7 of Pakhribas VDC, the remaining three Wards have adequate availability of credit. The farmers of Ward Nos. 3 and 7 use credit for the purchase of CF, whereas the farmers of Ward Nos. 6 and 8 do not. As reported by the key informants, the credit money has been used for livestock purchase, farming, vegetable gardening etc. Some farmers also use this loan money in business, health care, land purchase and social events.

Most farmers do not use loans for purchasing CF. Credit for CF alone is not given. It takes about three to four months to get a loan from the Bank. The payback of the loan depends upon the profit, which the farmers make. Consequently, the farmers still approach local merchants to get the loan, either for the purchase of CF or other items.

The key informants of Murtidhunga VDC reported that the credit availability was adequate in Ward Nos. 2 and 9 but it is inadequate in Ward Nos. 1 and 9. The farmers of all Wards take credit for the purchase of CF.

Most farmers use credit for purchase of agricultural inputs, purchasing and raising animals, vegetable gardening, poultry farming and in irrigation. Some of them use credit for business, purchase of food and in social events. The key informants mentioned that the Banks do not provide credit for fertiliser.

Most farmers use credit for purchase of agricultural inputs, purchasing and raising animals, vegetable gardening, poultry farming and in irrigation. Some of them use credit for business, purchase of food and in social events. The key informants mentioned that the Banks do not provide credit for fertiliser purchase alone because of less money required for it. However, they provide credit for farming, in which case, they also purchase CF. The key informants reported that it is a tedious job and time consuming to get credit from the Bank. The Bank also needs collateral. If some farmers take credit from the Bank, it becomes difficult for them to pay back the loan.

CHAPTER 6

RESULTS OF PRA AND GROUP DISCUSSION

This chapter provides the results and discussion of PRA and group discussions. The methods and tools employed for this study are described in Chapter 3.

6.1 PRA and Group Discussion

Three common PRA tools namely time line, agro-enterprise maps and well-being ranking were used at all selected Wards of four VDCs to generate various information about the Wards. The applications of these PRA tools were followed by the group discussion.

6.1.1 Results of PRA tools

6.1.1.1 Time line

The results of time line, which were used at Ward Nos. 1, 4, 5 and 6 of Pakuwa VDC, are presented in Table 6.1. This table illustrates the major events that occurred in the selected Wards in different years. The big earthquake of 1933/34 destroyed houses and killed some people and animals in Ward no. 1, 4 and 6. Subsequently, two other earthquakes occurred in 1957/58 and in 1988/89 but only in Ward Nos. 1 and 4. The heavy rainfall and drought that occurred in all four Wards in 1997/98 and 1998/99 destroyed the crops. In addition, events such as flood and erosion, use of chemical fertilisers, hail storms, introduction of improved breeds of animals, irrigation etc. are documented which are directly related to agricultural production in these villages.

It can be inferred from the results of time line that the increase in agricultural production does not depend only on technology, but that the natural calamities such as drought, heavy rainfall etc. were also constraints contributing to the decrease in crop production. This conclusion helps for future planning for the development of the selected Wards of Pakuwa VDC.

Table 6.1 : Time line of surveyed Wards of Pakuwa VDC, Parbat District, Western Region, 1999.

E. Na.	DATES	MAJOR EVENTS	PAKUWA VDC			
			Ward No. 1	Ward No. 4	Ward No. 5	Ward No. 6
1	1933/34	Earthquake	*			*
2	1940/41	Death of animals due to livestock disease	*			
3	1957/58	Flood and erosion			*	*
4	1957/58	Earthquake	*	*		
5	1959/50	Drought				*
6	1960/61	Primary school established			*	
7	1978/79	Irrigation canal construction			*	*
8	1980/81	Irrigation canal under operation			*	*
9	1980/81	Primary school established		*		
10	1981/82	Started using chemical fertilisers			*	*
11	1983/84	Started using chemical fertilisers	*	*		
12	1985/86	Introduction of improved animal breeds			*	
13	1988/89	Introduction of improved animal breeds				*
14	1988/89	Earthquake	*	*		
15	1988/89	Primary school established	*			
16	1990/91	Drought	*	*		*
17	1991/92	Hail storms				
18	1991/92	High School established			*	
19	1993/94	High School established		*		
20	1996/97	High School established	*			
21	1996/97	Hail storms	*	*		
22	1997/98	Hail storms			*	
23	1997/98	Heavy rainfall	*	*	*	*
24	1998/99	Drought	*	*	*	*

Table 6.2 depicts the results of time line of Ward Nos. 1, 4, 7 and 8 of Bhanu VDC. Twenty seven events were mentioned by the group members with their corresponding dates illustrating a range of events such as earthquake, hail storms, drought, heavy rainfall, animal disease, epidemics, use of chemical fertilisers and improved varieties, construction of motorable road, establishment of schools etc. The events like drought, heavy rainfall, hail storms etc. directly affect the crop production. Increased use of improved crop varieties and the use of chemical fertilisers were healthy signs for increasing crop production. Table 6.2 provides more information, which are useful for future planning for the development of sampled Wards of Bhanu VDC.

Table 5.2: Time fine of s u r v eyed Wards of Bhanti VDC, Tanahu District, Western Region, 1999

S. No.	DATES	MAJOR EVENTS	BHANU VDC			
			Ward No. 1	Ward No. 4	Ward No. 7	Ward No. 8
1	1933/34	Earthquake	*	*		
2	1940/41	Establishment of Primary School		*		
3	1949/50	Establishment of Primary School	*			
4	1968/69	Livestock disease epidemics			*	*
5	1969/70	Drought	*		*	*
6	1969/70	introduction of chemical fertilisers		*		
7	1970/71	Introduction of improved seeds		*		
8	1971/72	First use of chemical fertilisers by the farmers	*			
9	1974/75	Primary school established				*
10	1975/76	Primary school established			*	
11	1975/76	Improved rice varieties introduced (e, g. Masuli, Radha-7				
		Radha-9 etc.			*	*
12	1976/77	Introduction of chemical fertilisers			*	*
13	1980/81	Start of construction of motarable road across the villae (Dumre-Beshishahar Hihwa	*			
14	1983/84	Hail storms	*			
15	1985/86	Hail storms		*	*	*
16	1985/86	Motorable road constructed			*	*
17	1987/88	More plantation of improved crop varieties		*		
18	1990/91	Hail storms			*	*
19	1991/92 [1]	Middle school established			*	*
20	1992/93	Middle school established		*		
21	1993/94	Start of using improved seeds of various crop varieties	*	*		
22	1994/95	High School established		*		
23	1996/97	Heavy rainfall & loss of food rains	*			
24	1996/97	Motorable road constructed		*		
25	1997/98	High School established				*
26	1998/99	Drought	*	*	*	*

Table 6.3 illustrates the major events that occurred in the corresponding dates at Ward Nos. 3, 6, 7 and 8 of Pakhribas VDC. Death of animals due to a rabies epidemic in 1985/86 and the drought of 1998/99 were serious problems in selected four Wards. Other natural calamities, such as drought, hail storms, heavy rainfall, flood and erosion occurred in different years and destroyed the crops in the area. Some positive aspects such as establishment of schools, construction of motorable road, use of improved seeds of different crop varieties, use of chemical fertilisers and promotion of vegetable growing were appreciated by the members of the groups. These information are of particular importance for future planning of those selected Wards of Pakhribas VDC.

Table 6.3: Time line of surveyed Wards of Pakhribas VDC, Dhankuta District, Eastern Region, 1999.

No.	DATES	MAJOR EVENTS	PAKHRIBAS VDC			
			Ward No. 3	Ward No. 6	Ward No. 7	Ward No. 8
1	1947/48	Cholera epidemics	*			
2	1954/55	Drought				*
3	1962/63	Hail storms	*			
4	1967/70	Introduction of chemical fertilisers	*			
5	1972/73	introduction of improved seeds	*			
6	1975/76	Started using chemical fertilisers			*	
7	1977/78	Drought				*
8	1978/79	Started using chemical fertilisers		*		*
9	1979/80	Started using improved seeds of crop varieties		*		
10	1979/80	Drought		*		
11	1979/80	Middle school established	*			
12	1983/84	Primary school established			*	
13	1983/84	Started using im roved seeds of crop varieties			*	
14	1985/86	Heavy rainfall, flood and irrigation				*
15	1985/86	Death of animals due to rabies epidemics				*
16	1988/89	Earth cake	*	*	*	*
17	1988/89	Promotion of vegetables growing			*	
18	1995/96	Construction of motorable roads	*			
	1995/96	Hail storms				*
20	1997/95	Flood and erosion	*	*		
21	1997/98	Started motorable road		*		
22	1998/99	Drought	*	*	*	*

Forty-two events with their corresponding dates were noted from the groups of farmers of Ward Nos. 1, 2, 5 and 9 of Murtidhunga VDC. Table 6.4 shows those dates and events. Introduction of improved seeds in 1988/89, an epidemic of goat disease in 1998/99 and drought in 1998/99 were the events common to all four Wards. Flood, erosion, heavy rainfall, drought and hail storms were the major natural calamities which occurred within the interval of a few years and made farming a risky business in the area. In addition, epidemics of animal and poultry diseases were troublesome events which occurred in past in the area. The members of the groups were happy following the establishment of schools, the introduction and use of chemical fertilisers, the introduction and use of improved seeds, the construction and maintenance of irrigation canals, the establishment of a depot of the Dairy Development Corporation and a family planning clinic.

These historical events of surveyed Wards provide a guideline for future planning of those four Wards of Murtidhunga VDC.

Table 6.4: Time line of surveyed Wards of Murtidittinga VDC, Dhankuta District, Eastern Region, 1999.

S. No.	DATES	MAJOR EVENTS	MURTIDHUNGA VDC			
			Ward No. 1	Ward No. 2	Ward No. 5	Ward No. 9
1	1952/53	Construction of Laxmi Irrigation Canal	*			
2	1954/55	Epidemic of Cholera				*
3	1956/57	Primary school established			*	*
4	1965/66	Construction of irrigation canal but not managed properly			*	
5	1966/67	Flood and erosion	*			
6	1967/68	Heavy rainfall, flood and irrigation			*	
7	1971/72	Hail storms	*			
8	1971/72	Drought			*	
9	1972/73	Hail storms			*	
10	1978/79	Introduction of chemical fertilisers			*	
11	1978/79	Introduction of improved seeds			*	
12	1980/81	Introduction of chemical fertiliers		*		
13	1983/84	Introduction of chemical fertilisers	*			
14	1984/85	Introduction of improved seeds		*		
15	1986/87	Introduction of chemical fertilisers				*
16	1986/87	Introduction of improved seeds				*
17	1988/89	Introduction of improved seeds	*			
18	1988/89	Earthquake	*	*	*	*
19	1988/89	Use of chemical fertilisers by more people			*	
20	1988/89	Use of improved seeds by more people			*	
21	1989/90	Establishment of Depot of Dairy Development Corporation				*
22	1989/90	Hail storms				*
23	1990/91	Flood and erosion			*	
24	1991/92	Drought	*			
25	1991/92	Hail storms		*		
26	1991/92	Flood and erosion		*		
27	1991/92	Epidemic of poultry disease	*			
28	1994/95	Hail storms	*			*
29	1994/95	Primary school established	*			*

30	1994/95	Epidemic of animal disease	*			
31	1994/95	Drought		*	*	
32	1994/95	Maintenance of irrigation canal				*
33	1994/95	Family planning clinic				*
34	1995/96	Increase in cultivation of more vegetables			*	
35	1995/96	Maintenance of irrigation canal				*
36	1995/96	Flood and eroslon				*
37	1996/97	Construction of Deurali Irrigation Canal	*			
38	1996/97	Establishment of Middle school.				*
39	1997/98	Epidemic of poultry disease (Ranikhet)			*	
40	1998/99	Epidemic of goat disease	*	*	*	*
41	1998/99	Drought	*	*	*	*
42	1998/99	Fire on community forest land				*

6.1.1.2 Agro-enterprise Maps

Agro-enterprise maps of 16 Wards of four VDCs were drawn by a few farmers with the help of other farmers in the groups. Those maps were first drawn on a chart paper by using pencils and then coloured by marker pens to show different enterprises available in the villages. The legends were shown to locate the particular agricultural and non-agricultural enterprises. In most cases, it took about an hour to complete a map and the farmers' participation in drawing those maps was very encouraging.

All ago-enterprise maps were drawn on the white chart papers, which were then copied to A4 size papers and were coloured. Instead of presenting all maps and their description, four selected maps of four VDCs are included in this section. Remaining 12 maps are presented in another Annex volume of this report.

Figure 6.1 illustrates the existing situation of resources, land types, crops grown and boundaries of Ward no. 1 of Pakuwa VDC. The map shows PakhoBari land (up land) with the pre-dominant cropping pattern of maize/millet - mustard. In Khet land (low land), the pre-dominant cropping patterns are rice - wheat, rice - maize, and rice - wheat - maize. Most Khet land is located at Silme phant and there is access of irrigation water through Silme Khola (also called Khahare Khola).

The forest areas are mostly scattered towards north and west sides. The houses are along both sides of footpath across the middle of the Ward. The Ward No. 1 of Pakuwa is bordered by Anapbote (Ward No. 2) in east, Modi Khola in west, Jare Khola in north and Silme Khola in south.

There exists a school and two temples. The drinking water taps are scattered in the main footpath close to the settlement.

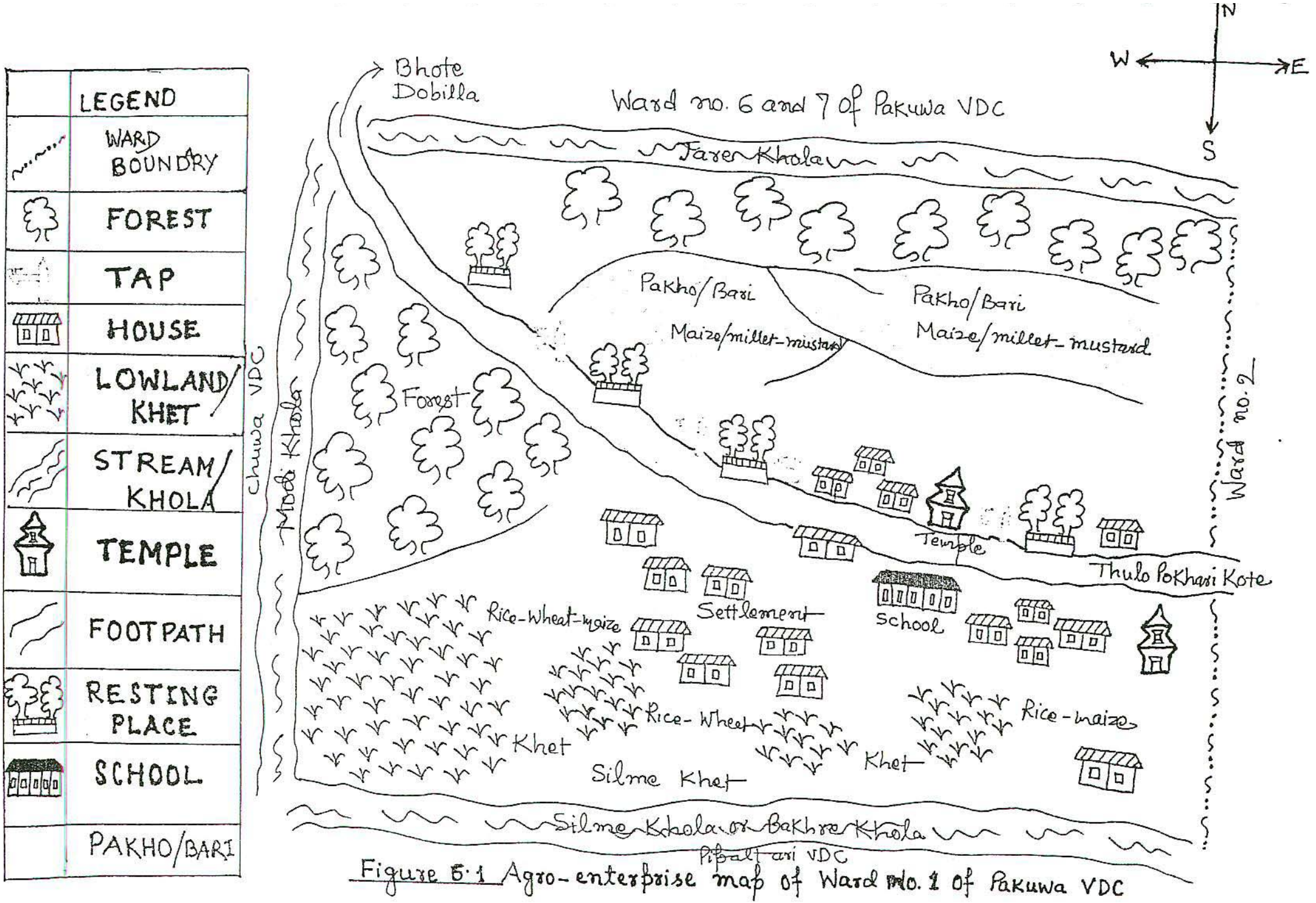


Figure 5.1 Agro-enterprise map of Ward no. 1 of Pakuwa VDC

The agro-enterprise map of Ward No. 1 of Bhanu VDC is presented in Figure 6.2. It shows the existing resources and various enterprises of Ward No. 1.

This map illustrates PakhoBari land with pre-dominant cropping patterns of maize/millet-fallow, upland rice (ghaiva) - maize - blackgram and low land with the pre-dominant cropping pattern of rice - wheat - maize. The pre-dominant cropping pattern of Khet land is rice - wheat.

The high way to Beshishahar from Dumre passes Khahare Bazar and Simle Bazar. There are few houses along both sides of main road and at the village.

There exist a few irrigation canals like Muhan Kulo and Chap Chaur Kulo which are used for irrigating Khet land such as Gauri Phant and Sat Bise Khet.

There are schools, health post and temples in this Ward. This Ward is bordered by Marsyangdi river in the east, Dordor Village in the west, Bajuwa VDC and Ward Nos. 7, 8 and 9.

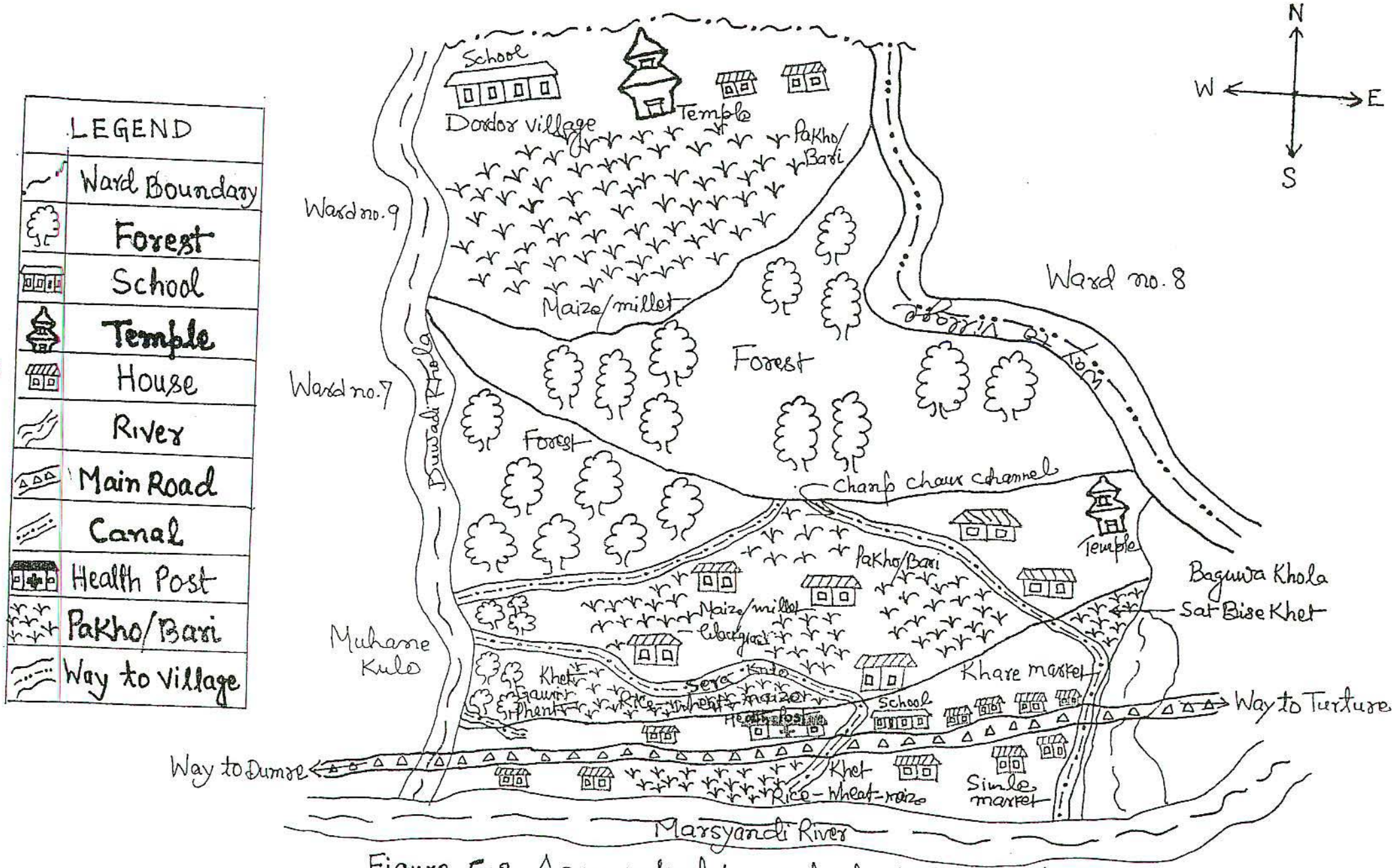


Figure 5.2 Agro-enterprise map of Ward No. 1 of Bhanu VDC

The agro-enterprise map of Ward No. 8 of Pakhribas VDC was drawn by the selected farmers and shown in Figure 6.3. The map illustrates the Ward's boundaries - rivers in east and west and forest in north and south sides. The houses are scattered across the Ward. Budhabare Tole is located close to the centre of the Ward.

Pakho/Bari land is located on both upper and lower sides of the road and the pre-dominant cropping patterns are maize/millet - mustard, maize/millet - potato and maize - wheat. Pak-ho/Bari land dominates the area. Khet land is located mostly towards the southern sides, which are close to the settlement. The pre-dominant cropping patterns in Khet land are rice - wheat and rice - potato. There is no canal for irrigation in this Ward.

Budhabare market and the houses are linked by village roads. The main road from Hile Bazar to Tehrathum district passes through the northern side of the Ward.

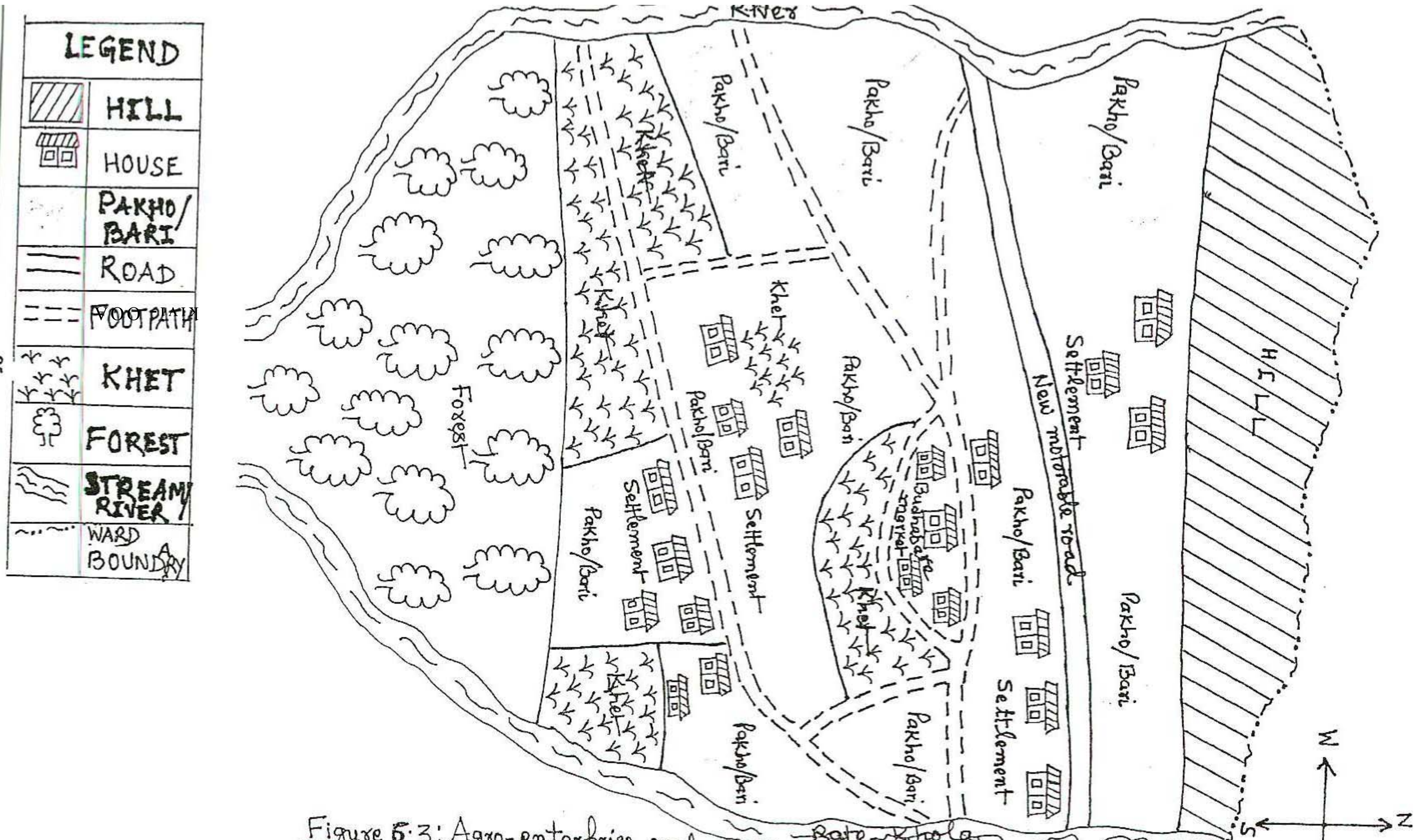


Figure 5.3: Agro-enterprise map of Ward No. 1 of Pakhrilas VDC

Figure 6.4 illustrates the existing resources, agricultural and non-agricultural enterprises, settlement, school, roads etc. of Ward No. 9 of Murtidhunga VDC. The Ward is bordered by Ward No. 6 in east and Arghanule Jitpur village in west, Ward No. 1 in north and Arghanule Jitpur village in south. The Ward is crossed by a few footpaths and rivers.

The area is dominated by Khet land and the major cropping patterns are rice - maize, rice - wheat and rice - fallow. In Pakho/Bari land, the major cropping pattern is maize/millet - fallow. The run off river water is used to irrigate both PakhoBan and Khet land.

There exist community forest area in western side of the Ward.

The main trek route from Sidhuwa to Khandbari passes throu[g]h the northern side of this Ward via Neta Chowk.

The houses are scattered around different villages of the Ward. There is school and taps for drinking water.

This map was drawn by one of the key informants in support of other members of the group.

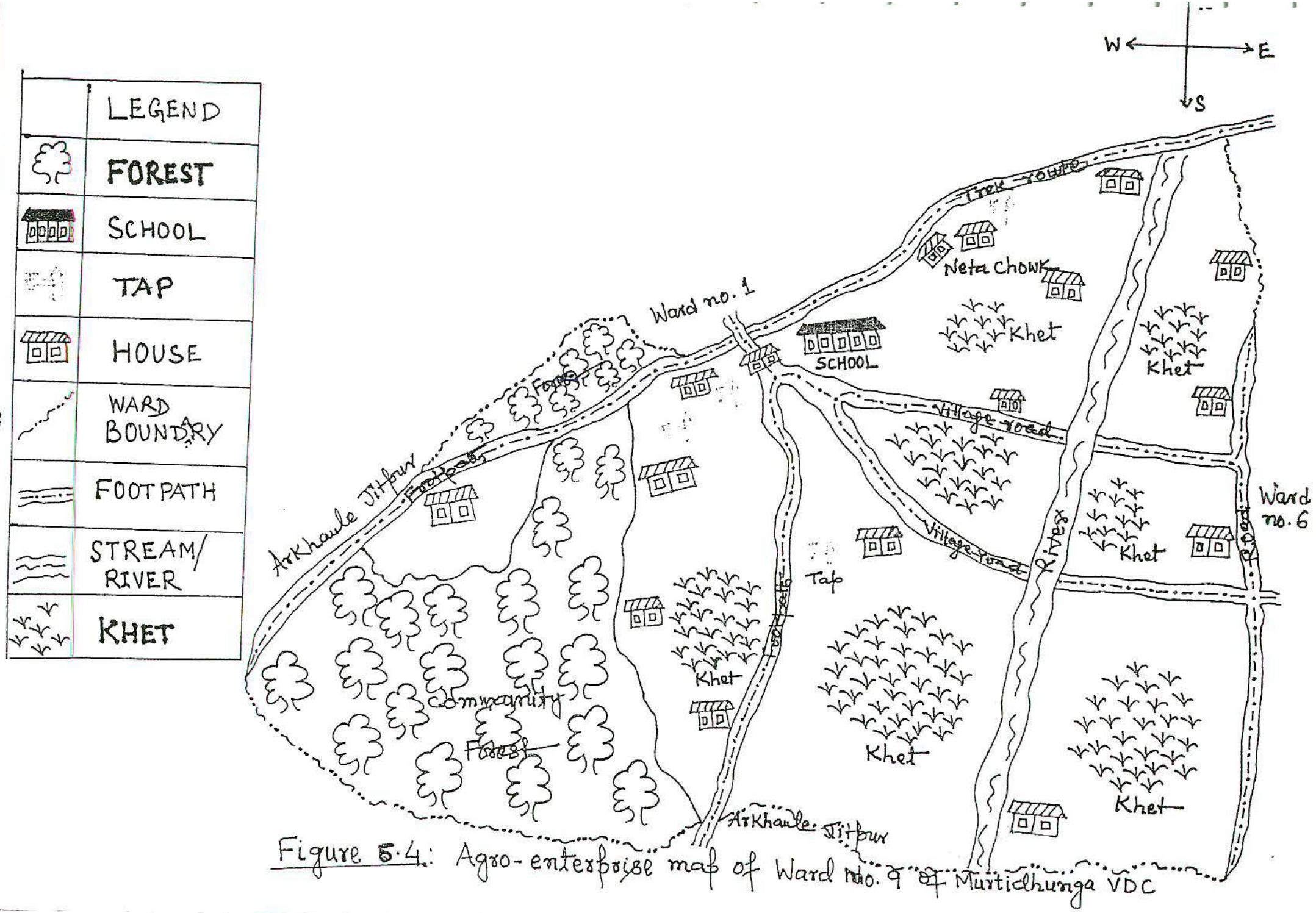


Figure 5.4: Agro-enterprise map of Ward no. 9 of Murtidhunga VDC

6.1.1.3 Well-being Ranking

Based on the method of well-being ranking detailed in chapter 3, this approach was used in 16 Wards of 4 VDCs. Food self-sufficiency for the whole year was an indicator of well-being in the village community. Based on the responses of the members of the groups, total HHs of each Ward were divided into four categories of food - sufficiency for 3 months, 6 months, 9 months and 12 months. The results of well-being ranking by Wards of each VDC are presented in Table 6.5.

Table 6.5: Status of Food Self-Sufficiency in four selected Wards of four surveyed VDCs, Eastern and Western Districts, 1999.

DISTRICT	VDCs	WARD Nos.	FOOD SELF-SUFFICIENCY FOR				TOTAL HHS
			3 months	6 months	9 months	12 months	
Parbat	Pakuwa	1	65(63%)	16(15%)	10(10%)	12(12%)	103100)
		4	16(18%)	15(16%)	40(44-/o)	20(22%)	91(100%)
		5	30(51%	15(25%)	10(17%)	4(7%)	59(100%
		6	25(47%	10(19%)	8(15%)	10(19%)	53(100%
Tanahu	Bhanu	1	2816%)	31(18%)	2313%)	93(53%)	175(100)
		4	40(20%)	40(20%)	20(10%)	100(50%)	200(100%
		7	77(45%	42 25%)	34(20%)	17(10%)	170(100%)
		8	300(60%)	100(2%)	50(10%)	50(10%	500(100%)
Dhankuta	Pakhribas	3	40(27%)	60 (40%)	40(27%	10(6%)	150(100%)
		6	10(19°i0)	20(38%)	15(29%)	7(14%)	52(100%
		7	20(17%)	30(25%)	56(46%)	14(12%)	120(100%)
		8	37(44%)	10(12%)	25(30%)	12()4%)	84(100%)
Dhankuta	Murtidhuna	1	16(25%)	20(30%)	10(15%)	20(30%)	66(100%)
		2	36(40%)	35(38%)	10(11%)	10(11%)	91(100%)
		5	45(42%)	30(29%)	20(19%)	11(10%)	106(100%)
		9	25(41%)	17(28%)	10(16%)	9(15%)	61(100%

Source: Based on the results of key informant Surveys and Group Discussions, SFMP, 1999.

* As reported by the key informants during the group discussion, the total number of households were 134 but 84 households were permanently settled and are doing farming. Other 50 were renting shops for business, service holders, businessmen, people shifted from other Wards and renting land and settling in the Ward No. 8 and doing some farming. Hence.. only 84 households are included as the total number of households of Ward 8 of Pakhribas VDC.

Table 6.5 shows that in general less than 20 percent HHs have sufficient food for 12 months. Frequently (at least one Ward in each VDC) more than 40 percent have sufficient food for only 3 months. Average for VDC disguises variability between Wards, which is especially great for 3 and 12 months cate[g]ories.

6.2.1 Results of Group Discussion

5.2.1.1 Pakuwa VDC

The following table shows the number of participants in group discussion by Ward and sex.

WARD NUMBERS		NUMBER OF PARTICIPANTS	
	Male	Female	Total
1	11	3	14
4	8	4	12
5	6	2	8
6	7	3	10
Total	32	12	44

Present practices for management of soil fertility

Farmers of four selected Wards did not know about the use of chemical fertilisers in wheat until 15 years ago. In the last 5 to 10 years, chemical fertilisers, particularly, urea and DAP have been used in rice, wheat, maize and other crops. With initial use of chemical fertilisers, the production of rice, wheat and maize was substantial. Now, even with the use of chemical fertilisers, the productivity of these crops has declined considerably.

The farmers reported that the use of FYM has declined considerably, because the animal population is lower per household and the forest area has also decreased. All farmers complained that soil is becoming harder and it is difficult to plough land properly.

The farmers of selected Wards had the general consensus that the soil fertility in both PakhoBari land and Khet land has declined and that the soil is becoming more acidic. Based on their experiences, the farmers stressed that both chemical fertilisers and FYM should be applied to get better crop productivity. With the use of chemical fertilisers without FYM, the crop productivity has been low. After soil testing, the farmers added that soil should get rid of acidic problem. The farmers of Ward No. 1 know that the fertility of the soil can be improved by following crop rotation practice including leguminous.

Suggestions for improving soil fertility

The farmers sug[g]ested that soil testing of the area should be conducted to find out the nutrient deficiencies, the problem of acidity in soil etc. They had also stated stron[g]ly that on-farm trials related to soil management and fertility are essential in all four Wards. The farmers were not sure whether they should use lime to stop the decline in soil fertility. Hence, the farmers suggested that the concerned scientists should conduct the research on those issues to solve the soil fertility problem.

Uses and sources of chemical fertilisers

Chemical fertilisers had been used by the farmers of the Ward Nos. 1, 4. 5 and 6 since 1983/84, 1983/84, 1981/82 and 1981/82 respectively. On the advice of Junior Technicians (JTs) and Junior Technical Assistants (JTAs), the chemical fertilisers have been used. Only a few farmers had received training on use of judicious amount of chemical fertilisers. Many of them started using

chemical fertilisers by following their neighbours who had been using them. Most farmers do not use them as required by the crops due to lack of cash and sometimes due to unavailability of required amount. Both male and female are involved in bringing the fertilisers from the market to their homestead and to apply them in their fields. But in Ward No. 6, men mostly go to the market to get the fertilisers.

The most common complaint of the farmers was that with the use of chemical fertilisers, soils were becoming harder, and new unknown weeds had appeared in their field.

Uses and sources of FYM

FYM has been used since their forefathers' time. The preparation of FYM and its use for crop production is the traditional practice of the farmers. Green leaves and grasses are collected and placed for bedding in the animal shed. The bedding includes Chilaune, weeds, grasses and maize stalk. They are mixed with dung and urine and with other waste bedding materials. Everyday, these materials are transferred into the pits, which are dug for this purpose. They are left inside the pits at least for three to four months until they get black in colour. Once, it becomes black, the farmers consider that the FYM is ripe. Then, it is carried to the fields with the help of *bamboo* basket (dock) and left there in heaps. Most ripe FYM is used in PakhoBari land. New FYM (FYM that is not ripe) is used in Khet land. The use of FYM has been continuously declining due to lack of animal numbers and also due to lack of green leaves and grasses.

The following is the response on the division of work.

ACTIVITIES	JOB PERFORMED BY	
	Male	Female
1. To carry green leaves from the forest	√	√
2. Bedding of green leaves, grasses etc. at animal shed	√	√(mostly)
3. To collect dung and litter	√	√
4. To fill up the pits	√	√
5. To carry• FYM in doko at the field		√
6. To spread in the field		√

Use of compost

Some farmers mentioned that they received training on compost making and its use. However, they did not put them into practice. Both male and female farmers were involved in making compost. At present, none of the farmers are preparing and using compost.

Green manuring

About seven years ago, Dhaincha was planted by the farmers of Ward Nos. 5 and 6 and used as a green manure. They had experienced that soil became light and loose after Dhaincha cultivation. At present, Dhaincha has disappeared from those Wards. Some farmers were demanding Dhaincha seeds, which is not easily available. The farmers of Ward Nos. 1 and 4 have never planted Dhaincha.

Farmers' perception about use of manure and chemical fertilisers

With use of chemical fertilisers, the crop production has been increased significantly in the past. But, at present, it has little positive impact. The farmers expressed that soil testing and field trials were essential to indicate the amount of the chemical fertilisers to be used. Most farmers have the perception that they should use both FYM and chemical fertilisers for better crop production. The farmers expressed the opinion that crop rotation practice with leguminous crops makes soil fertile.

Changes in previous and current cropping practices

The cropping patterns have changed from monocropping in past to triple cropping in all Wards at present. This has been possible due to the use of chemical fertilisers. The major change in cropping pattern in Pakho/Bari land is maize/millet - fallow in past to maize/millet - mustard at present. In Khet land, the cropping pattern of rice - fallow has been changed to rice - wheat - maize.

Activities to keep the land more fertile

The farmers expressed the following views to keep the land more fertile.

(i) Encourage planting more of Dhaincha;
(ii) Use of lime to get rid of acidity problem;
(iii) Prepare compost and use it;
(iv) Use more FYM as well as chemical fertilisers; and
(v) Use recommended doses of chemical fertilisers.

Expenditures and their ranking

Based on farmers' consensus, the following are the major expenditures and their ranking in Pakuwa VDC.

EXPENDITURES BY ACTIVITIES	RANKING			
	Ward no. 1	Ward no. 2	Ward no. 3	Ward no. 4
1. Expenses in schooling	4	1	1	5
2 Purchase of salt, edible oil and kerosene oil	2	2	2	2
3. Purchase of clothes	1	4	5	4
4. Purchase of chemical fertilisers	3	3	4	1
5. Expenses in celebration of festivals	5	5	6	6
6. Expenses in hiring of labour	6	6	3	3

6.2.1.2 Bhanu VDC

The number of participants in group discussion by Ward and sex for Bhanu VDC are given below:

NV ARD N ... BERS	NUMBER OF PARTICIPANTS		
	Male	Female	Total
1	16	8	24
4	10	5	15
7	13	9	22
8	10	6	16
Total	49	28	77

The results of group discussion in Bhanu VDC are as follows.

Present practices for management of soil fertility

Pakho: The common practice in all four Wards of Bhanu VDC has been the use of as much FYM as possible. It was mentioned that there were shortages of green leaves of Asuro. Pati etc. because of the restricted entry to the nearby forest. The farmers have been applying chemical fertilisers as well. At present, even with uses of both FYM and chemical fertilisers, the yields of major crops are declining. A majority of farmers expressed that Pakho/Bari land was more fertile five to ten years ago. During the discussion in Ward No. 8, the farmers stated that at present, most cultivable land does not remain fallow even in winter. Now, it has been possible to grow two to three crops in Pakho/Bari land.

The major existing cropping patterns in Pakho/Bari land are as follows:

(i) Upland rice - blackgram;
(ii) Upland rice - mustard or wheat; and
(iii) Maize - mustard or blackgram.

These cropping patterns were similar in all four surveyed Wards.

Khet: In earlier days, FYM was substantially used in Khet land compared to the present use. A single crop of rice in a year was the common practice, which is now changed to multiple cropping. However, the productivity of major crops grown in Khet land (such as rice, wheat, maize and potato) has declined even with the use of FYM and chemical fertilisers.

The farmers of Ward No. 7 had been using chemical fertilisers in rice in three split doses. Some plants such as Asuro, Pati etc. were also used for green manuring in the rice field.

However, the farmers of all four Wards commented that Khet land is slowly deteriorating in terms of its' fertility.

At present, the major cropping patterns in Khet land are as follows:

(i) Rice-rice-fallow;
(ii) Rice-maize;
(iii) Rice-wheat; and
(iv) Rice - potato or onion.

Suggestions for improving soil fertility

Chemical fertilisers are considered to be essential for improving the productivity of the crops. None of the farmers are willing to give up the use of chemical fertilisers. They state that without it, there is no hope of growing various crops. There was comment made by the farmers that crop diseases have been spread due to increased use of the chemical fertilisers. Farmers have Iittle knowledge on the types and doses of chemical fertilisers to be used by crops. Farmers also expressed their willingness to learn good compost making procedures so that they can benefit from its use. Farmers showed interest of growing Dhaincha *(Sesbania robusta)* for green manuring. Most farmers have the opinion that using both FYM and chemical fertilisers will improve the soil fertility and increase production.

Uses and sources of chemical fertilisers

Chemical fertilisers were introduced in Ward No. I in 1971/72 and the farmers of Ward No. 4 have been using various types of chemical fertilisers since 1977. The source of chemical fertilisers is through the co-operative. JTs and JTAs had explained the advantages of using chemical fertilisers. Some farmers have purchased shares in the co-operative, and they get fertilisers from these co-operatives on a loan basis.

Men mostly go to the co-operative to purchase and bring back chemical fertilisers. Urea has been frequently used followed by DAP.

FYM and the chemical fertilisers are applied equally to maize and upland rice. Both male and female farmers are equally involved for their application.

Uses and sources of FYM

FYM has been in use for many years. The use of FYM for growing crops is the traditional practice and this has not changed much in its preparation for many years. Green leaves, fodder etc. are collected and spread for bedding in the animal shed. The dung and urine are mixed with the waste bedding materials. A11 of these are collected and kept in a pit dug for this purpose. They are kept for several months and then transferred to the fields and left in heaps in the field. A few hours before planting, they are spread in the field. Both male and female farmers do these activities.

The following is the response on the division of work.

ACTIVITIES	JOB PERFORMED BY	
	Male	Female
1. To carry green leaves, fodder etc. from the forest	-/	-/
2. Bedding of green leaves, fodder etc. at animal shed	-/	-/
3. To collect dung and litter	-/	-/
4. To fill up the pits	-/	-!
5. To carry FYM in doko at the field		-/
6.To spread in the field		-/

Use of compost

The fanners mentioned that compost has not been used in the field because none of the farmers have knowledge of making pits and preparing compost. The farmers have no training in compost making and lack technical knowledge on how to make good compost.

The farmers had demanded training on compost making. They strongly believe that the application of compost to the field makes the soil more fertile.

Green manuring

Green manuring is practised to a limited extent, particularly for seed bed of rice, but also in maize and upland rice. Plants such as Titepate, Asuro, Padake, Pate and Chilaune were used earlier but

these are not much used at present. To some extent, Dhaincha *(Sesbania robusta) is* also grown by a few farmers for the purpose of green manuring maize and upland rice.

Green manuring is mostly practised in PakhoBari land. The green leaves are cut into pieces and spread in the field. The left over stalks are burned into ashes. After this, the field is ploughed. Both male and female are involved in preparing and using green manure.

Farmers' perception about use of manure and chemical fertilisers

The farmers have the impression that with the use of FYM, soil becomes loose and light. The land, where FYM has been continuously used, becomes easier to plough even during the drought. The farmers are also confirmed users of chemical fertilisers because they believe that they provide adequate nutrients for the plants, but the farmers believe that continuous use of chemical fertilisers makes soil harder.

The farmers of Ward No. 8 explained that both FYM and chemical fertilisers should be used as recommended. The farmers are in favour of using compost but they need training for its preparation. It is the farmers' voice that soil should be protected from being hard with use of chemical fertilisers.

Changes in previous and current cropping practices

About ten years ago, wooden ploughs were used for digging the land for crop cultivation. Recently, that has been changed. The wooden ploughs as well as metallic ploughs have been used. According to the farmers, metallic ploughs are better than wooden ploughs. With the use of metallic ploughs, the land can be ploughed faster; green grasses and weeds will be turned over and soil becomes loose. Due to its efficiency, the land will not remain fallow. Metallic plough is mostly used in Khet land. The land is ploughed two to three times. But, in past, the land was ploughed once or twice. The use of chemical fertilisers is also increasing.

Expenditure and their ranking

The main expenditures of farmers, based on the group consensus, were as follows by each Ward

EXPENDITURE BY ACTIVITIES		RANKING		
	Ward no 1	Ward no 4	Ward no 7	Ward no 8
1. Expenses in health care	1	4	2	9
2. Expenses in clothes	7	3	4	1
3.Expenses in celebrating festivals	3	6	7	7
4. Expenses in electric bills	4	-	-	3
5. Expenses in schooling	5	1	1	5
6. Expenses in purchase of bullocks	8	-	-	-
7. Expenses in chemical fertilizers	9	5	6	6
8. Expenses in hiring labourers	10	10	-	-
9. Expenses in salt, edible oil and				
kerosene oil	2	2	3	2
10. Purchase of food	5	7	4	1
11. Expenses in rice milling	11	8	8	3
12. Travel expense	12	9	9	8

6.2.1.3 Pakhribas VDC

The following table shows the number of participants in group discussion by Ward and sex

WARD NUMBERS		NUMBER OF PARTICIPANTS	
	Male	Female	Total
3	10	6	16
6	7	4	11
7	9	5	14
8	10	6	16
Total	36	21	57

The results of group discussion are as follows.

Present practices for management of soil fertility

Pakho/Bari: The farmers are continuously using chemical fertilisers as well as FYM in various crops grown in Pak-ho/Bari land. However, the major concern of the majority of the farmers was the hardness of the soil due to continuous use of chemical fertilisers. The farmers stressed that it is now more difficult to plough land than before. It was mentioned that in the beginning, the productivity of crops was high with the use of chemical fertilisers. This has slowly declined. The farmers complain that even with the use of chemical fertilisers, the productivity of crops has declined. In 1996197, there was a shortage of chemical fertilisers and farmers had to use only FYM. The crop yields were very low. Farmers' experiences have shown that use of both FYM and chemical fertilisers give better results. The use of chemical fertilisers needs to be continued, However, the price of fertiliser is increasing rapidly. DAP has been used for top dressing in Ward No. 7. Some leguminous crops like soybean and beans are grown to make soil fertile. There seems not to be much change with time in practices for management of soil fertility on PakhoBari land.

Khet land: The farmers stated that the soil fertility of Khet land has declined. Ten years ago, there was enough rainfall and FYM, resulting in good rice and wheat yields. At present, there is very little rain. The rivers have less water and they are dryin[g]. Specific practices for management of soil fertility in Khet land has not changed compared to 5 to 10 years ago, except more use of the chemical fertilisers. The trend for using urea has increased. Before ploughing Khet land, bonds are trimmed of green grasses and weeds and these are allowed to decay on the land. This is a common practice in all four Wards.

The major constraints for both Pakho/Bari and Khet land in managin[g] soil fertility as cited by the farmers were (i) lack of cash to purchase chemical fertilisers (ii) unavailability of fertilisers on time (iii) deterioration of the qualin' of fertiliser (iv) abundant growth of weeds (%') lack of training in compost making and (vi) lack of green grasses.

The suggestions of the farmers for better management of soil fertility for both Pakho.Bari and Khetland are as follows:

(i) Encouragement to use both FYM and chemical fertilisers:
(ii) Timely availability of chemical fertilisers as per season:
(iii) Require to make distinction between real and low quality fertilisers;
iv) Increase amount of F Y M by increasing the number of animals

(v) Requirement of loans for the purchase of more animals;
(vi) Necessity of making land levelled with high bunds so that water for irrigation can be tapped; and
(vii) Requirement of soil test to know the deficiency of nutrients in the **soil.**

Uses and sources of chemical fertilisers

Chemical fertilisers had been used by the farmers of the Ward Nos. 3, 6, 7 and 8 since 1972, 1978, 1977 and 1978/79 respectively. The farmers were encouraged to use chemical fertilisers by Pakhribas Agricultural Centre. The agricultural scientists, JTs and JTAs have also advised to use chemical fertilisers.

Both male and female goes to the market to purchase the chemical fertiliser and carries it back to the homestead. Male and female, depending upon their time available, apply the chemical fertiliser in the field. FYM, as well as chemical fertilisers, is also applied by both male and female.

Uses and sources of FYM

FYM has been in use since the time of their forefathers. The use of FYM is the traditional and common practice for growing crops. The farmers have a strong belief that FYM increases crop yields. Green fodder and leaves are collected and spread in the animal shed. Dung and urine are mixed and litters are collected two to three times per day. They are kept in a pit for about 5 months and transferred to the field with the help of doko. They are left in the fields in heaps for a couple of days and spread in the field.

Both male and female perform these activities as follows:

ACTIVITIES	JOB PERFORMED BY	
	Male	Female
1. To carry green leaves, fodder etc. from the forest	-/	-/ (mostly)
2. Bedding of green leaves, fodder etc. at animal shed		-/
3. To collect dung and litter		-/ (mostly)
4. To fill up the pit		-/
5. To carry FYM in dokos at the field		-/
6. To spread in the field	-/	-/(mostly)

Use of compost

In Ward No. 3, a few farmers had prepared and used compost in past but not at present. The use of compost is not practised in other Wards.

Green manuring

In Ward Nos. 3 and 6, green manure plants such as Titepate, Sirish, Asuro, Banmara and Khira were used in past but at present they are difficult to find. The green leaves of these plants are made into pieces and they are spread in the field. Later on, the field is ploughed to turn over those decayed

plant materials to improve soil fertility. Green manuring is practised mostly in rice, millet and sweet potato. Some leguminous crops like soybean, masyans, blackgram, beans, peas and lentils are also planted both in Pak-ho/Bari and Khet land.

In Ward Nos. 7 and 8, the green manuring is not practised.

Farmers perception about use of manure and chemical fertilisers

The farmers want to increase animal numbers to produce more FYM. Since their forefathers' time, FYM has been used for better strength of soil. In the past, the practice of in-situ manuring was common and there was no substitute for FYM. A majority of farmers expressed their views that FYM and chemical fertilisers should be used so that the productivity of crops will be increased. Use of chemical fertilisers alone does not do well for soil and crop production. FYM should be applied in combination with some urea and DAP. Hence, the farmers are willing to increase the amount of chemical fertilisers per crop so that the productivity of the crops can be increased. It is necessary to have availability of more chemical fertilisers when they are required. If chemical fertilisers disappear, then the only option will be the use of FYM.

All members of four Wards representing group discussion have the following concern about the use of chemical fertilisers:

(i) With the increase of prices of fertilisers specifically DAP, the farmers are discouraged to use chemical fertilisers.

(ii) Most farmers are cheated by the low quality chemical fertilisers and the qualities of those fertilisers are not maintained. It is necessary for the Government to take serious action against those suppliers who are distributing low quality fertilisers.

(iii) Most farmers mentioned that they need quality fertilisers in cheap rate on time.

(iv) Farmers have also admitted that they lack knowledge of the judicious use of chemical fertilisers due to lack of training.

Changes in previous and current crop practices

The farmers of Ward Nos. 6, 7 and 8 stated that there was no change in current cropping practices compared to past in PakhoBari land. But the farmers of Ward No. 3 noted that with use of metallic ploughs, the clods can be turned over to make soil loose in PakhoBari land. With use of FYM of buffaloes, cows. goats and chemical fertilisers, the productivity of crops has been increased per unit of land. The farmers of Ward No. 6 stressed that, in Khet land, the number of ploughings have increased to two or three ploughings at present. All farmers of four Wards expressed that the uses of chemical fertilisers have increased.

Activities to keep the land **more fertile**

The farmers expressed the following views to keep the land more fertile.

(i) Timely ploughing;
(ii) Use of more FYM;
(iii) Use of green manure;
(iv) Cultivation of more leguminous crops;

(v) Requirement of training on various aspects related to soil fertility and management to improve farmers technical knowledge;
(vi) To trim the bunds of Pakho or Khet land;
(vii)To prepare compost and use it; and
(viii)To encourage the practice of in-situ manuring.

Expenditures and their ranking

Based on farmers' consensus, the following are the major expenditures and their ranking.

EXPENDITURE BY ACTIVITIES		RANKING		
	Ward no	Ward no 4	Ward no 7	Ward no
1.Expenses in schooling	3	2	1	1
2.Expenses in purchase of food	1	1	4	2
3.Purchase of salt, edible oil, and				
kerosene etc	2	4	3	3
4. Expenses in celebrating festivals	4	6	6	4
5. Expenses in clothes	5	3	2	5
6. Expenses in chemical fertilizers	6	5	5	6
7. Expenses in electric bills	7	7	7	7
8. Expenses in rice milling	9	8	8	8
9. Travel expenses	8	9	9	9
10. Expenses in health cure	10	10	10	10
11. Expenses in purchase of fodder	-	11	-1	-

6.2.1.4 Murtidhunga VDC

The following table indicates the number of participants in group discussion by Ward and sex.

WARD NUMBERS	NUMBER OF PARTICIPANTS		
	Male	Female	Total
1	5	9	14
2	15	6	21
	8	3	11
9	14	6	20
Total	42	24	66

The results of group discussion are as follows.

Present practices for management of soil fertility

Pakho: Five to ten years ago, the use of FYM only was common. Novv, the use of chemical fertilisers is becoming popular. The farmers can afford to use both chemical fertilisers and FYM. The use of chemical fertilisers has become compulsory due to low yields. However, due to its continuous use, loose and light soil has been converted into coarse and hard soil.

In the past, green leaves and grasses were cut into pieces and spread in the field. At present, due to deforestation and the prohibition of collecting green leaves and fodder from the forest, the farmers reported that they collect and mix crop residues and the grasses grown in the terraces in the field. Then they burn it to make ash out of them and plough the land to mix ash with the soils. Instead of

terraces, some farmers would like to make land level and flat and use FYM as much as they can in PakhoBari land.

Khet: Ten years ago, most farmers were applying FYM in Khet land. At present, both FYM and chemical fertilisers are in use. However, the quantity of FYM applied has decreased because of its declining availability. The productivity of crops grown in Khet land has significantly declined. The use of urea and DAP has also declined due to increase in their prices.

The farmers expressed that with use of chemical fertilisers, the vegetative growth is better but the grain formation is poor. Without the use of the chemical fertilisers in Khet land, the productivity of rice is low. The farmers expressed that whatsoever the case, they are compelled to use both FYM and chemical fertilisers in Khet land. A majority of the farmers mentioned that they have no knowledge about the judicious use of chemical fertilisers.

Some farmers have practised trimming bunds to get grasses, puddle them in water and they believe that it works as fertiliser. The number of ploughings and puddlings using harrow has also increased.

Suggestions for improving soil fertility

The suggestions of the farmers for better management of soil fertility at both PakhoBari and Khet land are as follows:

(i) Encouragement to increase number of animals;
(ii) Encouragement to use both FYM and chemical fertilisers;
(iii) Timely delivery of chemical fertilisers in adequate amount;
(iv) To make potash available;
(v) Requirement of testing of soil;
(vi) To make agricultural lime available;
(vii) Requirement of training to promote technical knowledge in compost making, good quality seed, good organic manure preparation etc;
(viii) Provision of loan for purchase of animals and chemical fertilisers; and
(ix) Plantation of trees for green leaves in Pak-ho/Bari land.

Uses and sources of chemical fertilisers

Chemical fertilisers had been used by the farmers of the Ward Nos. 1, 2, 5 and 9 in 1983, 1980, 1978 and 1988 respectively. The farmers of Ward No. 2 had started using chemical fertilisers on the guidance of then Pakhribas Agricultural Centre (PAC), Pakhribas. The farmers of Ward Nos. 1 and 9, however, started using chemical fertilisers by following other neighbours of the nearby villages. On advice of JTs and JTAs and loan through co-operative, the farmers of Ward No. 5 had started usins chemical fertilisers.

Chemical fertilisers are mostly used in rice, wheat, maize, millet, mustard, potato, cabbage and cauliflower.

Both male and female farmers go to the market to bring chemical fertiliser to their homesteads. In Ward Nos. 2 and 5, it is female who mostly goes to the market. But, in Ward Nos. 1 and 9, it is mostly male. Both male and female are involved in spreading the chemical fertilisers in the field.

Uses and sources of FYM

FYM has been used since forefathers' time. It is used in almost all crops such as rice, wheat, maize, millet, mustard, potato, cauliflower, cabbage etc. In Ward No. 9, FYM is not used in rice due to its unavailability. Green leaves, green fodder and grasses are collected and spread for bedding at animal shed. Dung and urine are mixed with the waste bedding materials. All of these are collected and kept in the pit for about four to five months. They are transferred to the fields mostly by women in the bamboo basket (doko) and left in heaps for some days. A few hours before planting, they are spread in the field.

The following is the division of work.

ACTIVITIES	JOB PERFORMED BY	
	Male	Female
1. To carry green leaves from the forest		√ (mostly)
2. Bedding of green leaves, grasses etc. at animal shed	√	√
3. To collect dung and litter	√	√ (mostly)
4. To fill up the pits		√
5. To carry FYM in doko at the field		√
6. To spread in the field	√	√ (mostly)

Use of compost

Except some farmers of Ward No. 2, none of the farmers of other three Wards have received training in compost making. Hence, compost is not prepared and applied in the field. Some farmers of Ward No. 2 had received training in compost making but they never put them into practice due to lack of dung and green grasses.

Green manuring

Green manuring was practised in Ward Nos. 2, 5 and 9 but not in Ward No. 1. In the past, green manure plants like Dhaincha, Siris, Titepate and Charibhang were used, but no longer. The use of Titepate for rice and millet seed bed and for bedding in animal shed was the traditional practice. However, at present, about 5 percent of farmers might use Titepate for the same purposes.

Leguminous plants are other sources for green manuring. Except Ward No. 1, the farmers of Ward Nos. 2, 5 and 9 grow soybean, peas, black gram, beans and masvana. Both male and female of the households are involved in above practices of green manuring.

Farmers' perception about use of manure and chemical fertilisers

Farmers' perception about use of FYM and chemical fertilisers varied from Ward to Ward. The farmers of Ward No. 1 had focussed on (i) increasing number of animals for more FYM; (ii) use both FYM and chemical fertilisers for better production; and (iii) requirement of proper training and guidance for judicious use of chemical fertilisers.

The farmers of Ward No. 2 had their perception and demand as follows:

(i) Requirement of agricultural lime;
(ii) Unavailability of potash;
(iii) Requirement of soil testing;
(iv) Requirement of research to find out deterioration of soil due to use of chemical fertilisers; and
(v) To get rid of weeds due to use of more chemical fertilisers.

The farmers of Ward No. 5 had their specific demand on (a) requirement of technical training and guidance for judicious use of chemical fertiliser; and (b) requirement and use of agricultural lime and potash to make soil better.

The farmers of Ward No. 9 had focussed on (a) requirement of increasing the dose of chemical fertilisers application but lack of cash and (b) willingness to use of compost.

Changes in previous and current crop practices

Pakho: The cropping practices have changed to some extent in all Wards compared to a few years ago. In Ward No. 1, most land is under cultivation. Trees of Utis. Amleso(Broomgrass) and cardamom are planted in new PakhoBari land so that the farmers will have access to wood and grasses. These trees are planted mostly close to the homestead.

The farmers of Ward No. 2 had received training from then PAC, Pakhribas in various current cropping practices and in recent years, most farmers have practised multiple cropping and intercropping. Some crops like wheat are planted in rows rather than broadcast.

As reported by the farmers of Ward Nos. 5 and 9, the land preparation technique has changed. The land is ploughed two to four times with the help of bullock and plough. The harrowing is practised to break the clods into small particles which allows for better crop production. Terrace making in PakhoBari land has also been common practice.

Khet: There is no change in cropping practices in Khet land in Ward Nos. 5 and 9. But, in Ward Nos. 1 and 2, the cultivation of wheat and mustard has increased. Wheat is sown in rows because the farmers have experienced low production by broadcasting. The use of chemical fertilisers in both Wards has also increased. The number of ploughings has also been increased upto two to four ploughings.

Activities to keep the land more fertile

The farmers had expressed the following views to keep the land more fertile.

(i) Use of more FYM;
(ii) Proper ploughing;
(iii) Soil testing to find out the lack of nutrient;
(iv) To spread green manure leaves and grasses in the field;
(v) To convert terraces into plain land;
(vi) Follow-up of in-situ manuring practices;
(vii) To decay Titepati in the field;
(viii) To burn waste and maize stalk to make ash in the field; and
(ix) To trim the terraces and bunds.

Expenditures and their ranking

Based on farmers' consensus, the following are the major expenditures and their ranking.

EXPENDITURES BY ACTIVITIES	RANKING			
	Ward no. 1	Ward no. 2	Ward no. 5	Ward no. 9
1. Expenses in food	1	3	1	1
2. Expenses in clothes	2	5	2	3
3. Expenses in salt, edible oil and kerosene oil	3	6	5	5
4. Expenses in schooling	4	2	4	4
5. Expenses in chemical fertilisers	5	4	3	6
6. Travel expenses	6	8	7	7
7. Expenses in rice milling	7	7	6	8
8. Expenses in celebrating festivals	8	1	8	2

CHAPTER 7

RESULTS OF HOUSEHOLD SURVEY

This chapter provides the results of household survey, which consists of demographic features, soil fertility status, crop productivity, chemical fertiliser use, FYM use, soil management practices and its improvement. The results described in this section are based on responses provided by 512 respondents (256 males and 256 females) who represent 16 Wards of four VDCs in the eastern and western regions of the country. The method employed for the HH survey is described in Chapter 3.

7.1 Demographic Features

7.1.1 Population and family size

The sample population of surveyed households is estimated to be 3,129 with a male female ratio of 51:49. The average family size of the sampled households is 6.1 members per household, but ranging from a minimum of 5.9 in Pakuwa and Murtidhunga VDCs to a maximum of 6.4 members in Pakhribas VDC as indicated in Table 7.1.

Table 7.1: Sample Population, Family Size and Economically Active Population

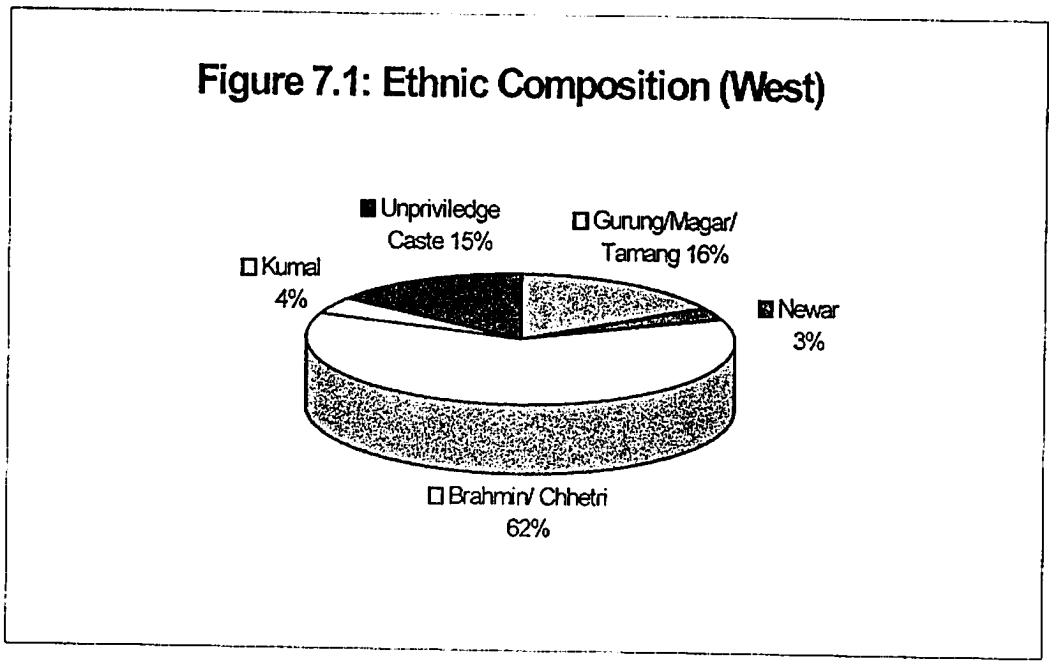
S. N.	VDC	SAMPLE HH. (NO.)	SAMPLE POPULATION! (NUMBER)			FAMILY SIZE (NO.)	ECONOMICALLY ACTIVE POPULATION (%		
			Total	Adult (15 Years and Above)	Children (Below 15 Years)		Both	Male	Female
1	Pakuwa	128	756	488	268	5.9	64.6	60.9	69.2
2	Bhanu	128	797	560	237	6.2	70.3	71.3	69.2
3	Murtidhunga	128	761	469	292	5.9	61.6	64.1	59.0
4	Pakhribas	128	815	542	273	6.4	66.5	65.7	67.2
	Overall	**512**	**3129**	**2059**	**1070**	**6.1**	**65.8**	**65.5**	**66.1**

Note: Figures are based on Table 2 of Annex Volume.

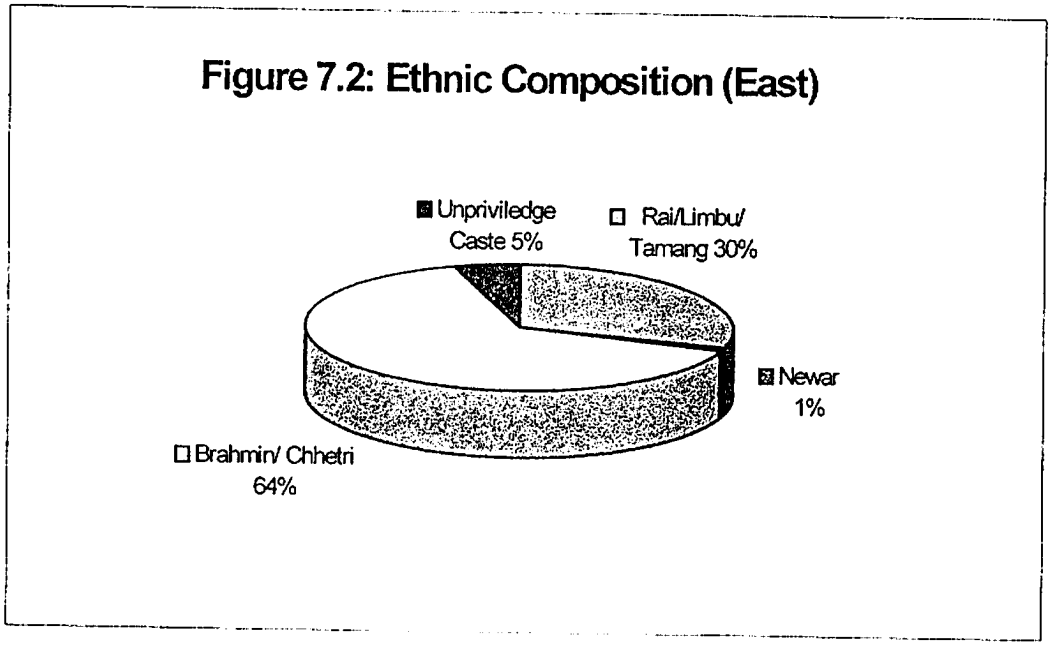
The respondents who are aged 15 years and above, and who are considered to be the economically active population constituted about 66 percent of the population (Table 7.1). The proportion of such population of male and female are more or less similar. Proportionately, there are more economically active males than females in Bhanu and Murtidhunga VDCs. The converse is true in Pakuwa and Pakhribas VDCs. Information byWard is presented in Table 2 of Annex Volume.

7.1.2 Ethnic composition

The ethnic composition in the east (Murtidhunga and Pakhribas VDCs) differed from that of the west (Pakuwa and Bhanu VDCs). The majority of the respondents were Brahmins and Chhetris accounting for 62 percent in the east and 64 percent in the west (Figures 7.1 and 7.2). The second



largest group was hill tribes such as Rai, Limbu and Tamang (30%) in the east and Gurung, Magar and Tamang in the west (16%). The unprivileged group comprised of Sarki, Damai and Kami were relatively less in the east (5%) compared to the east (15%). The respondents in the west also included Newars and Kumals, which were in minority.



7.1.3 Occupation

Farming has emerged as the main occupation for about 61 percent of the total economically active population (Table 7.2). The proportion is greater in Murtidhunga and Pakhribas VDCs, than in Pakuwa and Bhanu VDCs, because in the former farm enterprises are relatively well developed due to market access and road infrastructure. Also some of the respondents from Pakhribas VDC had the opportunity of employment in the Agriculture Research Station, Pakhribas, where they had learned improved farming practices. The second largest group of respondents (11.7 %) was found engaged in service, working either inside or outside the country. Gurung and Magars from Pakuwa and Bhanu VDCs have the opportunity to work in the military of foreign countries like India, Hong Kong,.

While others worked in government or non-government organisations as teachers and civil servants in nearby cities like Kusma and Pokhara. A small number of respondents were drawing pension after their retirement from military service.

Table 7.2: **Respondents indicating Major Occupation**

(Unit: % Responses)

S.N.	VDC	SAMPLE HH.(No.)	MAJOR OCCUPATIONS						
			Farming	Wage Labour	Business" Retail Shops	Pension	Service	Unemployed	Student
1	Pakuwa	128	52.1	1.8	3.6	0.45	16.9	1.8	23.2
2	Bhanu	128	55.0	0.8	1.0	0.2	16.3	0.8	26.0
3	Murtidhunga	128	72.1	2.8	0.2		0.9	2.3	21.6
4	Pakhribas	128	66.5	0.4	0.4		12.6	0.4	19.6
	Overall	512	61.4	1.5	1.3	0.2	11.7	1.3	22.6

Note: Figures are based on Table 4 of Annex Volume.

The students, who were studying at high schools or colleges, constituted about 22 percent of total respondents. This figure is a little higher because some students were aged between 25 to 40 years. They had enrolled themselves for higher studies in the morning campus, while working as part time in the daytime. About one percent of the respondents on average was found engaged as in business. Similar percentages were wage labourers. The types of business undertaken include selling of poultry, pigs, milk and milk products, maintaining teashops and groceries. Further information by Ward for each of the surveyed VDC is presented in Table 4 of Annex Volume.

7.1.4 Educational status

Approximately three-quarters (73.9%) of the sample respondents were literate in all the VDCs surveyed. This figure is relatively high due to the presence of educational institutions in many of the surveyed VDCs. Moreover, sampled VDCs lie either on the road or near to a sealed road, which facilitate easy movement of the villagers to the place of education. Among the literate group, about 81.4 percent of sample population had formal educational background ranaing from primary level to higher studies. The educational background of respondents by VDC is presented in Table 7.3 below.

Table 7.3: Educational Status of Sample Population

S. N.	VDC	SAMPLE HH. (No.)	LITERACY RATE (%)		EDUCATIONAL STATUS (°/o OF LITERATE ONLY)						
			Illitera	Literate	No Formal Education	Primary Level	Secondary Level	High School	Intermediate,	Bachefor	Master
1	Pakuwa	128	24.7	75.3	11.9	31.6	11.3	35.8	4.6	3.	1.6
2	Bhanu	128	25.3	74.7	17.0	34.4	15.5	25.8	3.7	2.1	1.5
3	Murtidhunua	128	28.3	71.7	26.6	39.5	12.3	18.0	2.3	1.3	-
4	Paldiribas	128	26-1	73.7	18.8	36.2	11.8	27.2	4.3	0.4	1.3
	Overall	512	26.1	73.9	18.6	35.4	12.7	26.7	3.8	1.8	1.1

Note: Figures are based on Table 5 of Annex Volume.

Among the literate population, the table shows relatively larger proportion of respondents with higher educational background (that is, intermediate and above) in Pakuwa VDC (9.4 %) followed by Bhanu VDC (7.3%).

7.2 Land System and Distribution

7.2.1 Land distribution

The present land use pattern of the surveyed area is comprised of Khet land, PakhoBari land, Tar land, Pasture land and Forest area. The overall average landholding size per household is recorded as 1.06 hectare as indicated in Table 7.4. Khet, Pak-ho/Bari and Tar land, in aggregate constitute 95 percent of the cultivated land and which is used for growing various crops. The proportion of Khet, PakhoBari and Tar were in the order of 36, 53 and 10 percent respectively of the cultivated area on average.

It is apparent from the table that VDCs in the east (Murtidhunga and Pakhribas) had relatively large average land holdings compared to those in the west Pakuwa and Bhanu). While the area of Khet land per household is relatively similar between east and west, the area of PakhoBari land is much less in the west, particularly in Pakuwa VDC, where respondents have converted their PakhoBari land into Khet land due to increased availability of irrigation

Table 7.4: Average Size of Land Holding

(Unit: ha/HH)

S.N	VDCs	AVERAGE LAND HOLDING					
		Khet land	Pakho	Tar	Pasture	Private forest	Total
1.	Pakuwa	0.40	0.10	0.02	0.01	0.03	0.55
2.	Bhanu	0.35	0.36	0.01	0.01	0.01	0.73
3.	Murtidhun a	0.23	0.63	0.36	0.04	0.18	1.44
4.	Pakhribas	0.41	0.94	-	0.02	0.16	1.53
	Overall	0.35	0.51	0.10	0.02	0.10	1.06

Note: Figures are based on Table 7 of Annex Volume.

The word "Tar" is often used to indicate an area of flat land located at altitude without access to irrigation. Such a land has low production potential and is used mainly for grazing purposes. This definition holds true in the west (Pakuwa and Bhanu VDCs). However, the farmers of the east have converted this "Tar land" into productive PakhoBari land by making bigger area of flat land, providing irrigation and improving their soil fertility status and now known as Khet land.

The area of pasture land is small both in east and west. Areas of private forest are larger in the east than in the west. Trees grown in private forest are used as a source of fodder for animals

The proportion of respondents for different land holding size varied from one VDC to another VDC. Pakuwa VDC had relatively large proportion of respondents (70%) with small land holding size (up to 0.5 ha1HH) when compared to the respondents of other VDCs. Conversely, the farmers of Murtidhunga and Pakhribas VDCs in the sample had relatively large land holding sizes (2 to 3 ha/HH) as shown in Figure 7.3.

Figure 7.3: Distribution of Respondents with Different Size of Land Holding by VDC.

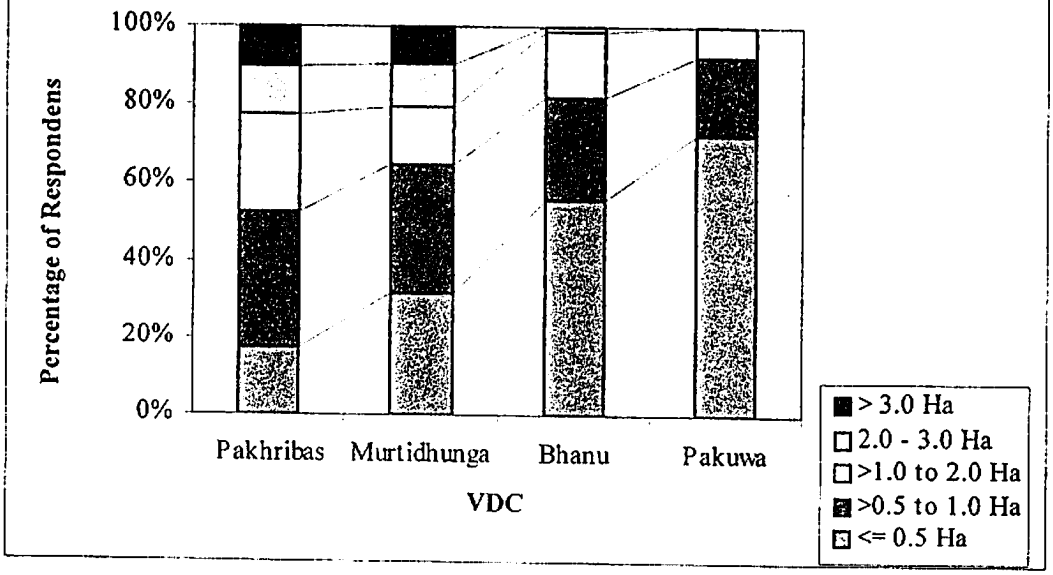


Table 7.5 shows the distribution of respondents under different size of land holding by VDC

Table 7.5: Number of Respondents by Different Land Size by VDC.

S.N.	VDCs	RESPONDENTS NUMBER BY LAND HOLDING SIZE				
		<= 0.5 (ha.)	>0.5 to 1.0 (ha.)	>1.0 to 2.0 (ha.)	>2.0 to 3.0 (ha.)	> 3.0 (ha.)
1.	Pakuwa	93	25	10	-	-
2.	Bhanu	71	34	21	2	-
3.	Murtidhunga	40	43	19	14	12
4.	Pakhribas	22	45	32	16	13
5.	Total	226	147	82	32	25

The distribution of respondents reporting different land holding size by Ward is presented in Table 7a.in Annex volume.

7.2.2 Land Renting System

Besides farming their own holdings, farmers also rent land from others, or leave their land to others. An informal land renting in and renting out system existed in the surveyed VDCs, but on a very small scale. Due to the small area of the rented land, the size of the operational land holding (own land – land rented out + land rented in) did not vary much from the area of the land owned by the farmers (that is, the land in cultivator's own name). This is indicated for different VDCs in Table 7.6

Table 7.6: Tenure Status

(Unit: ha/HH)

SN.	VDC	TOTAL. LAND OWNED (A)	FARM OPERATED B =A +C-D	RENTED N C)	RENTED OUT (D)
1.	Pakuwa	0.55	0.60	0.08	0.03
2.	Bhanu	0.73	0.77	0.11	0.07
3.	Murtidhun a	1.44	1.42	0.05	0.14
4.	Pakhribas	1.53	1.50	0.13	0.09
	Overall	1.06	0.99	0.09	0.08

Note: Figures based on Table 8 of Annex volume.

Further, the information on land renting system by ward can be obtained from Table 8 of Annex volume.

7.2.3 Land Parcel

The number of parcels of land belonging to an individual household varied from one to nine in the surveyed area. Overall, the average number of parcels is calculated as four, although there are more in Pak-uwa VDC (on average 61HH). These extra parcels of land in Pakuwa are mostly Khet lands. On average, most households commonly have two pieces of land although there in Pakuwa have three and there in Bhanu have one as indicated in Table 7.7.

Table 7.7: Number of Parcels by Type of Land

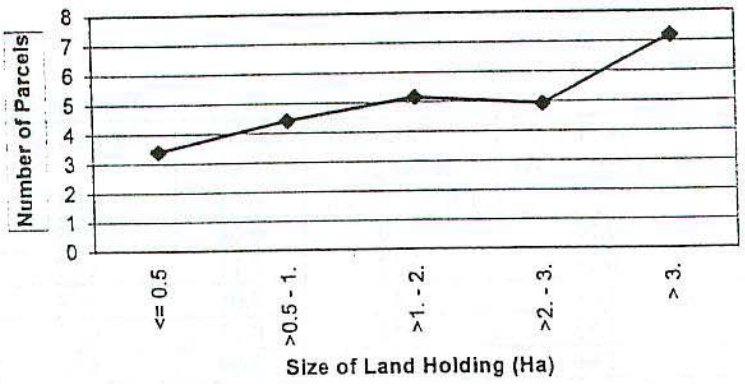
(Unit: No./HH)

S.N.	VDC	SAMPLE HE (No)	AVERAGE		NUMBER OF				MODE
			Lowland (Khet)	Upland (Bari/Pakho)	Tar	Pasture Land	Private Forest	Total	No.
1	Pakuwa	128	4.1	1.9	0.1	0.1	0.1	6.3	3
2	l3hanu	128	1.1	1.5	0.0	0.0	0.0	2.6	1
3	Murtidhun a	128	0.8	1.6	0.6	0.1	0.3	3.4	2
4	Pakhribas	128	1.0	2.0	-	0.1	0.6	3.7	2
	Overall	512	1.75	1.75	0.2	0.08	0.25	4.0	2

Note: Figures are based on Table 6 of Annex volume.

The number of parcels of land is positively correlated with the land holding size. An increase in land size means an increase in number of parcel owned (Figure 7.4).

Figure 7.4: Relation Between the Size of Land Holding and Number of Parcels



Overall, the average parcel size is 0.68 hectare, with maximum size of 2.62 hectares in Murtidhunga and Pakhribas VDCs and minimum of 0.3.hectare in Pakuwa VDC. Relatively larger parcel sizes are reported from the VDCs in the east (Murtidhunga and Pakhribas VDCs) as indicated in Table 7.8.

Table 7.8: Size of Parcel and their Distance

S.N.	VDCs	Size of Parcel (hectare)			Distance (minutes)		
		Average	Max.	Min.	Average	Max.	Min.
1.	Pakuwa	0.372	1.15	0.01	12.6	150	1.0
2.	Bhanu	0.596	1.83	0.03	13.4	120	1.0
3.	Murtidhunga	0.615	2.62	0.05	12.4	60	1.0
4.	Pakhribas	1.134	2.62	0.05	16.2	120	1.0
	Overall	0.679	2.62	0.01	13.7	150	1.0

Note: Figures are based on Table 14 of Annex Volume.

The average walking distance (from home to field and field to home) to the parcel was reported as 14 minutes with maximum and minimum distance of 150 and one minutes respectively in Pakuwa VDC.

7.2.4 Land ownership pattern

About half of the respondents indicated a change in the size of land they owned compared to ten years ago. Overall, around 40 percent of all respondents indicated a decrease in the land size, while 10 percent noted an increase in size over the last 10 years. More change was seen in Murtidhunga and Pakhribas than in Pakuwa and Bhanu (Table 7.9).

Table 7.9: Respondents Indicating Change in Size of Land Owned as Compared to 10 Years Ago

S.N	VDCs	PROPORTION OF RESPONDENTS INDICATING CHANGE		
		Decrease	Increase	No Change
1.	Pakuwa	30.5	9.5	60.2
2.	Bhanu	33.6	6.3	60.2
3.	Murtidhunga	50.8	16.4	32.8
4.	Pakhribas	43.0	7.8	49.2
	Overall	39.5	10.0	50.6

Note: The figures are based on Table 9 of Annex volume.

The reasons given for reduction in land size include division of land due to family breakdown, sale of land and landslide. Purchasing land increased the area of land owned.

7.3 Soil Fertility Status

During the household survey, the respondents were asked to compare the current status of soil fertility in PakhoBari and Khet land with that of ten years ago. The following Table 7.10 shows responses noted during field survey.

7.3.1 Soil Fertility Status by VDC

More than two third of respondents reported that changes (increase or decrease) have occurred in soil fertility status of both PakhoBari and Khet land. Relatively more number of farmers in all VDC indicated decline in soil fertility in PakhoBari as compared to Khet land (Table 7.10). A similar result has been obtained for the respondents indicating increased soil fertility.

Table 7.10: Respondents indicating Soil Fertility Status at Present Compared to 10 Years Ago

(Unit: No)

S.N	VDCS	RESPONDENTS INDICATING FERTILITY STATUS AT PRESENT					
			PakhoBari		Khet land		
		Decreased	Increased	No change	Decreased	Increased	No change
1.	Pakuwa	62	23	18	55	31	39
2.	Bhanu	39	33	49	17	34	36
3.	Murtidhunga	30	51	45	18	30	18
4	Pakhribas	72	35	20	42	14	17
	Overall	203	142	129	132	109	110

7.3.2 Soil Fertility Status by Land Holding Size

Relatively more number of respondents with small land holdings (up to 0.5 ha/HH) reported changes (decrease or increase) in soil fertility status in the surveyed area. The respondents indicating changes were relatively more for PakhoBari than for Khet land particularly for the land size below two hectares as shown in Table 7.11.

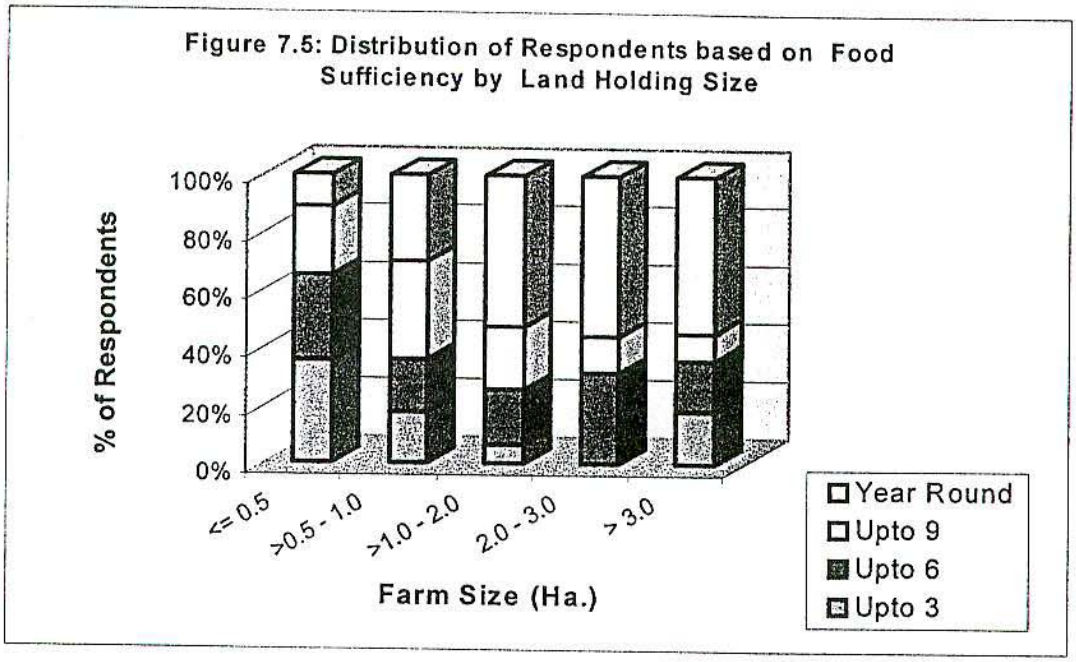
Table 7.11: Respondents indicating Soil Fertility Status at Present Compared to Ten Years Ago

(Unit: No.)

S.N	VDCs	Respondents indicating Fertility Status at Present					
		Pakho/Bari Land			Khet land		
		Decreased	Increased	No change	Decreased	Increased	No change
1.	Up to 0.5 ha.	87	78	74	54	59	57
2.	> 0.5 to 1 ha.	60	32	34	30	31	31
3.	> 1.0 to 2 ha.	33	28	13	23	16	16
4.	>2.0to3ha.	17	3	4	18	3	2
5.	>3.0 ha.	6	1	4	7	-	4
	Overall	203	142	129	132	109	110

7.3.3 Relationship between soil fertility and food self- sufficiency

Figure 7.5 shows that larger the land holding size, longer the period of food sufficiency. However, the food production from the larger farm size is not always adequate to the family throughout the year because of the larger family size and less productive land.



In spite of positive relationship between land holding size and food sufficiency, more number of farmers with adequate food (perhaps large farmers) reported change in soil fertility during the last ten years as compared to the farmers with less food availability. The rate of change was higher in Pakho/Bari land than in Khet land (Table 7.12).

Table 7.12: Respondents indicating Soil Fertility Status at Present Compared to 10 Years Ago by Food Sufficiency Level.

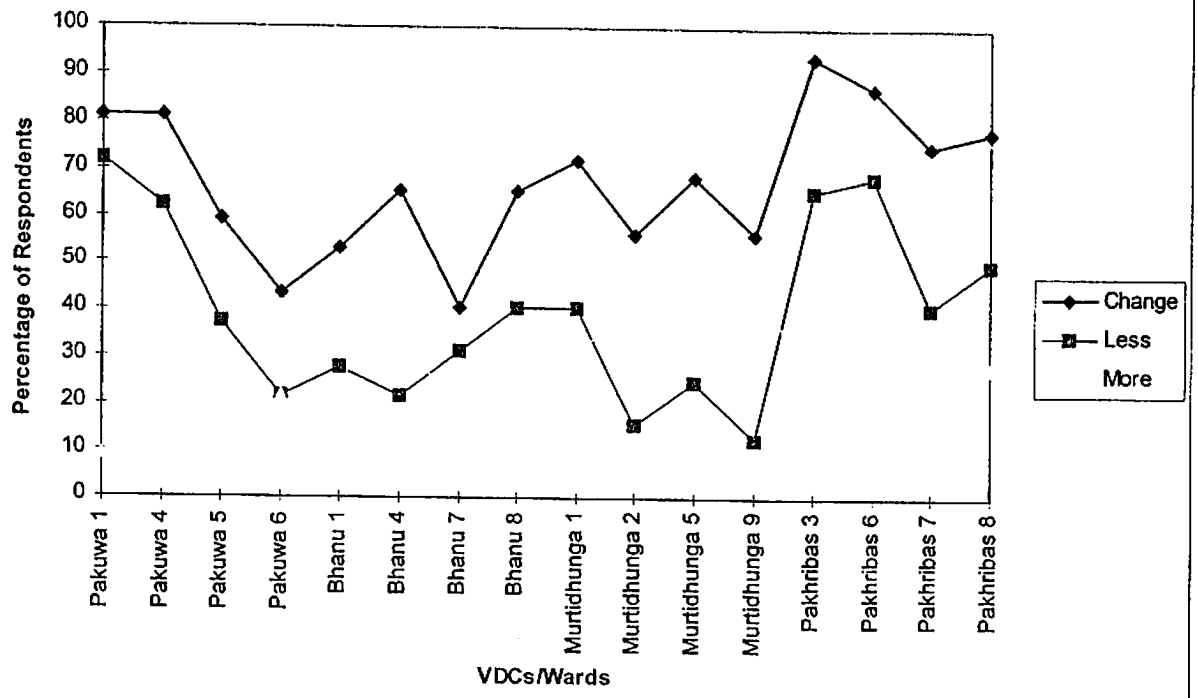
(Unit: No.)

S.N	FOOD SUFFICIENCY	RESPONDENTS INDICATING FERTILITY STATUS AT PRESENT					
	Level (month)	Pakho/Bari Land			Khet land		
		Decreased	Increased	No change	Decreased	Increased	No change
1.	Up to 3 months	47	37	39	23	19	26
2.	3 to 6 months	45	39	33	31	32	26
3.	6 to 9 months	50	38	30	36	26	24
4	9 to 12 months	61	28	27	42	32	34
	Overall	203	142	129	132	109	110

7.3.4 Changes in Soil Fertility Status by Ward

The analysis for assessing the soil fertility status by Ward was done using frequency distribution both for Pakho/Bari and Khet land as shown in Figures 7.6 and 7.7.

Figure 7.6: Frequency Distribution of Changes in Soil Fertility in Pakho/Bari (Upland) by Ward, 1999.

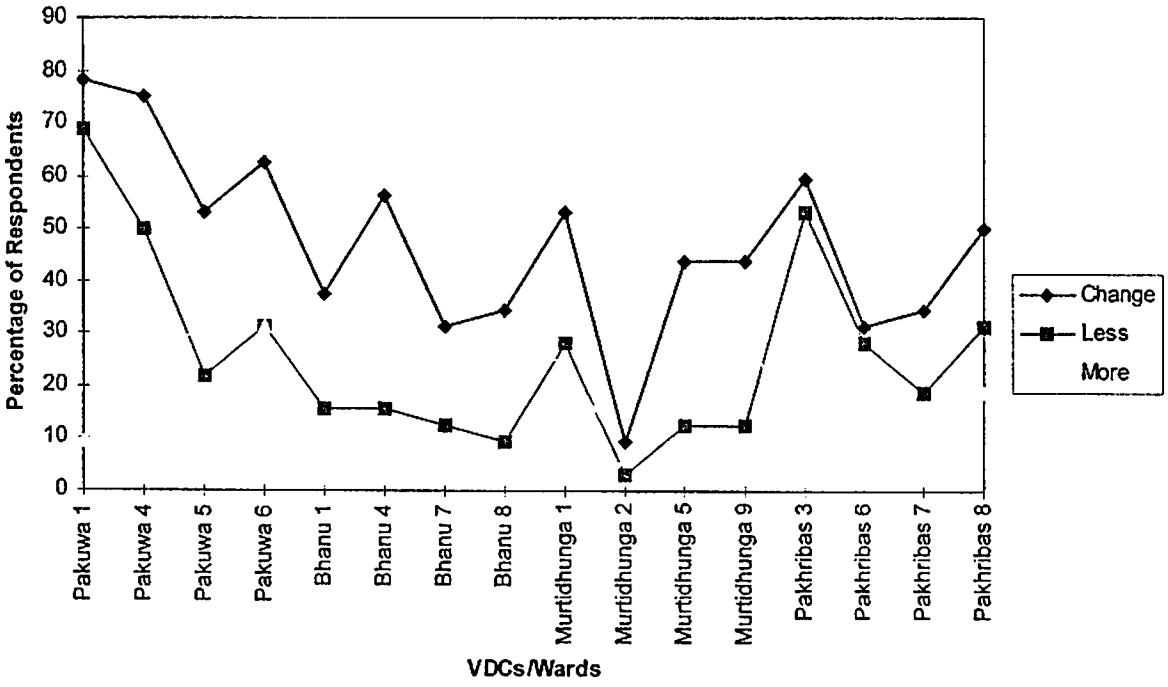


The figure for Pakho/Bari land (Figure 7.6) shows that 62 to 70 percent of respondents from Pakuwa, Ward Nos. 3 and 4 indicated as decline in soil fertility in Pakho/Bari land during past 5 to 10 years. Similarly, most respondents (68-70%) of Ward Nos. 3 and 6 of Pakhribas VDC indicated decrease in soil fertility. The major reasons for the decline, as cited by the sample respondents, were a reduction in use of manure, the occurrence of soil erosion, a lack of labour, lack of irrigation facility and the practice of multiple cropping. In addition, less rainfall and an increasing disease problem and the use of low quality chemical fertilisers were factors reported by respondents of Pakhribas VDC.

The soil is reported to be better managed by the surveyed households in Ward No. 4 of Bhanu VDC and Ward Nos. 2, 5 and 9 of Murtidhunga VDC. This is mainly due to the increased availability of FYM from the improved breed of livestock that farmers keep in the VDCs. An additional advantage was noted in Ward No. 4 of Bhanu VDC, where waste tap water was used for irrigation.

The figure for the Khet land on frequency distribution of changes in soil fertility was found different from that of Pakho/Bari land (Figure 7.7). Relatively, less percentage of respondents reported change in soil fertility in Khet land during last ten years. Fertility decline was reported relatively less particularly in Ward No. 2 of Murtidhunga VDC and Ward No. 6 of Pakhribas VDC.

Figure 7.7: Frequency Distribution of Changes in Soil Fertility in Khet (Lowland) by Ward, 1999.



7.4 Crop production

7.4.1 Crops and Crop Productivity

A. Khet land.

Rice, wheat, maize and mustard are the major crops grown on Khet land of the surveyed Wards of four VDCs. The crop yield varied within and between VDC (s) depending upon adequacy of irrigation water, amount of chemical fertiliser and FYM used and management practices followed. The results of household survey on crop yields are summarised in Table 7.13.

Table 7.13: Crop Productivity in Khet land

(Unit: t/ha.)

SN	CROPS	AREA FOR 4 VDCs (HA.)	YIELD BY VDC				
			Pakuwa	Bhanu	Murtidhun a	Pakhribas	Overall Weighted Average
1.	Rice	163.10	1.51	1.66	1.32	1.01	1.36
2.	Wheat	52.33	1.16	1.00	1.05	0.96	1.03
3.	Maize	41.34	1.30	1.30	0.97	0.97	1.21
4.	Mustard	5.00	0.58	0.72	0.83	0.86	0.82
5.	Early rice	2.08	0	2.43	0	0	2.43
6.	Potato	0.97	5.46	4.34	0	0	5.13

Note: Figures are based on Table 12 of Annex Volume.
Weighted Average is sum of individual production divided by total land area.

The overall weighted average rice yield reported for Khet land under irrigated condition is 1.36 tons per hectare, which is less than the average yields for respective districts (Parbat 2.00 tons/ha, Tanahu 2.20 tons/ha and Dhankuta 2.30 tons/ha). Poor performance of the rice might be attributed to low rates of application of chemical fertiliser (46 kg Urea, 13 kg DAP, and less than one kg Potash/ ha) and compost (2.9 tons /ha) in the area. The yields of potato and early rice are to be interpreted cautiously, as the areas under these crops are limited as shown in Table 7.13.

Table 7.14 shows the yield range for different crops in all 16 Wards and the coefficient of variation (CV) for the average household yields of a given crop. The CV can be used to compare the relative variation in yield for different crops. The higher CV values for mustard (57) and maize (53) indicate the relatively large variation in crop yields for those crops as compared to others in the list, perhaps indicating more scope for improvement in their productivity ("fable 7.14). CVs for particular crops vary considerably between VDCs and Wards (Table 12b of Annex Volume).

Table 7.14: Average, Minimum, Maximum and Coefficient of Variation of Crop Productivity in Khet land.

S.lti	CROPS	MINIMUM (T/HA)	MAXIMUM (T/HA.)	AVERAGE OF HH YIELD (T/ HA.)	STANDARD DEVIATION	COEFFICIENT OF VARIATION	NUMBER OF GROWERS
1	Rice	0.70	3.72	1.46	0.50	34	335
2	Wheat	0.65	2.64	1.15	0.48	42	222
3	Maize	4.64	3.90	1.38	4.73	53	187
4	Mustard	0.34	2.77	0.79	0.45	57	28
5	Early rice	1.17	4.68	2.77	1.19	43	8
6	Potato	3.16	7.64	5.11	1.41	28	15

Note: Figures are based on Table 12.b of Annex Volume.
Average of PII-I yield is obtained by summing average yield of individual household divided by number of household.

B. Pakho/Bari land.

Maize was reported to be the major crop grown in Pakho/Bari land followed by millet, mustard, upland rice and blackgram. Maize and millet were grown in all 4 VDCs. The area under maize crop was reported to be relatively higher in Murtidhunga VDC (110 ha) and Pakhribas VDC {87 ha.}. Upland rice was grown in Bhanu VDC, a most of the blackgram (29.6 ha.) was grown there too. In addition to food gains, the respondents of Murtidhunga and Pakhribas VDCs also reported some cultivation of potato and vegetables such as cabbage., cauliflower, and peas. This clearly indicates that VDCs in the east, that is, Pakhribas and Murtidhunga are tending towards commercialised farming, utilising the advantages of geographic location, road infrastructure and available market facilities in the area.

Based on the results of household survey, the crop yields reported for Pak-ho/Bari land are summarised in Table 7.15.

Table 7.15: Crop Productivity in Pakho/Bari land

(Unit: t/ha.)

S.N.	CROPS	PLANTED AREA OF 4 VDCs (HA.)	YIFLDS AT				
			Pakuwa	Bhanu	Muni dhur7ea	Pakhribas	Overall Weighted Average
1.	Maize	220.0	1.08	128	1.10	1.09	1.10
2	Millet	66.3	1.38	1.47	4.95	0.99	1.26
3.	Upland Rice	33.0	0	1:29	0	0	1.28
4.	Oilseeds Mustard	34.9	0.77	17.67	0.71	0.65	0.66
5.	Blackeratn	29.6	0.41	0.62	0.79	0	0.63
6.	Wheat	1 9	0	0	0	0.89	4.89
7.	Potato	15.0	0	6.72	3.86	4.38	3.97
8,	Soybean	2.5	0	0	0	o.51	0.51
9.	Pea	2.6	0	0	103	2.31	2.06
10.	Beans	0.8	1.15	1.37	0	0	1.35
11.	Cabbage	$.4	0	0	4.02	3.82	4.02
12.	Cauliflower	0.8	0	0	2.39	0	2.39

Note: Figures are based on Table 12a of Annex Volume.
Weighted Average is sum of individual household production divided by total land area.

The reported crop yields of maize, millet, upland rice, potato, cabbage and oilseeds -mustard were smaller than the yield levels reported for the district. Most of the farmers in the area have grown local potato, which has a lower yield potential, nevertheless has a good taste.

When comparing the crop yields between VDCs, Bhanu VDC clearly shows the advantage of low altitude in terms of productivity of maize, millet, upland rice and potato (Table 7.15).

Computation of the CV for the crop yield in the PakhoBari land indicates relatively more variation for the yield of cauliflower, peas, millet and blackgram as compared to other crops (Table 7.16). Fluctuation in crop yield is greater within a VDC rather than between VDCs for these crops. Relatively more yield variation has been noted for maize crop in Bhanu VDC (CV=54). The presentation of CVs by VDC for different crops can be found in Table 12.C of Annex volume.

Table 7.16: Average, Minimum, Maximum and Coefficient of Variation of Crop Productivity in PakhoBari land

S.N.	CROPS	MrNtmum (T/HA)	MAXIMUM (T/HA)	AVERAGE OF FIH YIELD T/fLA)	STANDARD DEVIATION	*COEF.* OF VARIATION (C.V)	GROWERS (No)
1	Maize	0.36	3.25	1.21	0.52	43	407
2	Millet	0.54	3.78	1.19	0.63	53	238
3	Upland rice	0.80	3.75	1.52	0.63	41	115
4	Oilseeds	0.40	1.72	0.67	0.20	30	120
5	Blackgram	0.40	3.67	0.66	0.34	52	102
6	Wheat	0.65	2.6	0.96	0.44	46	20
7	Potato	0.04	15.29	4.35	2.13	47	76
8	Soybean	0.40	0.65	0.51	0.07	14	8
9	Peas	0.48	5.73	2.64	2.03	77	16
10	Beans	0.65	1.99	1.36	0.38	28	13
11	Cabbage	2.18	7.01	4.24	1Al	33	35
12	Cauliflower	1.43	4.78	2,39	1.40	59	4

Note: Figures are based on Table 12c of Annex Volume
Average of HH yield is obtained by summing average vield of individual household divided by number of household.

7.4.2 Cropping Pattern

It is quite common in the hills and mountains that the prevailing croppin[g] pattern is found re[g]ulated and characterised by two distinct season i. e. summer and winter seasons. In some areas with low altitude, spring season crops can also be found.

The availability of irrigation facilities, chemical fertiliser, manure, and seeds as required for crop cultivation determines the cropping pattern in a particular domain. In addition, livestock husbandry practice also affect the cropping pattern to a considerable extent because, during the winter season in particular, livestock are left for open grazing in and around the farm, while in other cases they are stall fed.

A. Khet land

The cropping patterns followed in Khet land differed from those of PakhoBari land because of the availability of irrigation. Rice - wheat is the pre-dominant cropping pattern in Khet land followed by rice - fallow and rice - maize. These patterns are being adopted by more percentage of respondents of Pakhribas VDC.

In hill area of Pakhribas VDC, maize is traditionally grown. However, the increased availability of irrigation water enabled rice production, and in some cases with good access to irrigation wheat production during the winter seasons (Table 7.17).

Table 7.17: Pre-dominant Cropping Patterns in Lowland (Khet land)

(Unit: % of Resᵖonses.)

S.N	CROPPING PATTERNS	VDCs				
		Pakuwa	Bhanu	Murtidhun a	Pakhribas	Overall
1.	Rice - wheat	38.4	11.5	19.6	47.8	32.8
2.	Rice - fallow	27.4	22.1	33.3	44.4	29.6
3.	Rice - maize	18.6	16.8	19.6	1.1	15,5
4.	Rice -wheat -maize	10.4	29.2	3.9	-	11.9
5	Rice - wheat + mustard	1.6	-	11.8	1.1	2.1
6	Others	3.6	20.4	11.8	5.6	8.1

Note: Figures are based on Table 13 of Annex Volume.

With assured irrigation available for 12 months, about 12 percent of respondents reported to have grown three crops per year, that is, rice - wheat - maize. This was especially noticeable in Bhanu VDC.

B. PakhoBari land

Pak-ho/Bari land is characterised by a number of cropping sequences, which differ from one VDC to another. Maize/millet is the major pattern for Pakuwa, Murtidhunga and Pakhribas VDCs. However, upland rice - blackgram was the main cropping pattern in Bhanu VDC with maize - blackgram and upland rice - maize being other common practices in Bhanu VDC (Table 7.18).

Table 7.18: Pre-dominant Cropping Patterns in PakhoBari Land

(Unit: % Responses)

CROPPING PATTERNS	VDCs				
	Pak-uwa	Bhanu	Mwrtidhun	Pakhribas	Overall
Maize/millet - fallow	98	9	38	28	42
Maize - fallow	-	-	13	25	12
Maize - Oilseeds	1	5	4	21	10
Upland Rice - Blackgram	-	39	-	-	8
Maize - black	1	19	-	-	4
U land Rice - Maize	-	23	-	-	5
Maize - Vegetable/ Potato.	-	-	9	6	4
Maize/ Potato - cabbage	-	-	16	-	3
Maize /millet -wheat	-	-	11	-	-
Maize -wheat	-	-	-	7	3
Others	-	5	9	I3	9

Note: Figures are based on Table 13a of Annex Volume.

Diversified cropping patterns, which include vegetables, are noted especially in Murtidhunga and Pakhribas VDCs (Table 13.a of Annex Volume).

Almost all the sample farmers reported that they left some land fallow during the year. About 71 percent of respondents reported that they had left one or more of their Khet land parcel (s) fallow for about 5 months and Pakho land for 4 months. The reasons were lack of irrigation, reduced soil fertility and climate.

7.5 Use of Chemical Fertiliser and Farm Yard Manure

7.5.1 Chemical Fertiliser

The respondents in the surveyed VDCs were found to have applied all three types of chemical fertilisers, that is, Urea, Di-ammonium Phosphate (DAP) and Potash, but at different rates.

A. **Khet land**

About 98 percent of the respondents reported that they have applied urea. Around 46 percent have applied DAP and less than one percent used potash to the crops grown on the Khet land. The chemical fertiliser is applied mainly on wheat, rice, and maize crops grown in Khet land. The farmers also have reported growing of potato, however the area being very small, fertiliser use rate is not shown in the Table 7.19. The rate of fertiliser use in overall and for users shows considerably higher rate of application in wheat and rice crops as indicated in Table 7.19.

Table 7.19: Chemical Fertiliser Use in Different Crops of Khet land

S. N.	CROPS	OVERALL AVERAGE (KG/HA).			USERS' AVERAGE (KG/HA)		
		Urea	DAP	Potash	Urea	DAP	Potash
1	Rice	45.2	13.0	0.2	62	43	13
2	Wheat	47.0	23.0	0.3	50	47	20
3	Maize	28A	5.0	-	47	29	-
4	Early rice	6.4	-	-	46	-	

Note: Figures are based on Tables 17.1 to 17..6, and 17.1a. to 17..6a, of Annex Volume.

: Overall average is the Weighted Average and is calculated by adding up the quantity used by individual household and dividing it by total land area under a particular crop.
: Users' average is obtained by summing up of average quantity of chemical fertiliser use of individual household and divided it by users' number of household.

The range in fertiliser use and an indication of variability in fertiliser use is shown in Table 7.20.

Table 7.20: Average, Minimum, Maximum and Coefficient of Variation of Chemical Fertiliser Used in Khet land

S. N..	VDC	Crops	Minimum HH	Maximum HH (Kg/ha)	Average of HH (Kg/ha)	Standard Deviation	%Coefficient of Variation (CV)	Number of Users
1	Pakuwa	Urea	15	229	73	38	51	198
2		DAP	10	191	80	38	48	126
3		Potash						
4	Bhanu	Urea	15	239	68	46	68	145
5		DAP	13	191	51	32	64	55
6		Potash	6	24	18	7	37	5
7	Murtidhunga	Urea	16	143	52	32	61	60
8		DAP	13	38	20	7	35	28
9		Potash						
10	Pakhribas	Urea	15	115	44	24	54	92
11		DAP	16	76	25	17	65	26
12		Potash						
13	Overall	Urea	15	239	64	39	62	495
14		DAP	13	191	60	40	67	235
15		Potash	8	24	18	7	37	5

Note: Figures are based on 15b of Annex Volume.

B. Pakho/Bari land

In Pakho/Bari land, 87 percent farmers used Urea, 45 percent applied DAP and 2 percent used Potash. Potato, cabbage, maize and upland rice received larger application of fertilisers in Pak-ho/Bari land. Although the vegetables received higher dose, their area is relatively small and so this needs to be interpreted carefully (Table 7.21). The farmers also have grown other crops such as millet, beans, peas, radish in Pakho/ Bari land, however, they are not included in the Table 7.21 either because less area under them or due to the application of insignificant amount of chemical fertiliser.

Table 7.21: Chemical Fertiliser Use in different Crops in PakhoBari land

S.N.	CROPS	OVERALL AVERAGE (Kg/ha)			USERS AVERAGE (Kg/ha)		
		Urea	DAP	Potash	Urea	DAP	Potash
1.	Maize	35.1	5.0	-	46	30	13
2	Upland Rice	28.1	4.0	0.7	47	27	16
3	Wheat	23.5	7.0	-	25	23	-
4.	Oilseeds (Mustard)	16.8	2.0	0.3	23	15	13
5	Black am	0.2	-	-	38	19	-
6.	Potato	48.1	15.0	-	58	29	-
7.	Cabba e	34.8	15.0	0.5	35	22	13

Note: Figures are based on Tables 18.1, 18.3 to 18.6, 18.9, 18.11,18.16 and 18.1 a, 18.3a to 18.6a, 18.9a, 18.11 a, 18.16a of Annex Volume.

: Overall average is the Weighted Average and is calculated by adding up the quantity used by individual household and dividing it by total land area under a particular crop.

: Users' Average is obtained by summing up of average quantity of chemical fertiliser use of individual household and divided it by users' number of household.

The use of chemical fertiliser for crops grown on Pakho/Bari land is comparatively low because FYM is normally used as the means to enhance soil fertility on the type of land depending upon the crops to be grown. The variability in fertiliser use between household use in a VDC is shown in the Table 7.22.

Table 7.22: Average, Minimum, Maximum and Coefficient of Variation of Inputs Used in PakhoBari.

SN.	VDC	TYPE OF INPUTS	MINIMUM (Kg/Ha)	MAXIMUM (Kg/Ha)	AVERAGE (Kg/ha)	STANDARD DEVIATION'	%COEFFICIENT OF VARIATION (CV)	Number of Users
1	Pakuwa	Urea	13	191	80	53	67	30
2		DAP	38	153	72	36	50	9
3		Potash						
4	Bhanu	Urea	13	239	60	46	78	93
5		DAP	12	96	34	26	76	22
6		Potash	12	24	16	5	33	3
7	lvlurtidhung	Urea	13	239	69	51	73	146
8		DAP	11	96	35	25	72	39
9		Potash						
10	Pakhribas	Urea	13	248	44	35	80	195
11		DAP	11	127	30	26	88	49
		Potash	10	16	13		23	2
13	Overall	Urea	I3	248	57	46	80	464
14		DAP	11	153	35	29	81	119
15		Potash	10	24	15	5	33	5

Note: Figures are based on Table 16b of Annex Volume.

7.5.2 Trend in quantity of Fertiliser application

About 31 percent of respondents reported that over the last 10 years. they had increased the quantity of chemical fertiliser applied. The tendency of farmers to apply more chemical in order to increase production, has been facilitated by the easy access to fertiliser in nearby markets. Moreover, education has also contributed to increased use of fertiliser. Some respondents were of the opinion

that growing multiple crops (two or three crops in a year) and raising fewer livestock use of chemical fertiliser (Table 7.23).

Some respondents (5%) reported that they have decreased the rate of chemical fertiliser application on account of a shortage of chemical fertiliser, a lack of manpower to procure them and a rise in fertiliser price.

Table 7.23: Respondents indicating Change in Chemical Fertiliser Application as Compared to 10 Years Ago

(Unit: % of Resoondents)

S.N.	VDCs.	RESPONDENTS INDICATING THE TREND AS COWARED TO 10 YEARS AGO		
		Decreased	Increased	No change
1.	Pakuwa	4	28	68
2.	Bhanu	2	30	68
3.	Murtidhun a	2	31	67
4.	Pakhribas	13	33	55
	Overall	5	31	**64**

Note: The f i gures are based on Table 25 of Annex Volume -

7.6 Faroe Yard Manure

7.6.1 Quantity

The respondents in the survey area have maintained soil fertility largely by applying FYM. The use of compost is minimal. The highest amounts were applied to potato and maize crops grown on Khet land and to maize, upland rice and potato grown on Pakho/Bari land.

Table 7.24: FYM Use in Different Crops

	KHET LAND		PAKHO/BARI LAND	
S.N	Crops	Use of FYM (kg/ha)	Crops	Use of FYM (kg/ha)
1.	Rice	3246	Maize	4803
2.	Wheat	2861	Upland Rice	5011
3	Maize	3874	Oil seeds (Mustard)	2421
4.	Lars Rice	4700	Wheat	2017
5	Potato	11218	Potato	3937
6.			Cabbage	3240
7.			Beans	1132

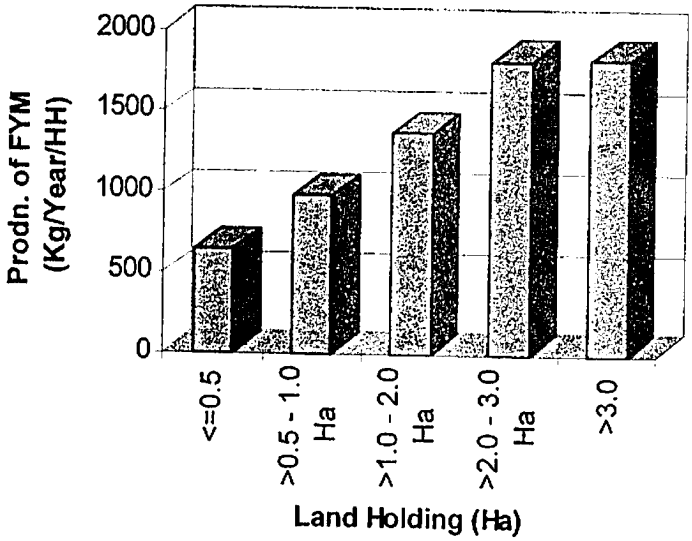
Note: Figures are based on Tables 17. la to 17.16a, 18.1a to 18.8a of Annex Volume.

From this study, three things became clear. First, the farmers with lar ger landholdings reported to have produced relatively large amount of FYM per year because of large number of livestock owned by them (Figure 7.8).

Secondly, the large number of livestock contributed in large amount of FYM production.

Third, as the number of farm animal increased, the use of FYM per household also higher increased accordingly as indicated by the Figure 7.9.

Figure 7.8: Relation Between FYM Production and Land Holding Size



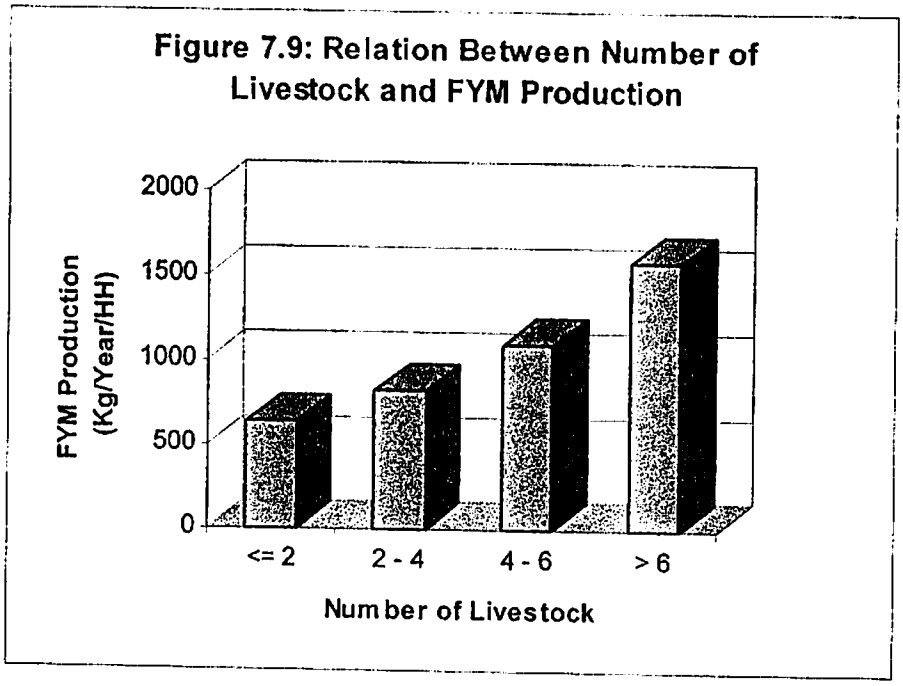
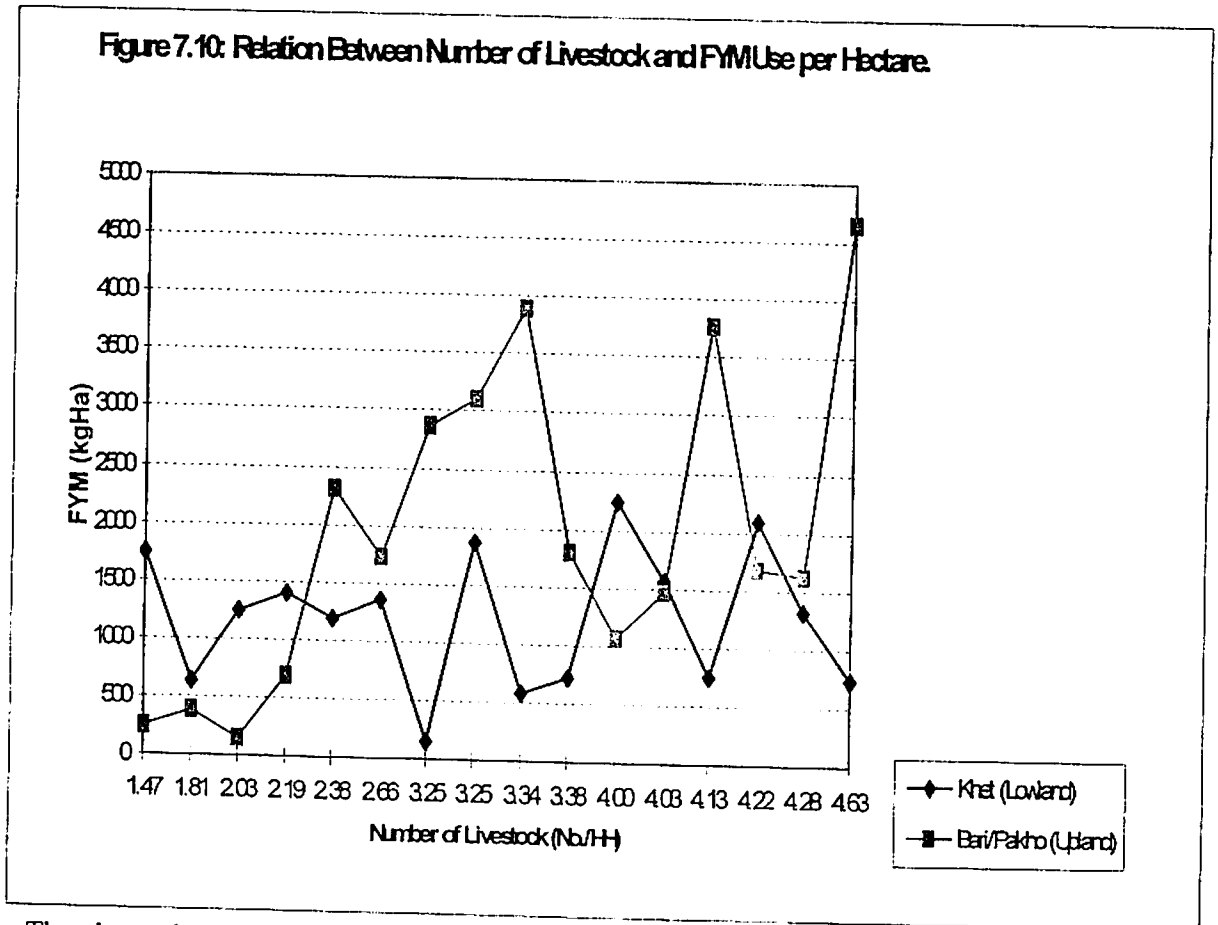


Figure 7.10 indicates that FYM use per hectare in Pakho/Bari and Khet land. The line graph shows that the rate of FYM application is relatively higher for Pakho/Bari than for Khet land.



The time of manure application varied according to the cropping pattern followed in the area. However, most of the respondents carried FYM to the field 8 to 14 days before ploughing and 98 percent of respondents spread it on the soil on the day of ploughing.

Table 7.25 shows that the rate of FYM use varied considerably both in Khet and PakhoBari land and, one VDC to other VDC. The CVs calculated indicate relatively more variation in manure use in the VDCs of the east (Pakhribas and Murtidhunga) both for Khet and Pakho.Bari land.

Table 7.25: Average, Minimum, Maximum and Coefficient of Variation of FYM Used in PakhoBari

S. N.	VDC	MINIMUM (Kg/Ha)	MAXIMUM (Kg/Ha)	AVERAGE (Kg/Ha)	STANDARD DEVIATION	% COEFFICIENT of VARIATION (CV)	NUMBER OF USERS
	Khet land						
1	Pakuwa	557	11944	4520	2407	53	185
2	Bhanu	562	9555	4455	2735	61	134
3	Murtidhunga	546	9555	3777	2666	71	93
4	Pakhribas	531	9555	3442	2422	70	81
5	Overall	531	11944	4185	2588	62	493
	Pakholand						
6	Pakuwa	1274	15925	8925	3696	41	68
7	Bhanu	717	14333	5744	3523	61	152
8	Murtidhunga	621	15925	5134	3653	71	148
9	Pakhribas	796	19110	5984	4301	72	175
10	Overall	621	19114	6053	4009	66	543

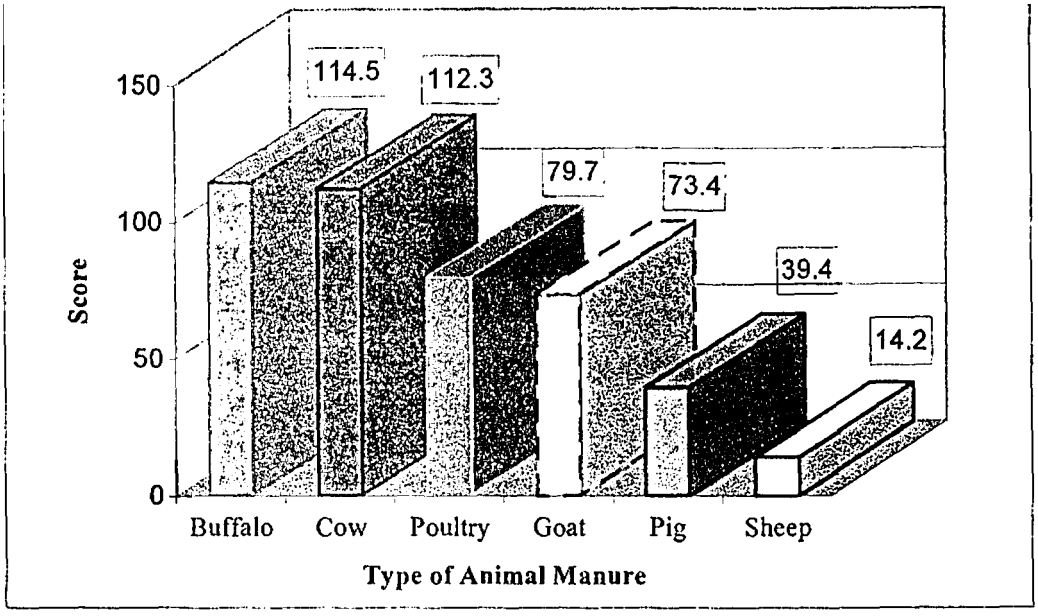
Note: Figures are based on Table 16b of Annex Volume.

Overall, 59 percent of respondents considered the amount of FYM available last year was adequate for farming, while the remainders felt it inadequate. The proportion of respondents indicating FYM was adequate and was higher for Bhanu VDC (67% respondents) and Murtidhunga VDC (64% respondents) than for Pakhribas and Pakuwa VDCs. Availability of manure last year by VDC is presented in Table 23 of Annex Volume.

7.6.2 Perception of Respondents on Fertility Availability from Different Animal Manure

When respondents were asked to indicate their perception for different animal manures in terms of their efficiency in making the soil fertile, the buffalo and cow manure received a high score followed by goat and poultry manure as shown in the Figure 7.11.

Figure 7.11: Priority of Different Animal Manure Use



The farmers' responses were based on their own experience of using different animal manure. It should be noted that when a farmer owned all types of animals, the priorities were inclined towards the manure of small animals. However, as most farmers owned cows and buffaloes, higher score were noted for large animals. The priority of respondents on different animal manure is presented in Tables 24.1 to 24.6 of Annex Volume.

7.6.3 Trend of Manure Application

About 22 percent of respondents indicated that the quantity of manure used has decreased, while 15 percent considered it to have increased compared to 10 years ago. Although the changes are noted in all the VDCs, the decrease in quantity has been observed mainly in Pakuwa VDC (Table 27 of Annex Volume).

The reasons given for the increased application of FYM is the greater availability of FYM because more livestock are raised and an increase in the availability of animal fodder. Similarly, a reduced availability of forest products, lack of labour, government policy to control community forest has limited the collection of forage, which, according to the respondents resulted in less use of FYM.

7.7 Livestock and their Management

7.7.1 Livestock Number

Most of the surveyed households owned cow, buffalo, goat and some birds. The modal analysis performed for the farm animals shows most of respondents owning two cows, one buffalo and one goat per household. Similarly, some respondents reported to have raised sheep, pig and poultry, whose mode number are in the order of 2, 4 and 5 per household respectively. The total number of livestock is presented in Table 7.26.

Table 7.26: Total Number of Livestock

S.1;	VDCs	FkwANTMALS					
		Cow	Buffalo	Goat	Sheep	Poultry	Pi
1.	Pakuwa	105	178	141	10	243	8
2.	Bhanu	250	212	280	5	584	25
3.	Murtidhun a	46	83	154	11	178	5
4.	Pakhribas	120	17	193	37	213	15
	Overall	**656**	**281**	**II5?**	**63**	**1384**	**121**

Note: Figures are based on Table 28 of Annex Volume.

More animals per household were found in the VDCs of the east (Pakhribas and Murtidhunga) compared to the VDCs in the west (Pakuwa and Bhanu). Although not all the respondents could give the exact number of animals owned ten years ago, those who responded indicate that there were fewer livestock now than 10 years ago. This scenario is more apparent for Pakuwa and Bhanu VDCs as indicated in Table 7.27.

Table 7.27: Chanae in the Number of Livestock in Surveyed Area

S. N.	VDCs	TOTAL NUMBER OF UVESTOCK		
		Present	5 Years Ago	10 Years Ago
1	Pakuwa	174	246	338
2	Bhanu	309	419	537
3	Murtidhunga	110	145	152
4	Pakhribas	70	78	109
	Overall	825	1055	1407

Note: Considers only those respondents. who gave livestock number for all three period.

7.7.2 Animal feed and their availability

Grass. tree fodder, crop residues and gains were seen as the major livestock feeds used by a inajority of respondent households. Their relative importance depended upon the season, availability and types of livestock reared. The respondents use grasses, which are abundant during the wet season, as a major source of livestock feed. Tree fodder and crop residues are reported as the main livestock feed during the winter season. Crop residues include straw of rice and millet, and are supplemented by tree fodder during winter season. In some cases, matured maize stalk are also used as feeds for livestock. The proportions of respondents providing different types of animal feeds are presented in

Table 7.28. For example, 80 percent of respondents feed grass to cattle and 40 percent of respondents feed gruel to pigs.

Table 7.28: Proportion of Respondents Providing Different Types of Animal Feed to Farm Animals

S.N.	FEEDS	CATTLE	BUFFALO	GOAT	PIG
I	Grass	80	85	68	-
2	Crop Residues	82	77	-	-
3	Tree Fodder	16	11	36	
4	Gruel	40	45	36	40
5	Grains	8	9	28	39
6	Bran	5	6	7	72

The animal feed package given to the different animals is shown in Table 7.29. Farm animals, like cattle and buffalo are provided with broom grass, Sateria and Jai in addition to their regular feed in the VDCs of the east. Goat and sheep were given the Titepati and Banmara in the west.

Table 7.29: Types of Animal Feed Provided to the Farm Animals

S.N.	ANIMALS	RAINY SEASON	WINTER SEASON
1.	Cowl Bullock	Grass, Gruel, Grains, Maize and millet stalks	Grass, Straw, Gruel, fodder Sateri Jai). wheat straw, broom grass, grains
2.	Buffalo	Grass, Kundo, Maize stalk, Grains	Grass, Straw, Gruel, fodder (Sateria, Jai), wheat straw, broom grass, grains
3.	Goat	Grass, Maize, Green leaves, Gruel fodder, Banmara. Tite pati	Grass, Gruel, fodder, wheat straw, maize, grains, Banmara.
4.	Sheep	Grass, Maize, Green leaves, Gruel fodder, Banmara, Tite ati	Grass, Gruel, fodder, wheat straw, maize,grains, Banmara.
5.	Pig	Bran, Wheat flour, grains, Sisnu, open grazing	Bran, wheat floor, grains, Sisnu, open grazing
6.	Poultry	Grains, Vegetables, Grazing	Grains, Vegetables. Grazin

Grass = Green Grass, Broom grass, Tall grass, Straw Stalk = Rice straw, wheat stalk, maize stalk, Grains = rice, wheat, maize.

About half of the respondents who are raising cattle and buffalo feel that the feed currently available is adequate. For other animals, the respondents in general feel the feed is inadequate (Table 30a. of Annex Volume). The animal feeds and their availability by Ward and farm animals is presented in Table 30.1 to 30.6 of Annex Volume. Comparatively, the respondents from the VDCs in the east (Pakhribas and Murtidhunga) were able to provide feed for livestock.

7.7.3 Livestock Management Practices

Livestock management practices considered in the study area included the type of animal grazing practised (free or stall feeding), type of sheds (temporary or permanent) being used and type of animal treatment (local, that is, treatment using medicinal plant or clinical, that is, veterinarian treatment) followed. About 72 percent of respondent stall feed their animals in account of limited land availability for grazing. This situation is created by an increased population (more area cultivated), lack of forest, occupation of land by cardamom cultivation and tree plantation in grazing land as indicated Table 7.30.

Table 7.30: Types of Livestock Management Practices

(unit: % of Respondents)

SIB.	VDCs	TYPE OF GRAZING		TYPE OF SHED		TYPE OF TREATMENT	
		Free	Stall feeding	Temp	Permanent	Local	Clinic
1.	Pakuwa	11	89	23	77	3	97
2.	Bhanu	66	34	14	86	21	79
3.	Murtidhun a	15	85	29	7I	64	36
4.	Pakhribas	20	80	34	66	39	61
	Overall	**28**	**72**	**27**	**73**	**36**	**64**

The table also shows that the majority of respondents use a permanent shed. Larger incomes, an increased awareness of the need to keep the animals under close supervision and protection for their good health are reasons given for this pattern.

Regarding the treatment of animals, the majorities (64%) of the respondents now prefer animal treatment from veterinary personnel rather than the treatment using medicinal plants. It has happened so because of increased availability of veterinary services at the village level provided by the Livestock Service Office (Table 32 of Annex Volume). Education also has made the people aware of the importance of treatment of their livestock by veterinary technicians.

The system of stall feeding is most in evidence in Pakuwa, Murtidhunga and Pakhribas VDCs. A relatively large proportion of respondent from Pakuwa and Bhanu VDCs prefer to get their livestock treated in veterinary hospital, although the treatment by local method is still in practice in the VDCs surveyed. The farmers indicating livestock management practices for different animal type is presented in Tables 31.1 to 31.6 of Annex Volume.

7.8 Soil Management

7.8.1 Labour Use in Soil Managetent Activities.

Soil management by using FYM and chemical fertiliser application is commonly practised in the surveyed areas. A very few respondents have learned to practise compost making and growing green manures. Farmers have considered the use of FYM to be the best way of improving soil fertiliq', althou[g]h it requires a greater range of activities, which consume more time. These activities include the collection of forage, arranging them as bedding material, cleaning the cowshed and making a manure heap. Further, the manure is to be carried out to the field and spread it in the soil before ploughing.

Some households, which still own private forest, have used them as source of forage, while others had to depend on the community forest of the respective VDC. The respondents collect the forage from the forest by travelling about two hours (from home to forest and forest to home). It is noted that the people in Murtidhunga VDC (Ward No. 5) had to travel longer distance (almost three hours) for the same purpose, as compared to the people of other VDCs (Table 37 of Annex Volume).

It is estimated that the respondents spend about 81 days in a year to prepare and manage FYM. However, the working days varied from a minimum of 53 days in Bhanu VDC to a maximum of 105 days in Murtidhunga VDC. The respondents of Murtidhunga VDC have used relatively higher quantity of compost and accordingly noted the highest number of days (105) spent in managing FYM. In preparing FYM, the role of women is found to be dominant as they spent 72 percent of the total days required for preparing FYM. The breakdown of days for different activities by VDC is shown in Table 7.31.

Table 7.31: Total Days Required in Managing FYM by VDC

S.N.	Activities	Name of the VDCs				
		Total	Pakuwa	Bhanu	Murti-dhunga	Pakhri-bas
1	Collection of forage	52	45	31	70	56
2	Arranging bedding materials/ Cleaning shed/ Makin manure heap	16	16	13	20	17
3	Carnryin manure to the field.	10	12	7	12	10
4	Mixing of manure in the soil.	3	3	2	3	2
	Overall	81	76	53	105	85

Note: Figures are based on Table 38 of Annex Volume.

7.8.2 Change in labour availability

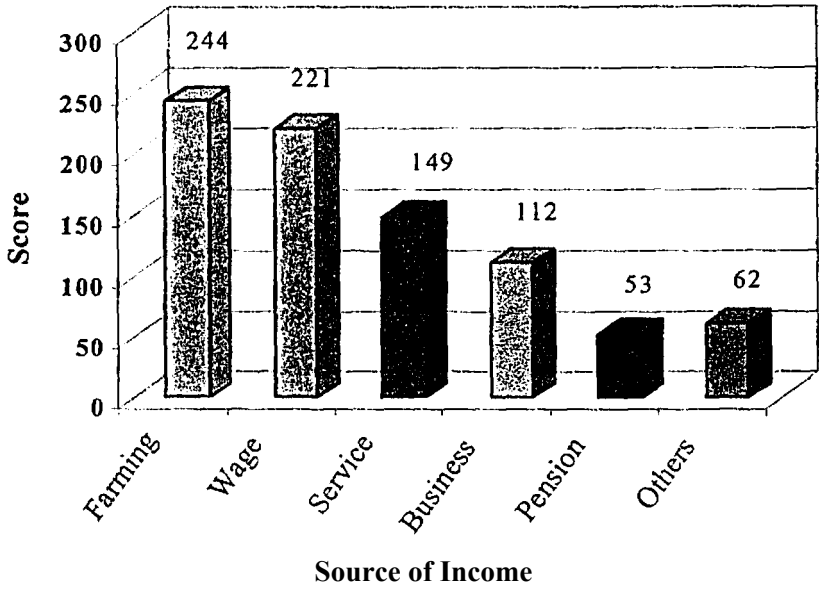
When comparing the present labour availability for soil fertility management with the situation of ten years ago, 34 percent of the respondents stated that labour availability had declined and 55 percent reported that the situation had not changed. The decrease in labour availability is more evident in Murtidhunga and Pakhribas area where relatively more labourers have left for nearby cities in search of jobs. Other reasons given for a decrease in labour availability in preparing manure are i) children going to the school and ii) educated people leaving the area in search of job. Similarly, increase in labour availability could be attributed to change in family size, multiple cropping (growing of more than one crop per year) etc

7.9. Income and Expenditure

7.9.1 Income

As explained in earlier section of expenditure, score is assigned to the priorities of respondents' income source. The results show farming as to be their main source of income. It is to be noted that most of the farmers sell farm produce and livestock products to meet their daily needs. While blackgram and food grains are sold in the western VDCs, vegetable and milk is the main earning source in the east. The score shows the wage income as second priority in the list of income sources. The wages in the area include the income from farm labour, income from carpentry, mason and priest and weaving of bamboo basket.

Figure 7.12: **Priority on Sources of Income by Activities**



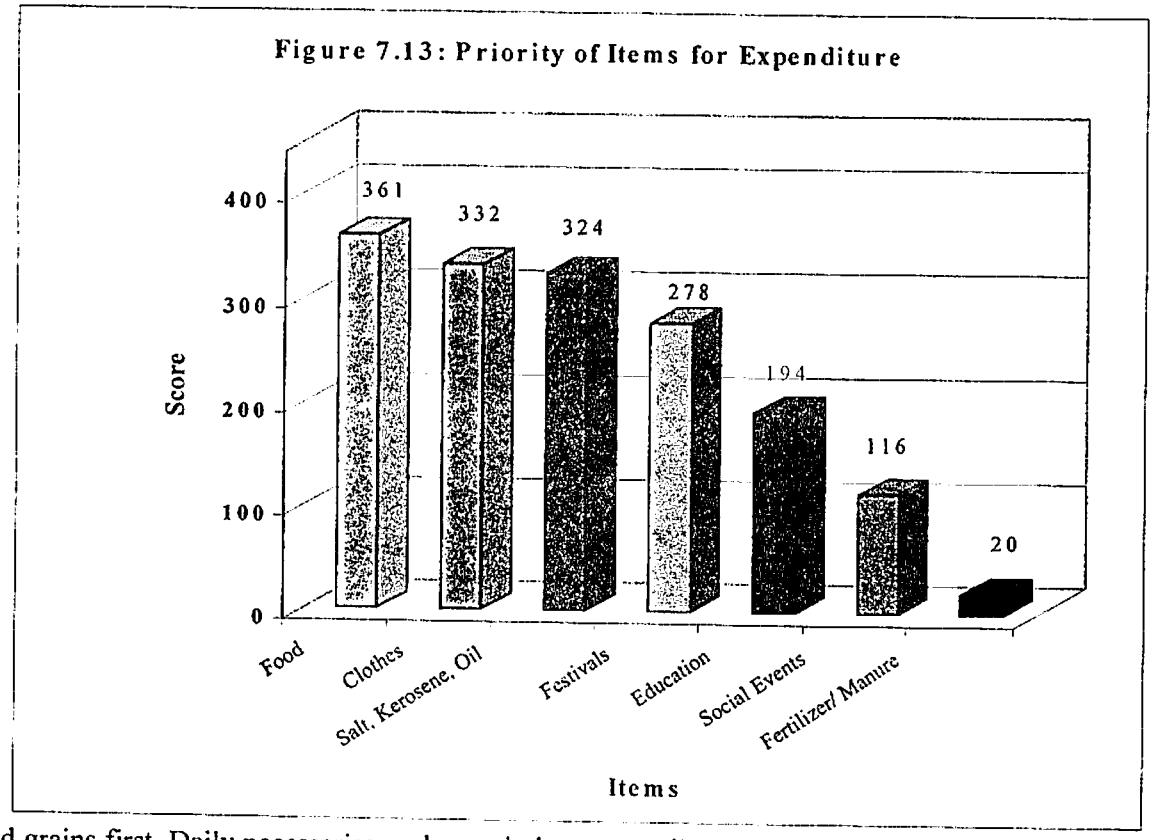
The respondents in the areas are found to be engaged in different types of business namely teashop, running of grocery stores and in hotel business. Selling of livestock, goat, and poultry in the west (Bhanu VDC) and selling of vegetables in the east were the most common businesses followed.

For a limited number of respondents, pensions were the main income source. They served in the Indian and British armies when younger and are now passing their retired as farmers. Another group of respondents has joined the government service, while some are engaged as teacher, campus lecturer or are employee in India. Farmers' priorities on income sources by Ward are presented in Table 35.1 to 35.6.

7.9.2 Expenditure

When the respondents were asked to prioritise the items of their expenditure for the previous year, the results depended upon their needs and location. Farmers priorities are then converted into the score (refer Annex III) to identify items of expenditure on priority basis. Out of seven commodities under consideration, food and clothes were found to be in top priority in expenditure list of the year 1998/99. It is to be recalled that 75 percent of the total respondent households were food deficit for the period ranging from 3 to 9 months. Thus, they were expected to spend more of their income the

Figure 7.13: Priority of Items for Expenditure



food grains first. Daily necessaries such as salt, kerosene, oil, came in the third priority as shown by the score point in the Figure 7.13

The respondents in the area emphasised on celebration of festivals, which have traditionally been celebrated every year. The priority of education for the children and festivals came in fifth and six priorities. Fertiliser and manure got the lowest priority on their expenditure list, as manure could be obtained with minimum cash expenditure and the amount of chemical fertiliser needed is small. Farmers' expenditure priorities by Ward are presented in Table 36.1 to 36.8.

CHAPTER 8

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 Summary and Conclusions

This study documents the hill farmers' perception of current and past levels of soil fertility and its management. The findings are based on the results of a socio-economic survey of two VDCs in the western hills, namely Pakuwa and Bhanu and two VDCs in the eastern hills namely, Pakhribas and Murtidhunga.

It is generally claimed by researchers, extensionists and farmers of Nepal that the soil fertility of both PakhoBari land (upland) and Khet land (lowland) of the hills of Nepal is deteriorating. Unfortunately, these measures are not in place, and this result in a food deficit in the hills of Nepal.

This study provides a socio-economic perspective on the ways in which farmers manage soil fertility in order to sustain their livelihood. The study records the responses of 2,081 households in 16 Wards of four VDCs from the mid hills of Nepal. Both male and female farmers representing various ethnic groups and with different food self-sufficiency categories were included in the field surveys.

Four familiar socio-economic methods namely the participatory rural appraisal (PRA) techniques, group discussion, the key informant survey (KIS) and the household (HH) survey were employed to gather the necessary data as envisaged by the objectives of this study.

8.1.1 Past and Present Scenario

Major events, which occurred in the surveyed Wards in the past, like drought, hail storms, heavy rainfall, flood and erosion were reported. They occurred over different time intervals, and made farming a risky enterprise in the surveyed areas.

Information on existing resources, land types, crops grown and pre-dominant patterns were gathered through agro-enterprise mapping of all 16 Wards. These could be instrumental in the planning of future agricultural development in each of the surveyed Wards.

Based on the HH survey results, the overall average landholding size per household is recorded as 1.06 hectare. Khet, PakhoBari and Tar land, together, form the cultivated and cropped land which constitutes 95 percent of the total land area. In average, the proportions of the cultivated land given to Khet, Bari and Tar were 36, 53 and 10 percent, respectively.

Overall the average size of a single parcel of land is 0.68 ha, with a maximum size of 2.62 ha in Murtidhunga and Pakhribas VDCs and minimum of 0.3.ha in Pakuwa VDC. The number of parcels was positively related to the overall size of the land holding.

Analysis of the food self-sufficiency status of HH in the area using well-being ranking, showed that in general, less than 20 percent of HH have sufficient food for 12 months and more than 40 percent have sufficient food for only 3 months. However, taking an average for a VDC disguises the large variability between Wards, which is especially great for the 3 and 12 months categories.

8.1.2 Soil Fertility Status by Land Type and by Land Holding Size

a. Western region: Farmers of the western region observed that the soil fertility in both PakhoBari and Khet land was declining and that the soil is becoming more acidic. They also reported that the use of FYM has declined considerably. Their experience is that with the use of chemical fertilisers alone without FYM, the productivity of major crops is declining. It was reported that PakhoBari land was more fertile five to ten years ago, and now, both PakhoBari and Khet land are steadily deteriorating in their fertility.

b. Eastern region: Previously, the farmers of the eastern region applied only FYM to both PakhoBari and Khet land. Now, both FYM and chemical fertilisers are used, but the quantity of FYM applied has decreased because it is in short supply. Chemical fertiliser, specifically urea, has been continuously applied by farmers to increase productivity of the major crops. However, the main concern of the farmer was the hardness of the soil in both land types, which the continuous use of chemical fertilisers reduced. Most respondents (68-70%) of Ward Nos. 3 and 6 of Pakhribas VDC indicated a decrease in soil fertility.

The key informants of 16 Wards of four VDCs confirmed that the soil of PakhoBari and Khet land is less fertile than five years ago. It was most fertile ten years ago. Both men and women have similar responses.

Further, a comparison of the current soil fertility status $_{with}$ the situation of ten years ago indicated inverse relation with land holding size, both for PakhoBari and Khet land. The rate of changes in soil fertility status, that is deterioration as well as improvement, are more distinct in PakhoBari land than in Khet land. Farmers apply higher rates of FYM to PakhoBari land than to Khet land. Around 25 percent of the respondents in most of the surveyed VDCs indicated an improvement in the soil fertility of PakhoBari land suggests better management. There were fewer such respondents for Khet land.

While analysing the fertility status of Khet land by VDC, an increase in land holding area is correlated with an increase in the proportion of respondents reporting a decline in soil fertility. This trend of fertility decline is more apparent for Pakuwa, Bhanu and Pakhribas VDCs.

In both the regions, the farmers also reported that, generally there had been no major changes within the last 10 years in practices for managing the soil fertility of both PakhoBari and Khet land. The only exceptions are that more use of chemical fertilisers is used now and the number of ploughings during land cultivation has increased.

8.1.3 Farmers' Perception in Ranking Fertility Status by Land Type

a. More fertile status of Pakho/Bari land: The ranking of the major reasons for increases in soil fertility given by the key informants of both east and west were very similar. The reasons included, (i) more use of FYM; (ii) more animals; (iii) continuous hard work and (iv) and access to larger forest areas for the collection of green leaves and fodder. There were differences in the opinions of key informants between the east and the west. Crop productivity has increased in the last five to ten years in the west on PakhoBari land. Whereas in the east, monocropping and good top soil have contributed to an improved fertility status.

b. <u>More fertile status of Khet land:</u> Reasons for increased fertility include (i) a larger number of animals (ii) monocropping (iii) free grazing of animals (iv) the practice of slash and burn and flood water entering the fields and (v) continuous hard work. These were ranked highest by the key informants of both east and west.

The reasons cited for a decline in fertility status in both land types in the east and west were generally the opposite of those stated above. However, a few reasons such as (i) more use of chemical fertilisers; (ii) lack of adequate irrigation; (iii) washing away of top soil; (iv) lack of labour to work in the field and (v) lack of adequate weeding were also ranked highly by the key informants for the causes of less fertility in both land types.

8.1.4 Chemical Fertilisers Use

The input of applying chemical fertilisers to various crops is of considerable significance to the farmer. The majority of farmers, including the respondents of KIS and HH surveys, repeatedly mentioned that the soil is deteriorating because of the application of chemical fertilisers. Consequently, crop productivity is reduced. The farmers imply that the hardness of the soil and the difficulty in ploughing were due to soil deterioration caused by the application of chemical fertilisers.

However, most farmers are applying chemical fertilisers to their main crops. Urea is used most frequently followed by DAP. The use of potash and other micro-nutrients by the farmers is minimal. It appears that most farmers simply guess the amount and type of fertiliser to apply to their crops. The reasons cited for this are a lack of training in the judicious use of chemical fertilisers, a lack of cash and shortages of fertilisers in the market. The survey result shows some respondents (12^{0}/0) reporting decrease in the rate of their use of chemical fertilisers because of shortages in supply, lack of manpower to procure them and an increase in price.

Most of the farmers are aware of urea and DAP. About 98 percent of the respondents reported that they had used urea. Around 46 percent had applied DAP and less than one percent used potash on the crops grown on Khet land. Chemical fertilisers are applied mainly to wheat, rice, mustard, and maize crops grown on Khet land. The overall rate of fertiliser use shows considerably higher rates of application to wheat and rice.

About 31 percent of respondents reported that they had increased the quantity of chemical fertiliser applied during the last 10 year ago. Application of more chemical fertilisers by process indicates an increasing effort to raise production which is offered by the easy access of fertiliser from nearby markets. In addition, farmers are now better educated and understand the benefits of fertiliser application to increase production. Some respondents have increased its use because of multiple cropping and because they raise fewer animals now.

8.1.5 Farm Yard Manure

A strong and widespread message from this study is that FYM has a very important place in the promotion of soil fertility in the hills. FYM is used both in PakhoBari and Khet land, but more in PakhoBari land. The farmers reported that black FYM is the best for improving soil fertility and increasing crop yields.

About 22 percent of HE survey respondents indicated that the quantity of FYM used had decreased, while 15 percent reported its use had increased in the last ten years. Less available forest products, lack of labour and the government's policy to control community forest have limited the collection of forage which according to the respondents, resulted in less use of FYM. However, the reason given for an increase in the use of FYM are its greater availability from more livestock being raised and an increased availability of animal fodder grass.

There have been no specific changes in FYM making practices for a long time. However, some farmers reported that in the past, more dung was used in making FYM because more animals were owned. Whereas, now more leaves, grasses and fodder are mixed with less dung to make FYM. Specifically, in Ward Nos. 2 and 9 of Murtidhunga VDC, the farmers made two pits to transfer the Iitter from one pit to another after an interval of four months to make well decomposed and good FYM.

Both men and women are involved in making FYM. Women are mostly involved in collecting green leaves, fodder and grasses for feed, clearing and collecting the litter and dropping it inside the pit, and then carrying it to the field and spreading the FYM in the field. Men are mostly involved in digging the pit, turning the manure upside down and spreading the FYM in the field.

The HH survey results indicate that the largest amount of FYM is applied to the potato (11.20 t/ha) and maize crops (3.87 t/ha) grown on Khet land and to maize (4.80 t/ha), upland rice (3.16 t/ha) and potato (3.84 t/ha) grown on PakhoBari land.

This study showed that the farmers with larger landholdings produced and used relatively more FYM per year, because they own more livestock. Moreover, the respondents apply larger amounts of FYM to PakhoBari land than to Khet land, irrespective of the number of farm animals they owned.

Farmers prefer FYM from small animals because it increases fertility more. However, most respondents owned mainly cows and buffaloes, and so the major source of FYM was noted from large animals.

Based on the farmers' response, the major constraints to applying FYM were (i) a lack of adequate green leaves, fodder and green grasses for animal feed; (ii) ownership of fewer animals; and (iii) unavailability of an adequate supply of dung.

It is estimated that the respondents spend about 81 days in a year to prepare and manage FYM. Murtidhunga VDC, which has used relatively higher quantity of FYM. indicated highest number of days (105) spent in managing FYM. In preparing FYM, the role of women is found to be dominant as they spent 72 percent of the total days required for preparing FYM.

When comparing the present labour availability for soil fertility management with the situation ten years ago, 34 percent of the respondents were of the opinion that labour availability has declined and 55 percent reported that the situation had not changed. The decrease in labour availability is more

evident in Murtidhunga and Pakhribas areas, where relatively more labourers have left for nearby cities in search of jobs

8.1.6 Compost Making Practice

Except for a few, most farmers of the sampled Wards were not making and using compost. However, farmers believe that the application of compost makes the soil better and increases crop productivity. The major constraints to compost making cited by the farmers were ignorance of the practice, lack of green leaves and dung, and a lack of technical knowledge in compost making.

8.1.7 Green manuring

The farmers in the study area had identified some locally available plants which were used for green manuring. These plants and leaves were cut into pieces and used mainly for rice and millet seedbeds and for maize. The use of Dhaincha was hardly mentioned by the farmers.

Recently, green manuring practices have diminished because of the unavailability of these green manuring plants. Both men and women are involved in the various activities associated with green manuring. Women are mostly involved in the collection of branches and leaves of green manure plants and cutting them into pieces. Awareness of its use and benefits was limited among the sampled farmers. The major constraints identified was unavailability of adequate materials, particularly Dhaincha seeds and lack of knowledge about Dhaincha plantation.

Leguminous crops are grown in most of the surveyed Wards but mainly on PakhoBari land. There is plenty of scope and potential to promote leguminous crops in the surveyed areas. Unfortunately, most of the sampled farmers were ignorant of the benefits of growing leguminous crops as a green manure.

8.1.8 Farmers' Perception about Use of Manure and Chemical Fertilisers

a. **Western region**: In the west, farmers had the impression that with the use of FYM the soil becomes loose and easier to plough, even during the drought. The farmers were of the opinion that while chemical fertilisers provided adequate nutrients to the plants, their continuous use made the soil harder. Most farmers agreed that they should use both FYM and chemical fertilisers for better soil and more crop production.

b. **Eastern region**: In the past, the practice of in-situ manuring was common. This is now disappearing. The majority of farmers expressed that the combination of FYM and chemical fertiliser should be used so that soil fertility will be maintained, and the productivity of crops increased. FYM should be applied more in combination with urea and DAP. The farmers had the following major concerns over chemical fertilisers: (i) the increase in price of DAP discourages its use (ii) the sale of low quality fertilisers in the markets and (iii) the unavailability of potash.

8.1.9 Ranking of Manures and Chemical Fertilisers

The application of both FYM and chemical fertilisers was the preferred soil fertility management option of most farmers. Based on the ranking provided by the key informants of all sampled Wards, FYM was preferred to compost which was preferred to fertiliser alone.

The ranking of both organic and inorganic fertilisers depended on the types of crops grown and varied from Ward to Ward. Crops ranked highest by farmers for the use of FYM were maize, potato, rice followed by mustard, blackgram and wheat. By contrast, fertilisers were applied as a priority to wheat followed by rice and maize. Combined application of FYM and fertiliser were applied preferentially to potato, and then maize, wheat and rice.

81.10. Crop Productivity

Overall, the weighted average yield of rice grown on Khet land under irri[g]ated condition was 1.4 tons per hectare which is less than the average yields for the respective districts (Parbat 2.0 tons/ha, Tanahun 2.2 tons/ha and Dhankuta 2.3 tons/ha). Poor performance of the rice can be attributed to the low average rate of application of chemical fertiliser (46 kg Urea, 13 kg DAP, and less than one kg Potash/ ha) and FYM (2.9 tons/ha). A relatively large variation in crop yields has been noted for mustard (CV=57%) and maize (53%) as compared to other crops grown on Khet land indicating a greater potential for improving in the productivity of these crops.

Maize was the major crop grown in Pakho/Bari land followed by mustard, upland rice and blackgram. The reported crop yields were less than the yield level of the district for most of the crops (maize, millet, upland rice, potato, cabbage and mustard). An explanation for the lower yield of potato for example may be that farmers grow local varieties, which have lower yield potentials, but better flavour.

When comparing the crop yields between VDCs, Bhanu VDC has demonstrated the advantage of its low altitude. Yields of maize, millet, upland rice and potato were 1,1, 1.3, 1.3 and 4.0 t/ha respectively.

Yields of pea, millet and blackgram vary more than other crops grown on Pakho/Bari land. Across VDCs', millet yields are relatively stable compared to other crops.

8.1.11 Changes in Previous and Current Cropping Practices

a. **Western region:** Cropping patterns have changed from one crop per year in the past to three crops per year at present. For example, maize-fallo·.v rotation has now changed to a maize/millet - mustard rotation in Pakho/Bari land and rice-fallout rotation in the past has now changed to a rice-wheat rotation in most Khet land. In the past wooden ploughs were commonly used but now, both wooden and metallic ploughs are used. Metallic ploughs are mostly used in Khet land. Generally, the land is ploughed two to three times.

b. **Eastern region:** In Pakhribas VDC, however, there was no chan[g]e in the current cropping practices on Pakho/Bari land compared to the past. There has been a change in Murtidhunga VDC. Most farmers of Murtidhunga practice multiple and inter-cropping. Wheat is not broadcast but sown in rows.

Rice-wheat is the pre-dominant cropping pattern practised on Khet land followed by rice-fallow and rice-maize. These patterns are very distinct in Pakhribas VDC. Being hill area, the respondents are traditionally growers of maize. However, with the increased availability of irrigation water to some Khet land, they are now starting to grow wheat.

On Pakho/Bari maize/millet is the major cropping pattern for Pakuwa, Murtidhunga and Pakhribas VDCs. However, upland rice-blackgram was the main cropping pattern adopted in Bhanu VDC. Maize-fallow, maize-oilseeds (mustard), and upland rice-blackgram were other common cropping patterns followed. Diversified cropping patterns, which include vegetables, are common especially in Murtidhunga and Pakhribas VDCs.

In both east and west regions, the technique for land preparation has changed, particularly with the increase in the number of ploughings. Harrowing is practised to break the clods into smaller particles, which allows better crop production.

8.1.12 Farm Animals and their Management

Households in the VDCs of the east have more large animals than those in the VDCs of the west. According to the respondents who were able to remember the number of animals has decreased in the last ten years, especially in Pakuwa and Bhanu VDCs.

Large ruminants, like cattle and buffalo, are fed broom grass, Sateria (green forage) and Jai (green fodder), in addition to their regular feed in the VDCs of the east. Goats and sheep were given Titepati and Banmara in the west. About half of the respondents raising cattle felt that feed availability was adequate, while 44 percent gave a similar indication for the feeding of buffaloes. Nevertheless, for other animals, the respondents felt that feed availability was inadequate.

About 72 percent of respondents currently reported that animals were stall fed because of the limited availability of land for grazing, increased population (more area cultivated), lack of forest, occupation of land by cardamom cultivation and planting of trees on grazing land. A permanent shed for animal housing is being constructed a majority of respondents, because of their greater income and because of their increasing awareness of the need to keep animals under close supervision to ensure their health.

With respect to the treatment of animals, a majority (64%) of respondents now prefers animal to be treated by veterinary personnel. The situation has arisen from the increased availability of veterinary services at the village Ievel from Livestock Service Office. Education has also made people aware of the importance of using veterinary technicians to treat their animals.

8.1.13 Sources and Adequacy of Credit Availability

According to the key informants the Banks do not provide credit solely for the purchase of chemical fertilisers, because the loan is too small. However, they do provide production loans for farming. Those who obtain these loans may use to purchase chemical fertilisers. Most farmers in the surveyed Wards use credit for the purchase of domestic animals, off-season vegetables cultivation and vegetables seed production, for poultry farming, for the purchase of tube wells to pump water for irrigation and also for the cultivation of cash crops like ginger and sugarcane.

Most farmers felt that the credit availability through formal sources was adequate, but some farmers dependent on local merchants for loans.

8.1.14 Income and Expenditures Priorities

a. **Western region:** A majority of farmers gave priority to food, schooling and clothes in their expenditure. Expenditure on chemical fertilisers was ranked between 1 to 4 by Wards in Pakuwa VDC. In Bhanu VDC, farmers purchased chemical fertiliser after paying for schooling, purchases of salt, edible oil and kerosene and provision for health care.

a. **Eastern region:** Most of the respondents of the sampled Wards of Pakhribas VDC gave the following ranking to their expenditures: schooling, purchase of food and purchase of salt, edible oil and kerosene oil. Chemical fertilisers ranked fifth or sixth on the list of expenditure. Purchase of food and clothes were given the highest priority by the respondents of most of the sampled Wards of Murtidhunga VDC. Priority to the purchase of chemical fertilisers ranked third to sixth.

Based on the HH survey results, out of the seven commodities under consideration, food and clothes were found to be top priority on the list of expenditure for respondents in the year 1998/99. Seventy five percent of the total sampled households were food deficient for a period ranging from 3 to 9 months. Consequently, it may be expected that they would spend more of their income on food grains. Daily necessities such as salt, kerosene, oil, were prioritised third. Chemical fertilisers and FYM got the lowest priority on their expenditure list, because FYM could be obtained with a minimum of cash expenditure, and chemical fertilisers required only a small amount.

The main source of income for most farmers is farming. Most farmers sell farm produce and animal products to meet their daily needs. Blackgram and food grains are sold by the respondents of the western VDCs, whereas vegetables and milk are the main source of earnings in the east. A wage income was the second most common source of income on the list. The wanes in the area come from farm labouring, income from being a carpenter, priest, and a mason and from basketry.

For a limited number of respondents, a pension is the main source of income. They served in the Indian and British armies when younger. Another group of respondents have joined the government service, and others are engaged as teachers, campus lecturers or are employed in India.

8.2 Recommendations

Based on the findings of this study, the following recommendations may be made: **1.**

Need **for continuous** soil testing:

The decline in soil fertility on both PakhoBari and Khet land has been noted by farmers. There is a general ignorance of its major causes. It is recommended that soil testing be conducted to identify the deficiencies of both major and micro-nutrients. Soil acidic was also frequently noted by farmers. The soils of those surveyed sites need thorough testing.

2. Orientation of on-farm trials to solve farmers' soil problems

Farmers have a strong conviction that the increasing hardness of the soil is due to the continuous use of chemical fertilisers. This needs to be examined perhaps by conducting appropriate on-farm trials. The results of the trials should be shared with the respondents of the surveyed areas.

3. Training to enhance the farmers' technical knowledge on the judicious use of chemical fertilisers

Farmers in the surveyed Wards were aware of their ignorance in the correct application of chemical fertilisers to meet the requirement of different crops (that is, correct types of fertiliser and appropriate doses). It is recommended that training is given prior to sowing of crops and that is supported by further training during the growth of the crop. Both men and women should be included in the training.

4. Training in the practice of FYM making

It is necessary to promote the use of FYM to maintain soil structure and to increase crop productivity. Farmers in the study area are increasingly literate among the farmers. A planned in-depth training showing the importance of FYM, the method of production and its proper use should be conducted for both men and women. This may promote soil fertility in the area.

5. Promote green manuring practice

The practice of green manuring should be encouraged among the farmers to improve soil fertility. Seeds of green manure crops like Dhaincha, should be made available to the farmers at the appropriate time. A well-developed programme for planting green manure plants should be implemented during the fallow period of land.

6. Promote the combined use of FYM and chemical fertilisers

Based on the results of on-station and on-farm trials, a combined application of FYM and chemical fertiliser should be encouraged. Farmers note that yields were greater with a combined application of fertiliser and FYM. A "balanced use of organic and inorganic fertilisers" should be encouraged by the relevant extension authorities, who provide guidelines on the appropriate dose and training for particular crops.

7. Management of timely availability of quality chemical fertilisers

The concerned authorities should reserve that different types of quality fertilisers like urea, DAP, MOP are available to the farmer at the appropriate time. The quality of fertilisers should be monitored.

8. Need for a food security programme

The survey showed a large number of households, who were unable to meet their food requirements for the whole year. It may be necessary to introduce a food security programme in these areas, an important component of which is the management of soil fertility.

8.3 Policy Implications

1. A programme to stimulate the production of FYM and its appropriate use should be planned for maintaining soil fertility and sustainable crop production. This may be achieved by increasing the number of animals, preferably improved breeds; facilitating and promoting the private forestry; recycling waste materials and using manure for crop cultivation. The recycling of organic materials to the soil should get priority.

2. Failure to provide quality chemical fertilisers on time, at the proper locations, and in sufficient quantities at reasonable prices tends to lead to an unbalanced application of nutrients to the soil. APP's crop production targets are based on the usage of chemical fertilisers. Consequently, it is important to ensure the availability of the required chemical fertilisers at the village level.

3. The lack of use of balanced fertiliser in the farmers' field is perhaps one of the major causes of deterioration of soil fertility. The majority of hill farmers are not usin[g] recommended levels of fertilisers in the correct proportion. The use of potash is virtually neglected. Raising awareness, providing training and publicity campaigns in the villages to use the recommended doses of fertilisers should all be effectively implemented.

4. Recommendations given to farmers for application of fertilisers to their land should take account of the soil fertility status of the land. This will require soil testing of the fields.

5. A credit package should be implemented, which makes it possible for farmers to apply a balanced fertiliser require to crops.

6. Extension agencies play a critical role in training farmers to manage their soil fertility. Therefore, training should be given to JTs/JTAs.

7. Leguminous crops should be included in the cropping patterns of Pakho.Sari land.

8.4 Areas for Further Research

Experience obtained in this research suggests that when recommending a package of technologies for adoption by farmers, due consideration should be given to soil fertility. Undertaking further research in the followin[g] areas may be worthwhile.

1. Lon[g]-term on-farm trials should be conducted on Pakho.Bari and Khet land in a number of locations representative of the hills of Nepal in order to provide robust recommendations for soil fertility management.

2. The long-term sustainability of soil fertility is a key issue. An easy and reliable method of soil testing at the field level needs to be developed.

3. Based on the farmers' response in the survey, the depletion of soil fertility was higher in PakhoBari land than in Khet land. The underlying cause of this situation needs to be identified.

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ANNEXES

Annex I

SOIL FERTILITY MANAGEMENT PROJECT

INTERVIEW SCHEDULE NO 1.

KEY INFORMANT SURVEY OF THE WARD/AREA

(This questionnaire should be used for collecting information about the selected ward/area from the key informant of the selected ward/area. Two key informants from each ward will be interviewed).

District( ): VDC( ): Ward No.( )

Name of the Village( ): Name of Area( )

Name of Key Informant: Male/Female:
( ) ( )

Name of Enumerator: Date( )
( )

(A) GENERAL INFORMATION(WARD/AREA)(

1. Total Population(Census Year……..):
( )
Male( )
Female( )

2. Total number of Households(HH)(

3. Common Ethnic Groups (as of HH)(

4. Sources of resources related to soil fertility:

5. Major items and practices used by farmers to maintain soil fertility(e.g., compost etc.)

(B) FARMERS' PERCEPTION OF SOIL FERTILITY:

1. How do the farmers know whether soil in the ward is fertile or not ?

2. What criteria do farmers use to judge the fertility status of soil?

PAKOBARILAND(_____):

3. How do farmers classify upland(PakhoBariland) in terms of fertility status?

4. What were the major changes in upland (PakhoBariland) as compared to 5 to 10 years ago?

	At present		5 yrs. ago		10 yrs. ago	
a) More fertile	Yes	No	Yes	No	Yes	No
b) Fertile	Yes	No	Yes	No	Yes	No
c) Less fertile	Yes	No	Yes	No	Yes	No

5. If more fertile, what could be the reasons and its relative importance?

Reasons Rank

1)
2)
3)
4)
5)

6. If less fertile, what could be the reason and its relative importance?

Reasons	Rank
1)	
2)	
3)	
4)	
5)	

KHETLAND(_____)

7. How do farmers classify lowland(Khetland) in terms of fertility status?

8. What was the major changes in lowland(Khetland) as compared to 5 to 10 years ago?

	At present		5 yrs. ago		10 yrs. ago	
a) More fertile	Yes	No	Yes	No	Yes	No
b) Fertile	Yes	No	Yes	No	Yes	No
c) Less fertile	Yes	No	Yes	No	Yes	No

9. If more fertile, ghat could be the reasons and its relative importance?

Reasons	Rank
1)	
2)	
3)	
4)	
5)	

10. If less fertile, what could be the reasons and its relative importance?

	Reasons	Rank
1)		
2)		
3)		
4)		
5)		

(C) MANAGEMENT PRACTICES(

1. What practices do the farmers follow to make the soil more fertile and productive?

   (a) Upland(Pakho/Bariland):

   (b) Lowland(Khetland).

2. What practices do the farmers follow in the following?

   (a)Compost Making(

   Explain in brief the compost making practices in the village.

Who does the majority of work(men, women, children)?

Practices	Male	Female	Children	Remarks
i)				
iv				
v)				

Are there any changes in these practices compared to last 5 to 10 years?

Yes No

If yes, what types of changes?

(b) Farm Yard Manure(FYM) (_____)

Explain in brief the practices of making FYM. Who does the majority of work(men, women, children)?

Practices	Male	Female	Children	Remarks
i)				
ii)				
iii)				
iv)				

Are there any changes in these practices compared to last 5 to 10 years?

Yes No

If yes, what types of changes?

(c)Green Manuring(_____)

Explain in brief green manuring application practices in the village.

Who does the majority of work(men, women, children?

Practices	Male	Female	Children	Remarks
i)				
ii)				
iii)				
iv)				
v)				

Are there any changes in these practices compared to last 5 to 10 years?

Yes No

If yes, what types of changes?

(c) Chemical Fertilizer Application( ):

Explain in brief the practices of applying chemical fertilizer.

Who does the majority of work(men,women,children)?

Practices	Male	Female	Children	Remarks'
i)				
ii)				
iii)				
1V)				
V)				

Are there any changes in these practices compared to last 10 years?

Yes No

If yes, what types of changes?

(D) CONSTRAINTS IN PRACTICES( )

1. What are the major constraints in malting compost?

Constraints	Reasons	Solutions
i)		
ii)		
iii)		
iv)		

2. What are the major constraints in applying FYM?

Constraints	Reasons	Solutions
i)		
ii)		
iii)		
iv)		

3. What are the major constraints for green manuring?

Constraints	Reasons	Solutions
i)		
ii)		
iii)		
iv)		

4. What are the major constraints for applying chemical fertilizers?

Constraints	Reasons	Solutions
i)		
ii)		
iii)		
iv)		

(E) RANKING IN TERMS OF FERTILITY AND QUALITY:

1. How do farmers rank the following in terms of quality and fertility?

Items	Rank	Reasons	Remarks
Compost			
FYM			
Green Manuring			
Chemical Fertilizer			
Compost+Fertilizer			
Others			

2. Does this ranking vary with different types of crops?

Yes No

If yes,

Items	Rank								
i) Compost	Rice	Wheat	Maize	Millet	Potato	Black gram	Soya bean	Lentil	Mustard
ii)FYM									
iii)Green Manuring									
iv) Chemical Fertilizer									
iv) Compost + Chemical Fertilizer									
v) Others									

(F) CHEMICAL FERTILIZERS(_____)

1. Do the farmers think that the application of chemical fertilizer detritus the soil fertility?

Yes No

If yes, why?

2. What are the advantages of applying chemical fertilizer?

3. What are the trend of applying fertilizer?((a)

PakhoBariland(

Types of Chemical Fertilizer:	Rates of application (kg/ropani) range	Number of HHs	Trend over the last ten years		
			Decrease	Constant	Increase
Urea DSP TSP Potash					
Compost					
FYM					
Green Manuring					
Leguminous Crops					

4. What are the trend of applying fertilizer?(_____)

(b) Khetland:

Types of Chemical Fertilizer.	Rates of application (kg/ropani) range	Number of Households	Trend over the last ten years		
			Decrease	Constant	Increase
Urea DSP TSP Potash					
Compost					
FYM					
Green Manuring					
Leguminous Crops					

5. Who goes to the market to purchase chemical fertilizer?

Male HH Head Female HH Head Others(specify):

(G) CREDIT(

1. What are the most important sources of credit (formal/informal such as Bank, NGO, Merchants etc.) for the villagers in this Ward/Area? List them.

i)

ii)

iii)

2. Are credit facilities sufficient?(

Yes No

Explain:

3. Do the farmers take credit for the purchase of fertilizer?

Yes No

If no, why?

4. What else farmers would use credit for?

(H) MARKETS:

1 . Where are the permanent market centres used by the farmers of this Ward/Area?

Name of Market	Name of Village	Distance from VDC Off (in Kms)	Types of Transport	Time taken
a)				
b				
C)				
d				

2. Where are the temporary market centres used by the farmers of this Ward/Area?

Name of Market	Name of Village	Distance from VDC Off (in Kms)	Types of Transport	Time taken
a)				
b)				
c				
d)				

3 . Is there accessible roads (by foot/motor) for transaction to temporary and permanent markets?

Yes No

(I) LAND TYPE AND AREA(_____)

Land *Type*	Total Area Cultivated		Total Area Fallow		Major Crops Grown
	Summer	Winter	Summer	Winter	
1.Upland(Irri)					
1.Upland(Unir igated)					
3.Lowland(Irri					
4.Lowland(Uni nigated)					

(J) FOOD SELF-SUFFICIENCY(_____):

1. Do the farmcrs of this Ward/Area produce enough food materials for households use from their own fields or they have to get from other sources?

Produce enough Get from other sources

2. . How many HH in this area are there which can fulfill the required food grains for 3 months HH consumption?

3. How many HH in this area are there which can fulfill the required food grains for 6 months HH consumption?

4. How many HH in this area are there which can fulfill the required food grains for 9 months HH consumption?

5. How many HH in this area are there which can fulfill the required food grains for 12 months or more HH consumption?

Annex II

Socio - economic Household Survey
Soil Fertility Management Project

Questionnaire 2

Farmer Category: Food adequate for 3,6,9,12 months **Date: .....**

District: ..... Interviewer .....

1. General Information

1.1 Name of Respondent …… 1.2 Sex 1.3 Ethnic Group .....

1.4 Village ..... 1.5 VDC .....1.6 Ward No...

1.7 Distance of household from sealed road (km) ....……

1.8 Household Characteristics

S.N.	H. H. Members (No)	Sex	Age	Education	Occupation	
					main	other
1.	H.H. head male					
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

2. **Land System and Distribution:**

2.1 Land Distribution

Items	Lowland	Upland	Tar	Pasture	Forest	Total
1. Farm size operated (ropani)						
2. Own land (ropani)						
3. Rented in area (ropani)						
4. Rented out area (ropani)						
5. No. of parcel						

2.2 Is there any change in land ownership in last 5 to 10 years? Yes No

If Yes, what were the changes ?

Item	!0 Years ago	5 Years ago	At present
Land owned (ropani)			

Reasons for change .....

(Example: sold, divided, purchased, eroded etc.)

2.3 Is there any change in soil fertility status in last 5 to 10 years ? Yes No

If Yes, what were the changes?

Item	10 Years ago	5 Years ago	At present
Soil fertility in Upland			
Soil fertility in Lowland			

Reasons of changes in Upland.

.....

Reasons for changes in Lowland .....

....

(Example due to irrigation, fertilizer, market, labour, more compost use)

3. Crop Production

3.1 Please give the following details

a. Lowland (Khet Land)

S.N.	Items	Crop I	Crop 2	Crop 3	Crop 4
I .	Name of Crop				
2.	Planted Area (ropani)				
3.	Total Production (kg)				
4.	Produce sold (kg)				

b. Upland Land (Pakho/Bari)

S.N	Items	Crop 1	Crop 2	Crop 3	Crop 4
I.	Name of Crop				
2.	Planted Area (ropani)				
3.	Total Production (kg)				
4.	Produce sold (kg)				

3.2 Is the food grins produced in the farm is adequate enough to feed your family?

Adequate ..... Not Adequate.....

If not adequate, then for how many months? ..... months.

4. Parcel wise Use of Chemical Fertilizer and Manure

4.1 Parcel wise application.

	Parcel No.					
Items	**1**	**2**	**3**	**4**	**5**	**6**
1. Name of parcel (also indicate khetlbari)						
2. Parcel size.						
3. Distance hr						
4. Cropping Pattern						
5. Fertilizer application (kg)*						
Crop 1						
Urea						
TS P						
DAP						
Muriate of Potash						
FYM (doko)						
Compost (doko)						
Crop 2						
Urea						
TS P						
DAP						
Muriate of Potash						
FYM (doko)						
Compost (doko)						
Crop 3						
Urea						
TS P						
DAP						
Muriate of Potash						
FYM (doko)						
Compost (doko)						

Continued Table 4.1 Parcel wise application

Crop 4		
Urea		
TS P		
DAP		
Muriate of Potash		
FYM doko		
Compost doko		

Note: l One doko compost = kg

2. Cropping Patterns

1) Maize / FM - fallow, 2) Rice- Wheat, 3) Maize - FM - Lentil or Mustard

4) Maize - Mustard 5) Maize/FM - Potato, 6) Maize - Soybean

7) Upland rice - Blackgram 8) Rice - Rice - Wheat

*3. Ask for one parcel of Khetland and one parcel of upland based on major cropping patter.

4.2. Does your land remain fallow? Yes No

If yes, indicate the month ..... for Khet..... for Pak-ho/Bari

What are the reasons of leaving land fallow?

Reasons for not growing legumes and opinion on fertility while taking 3 crops a year.

4.3 At what time / Crop stage do you apply chemical fertilizer ?

First dose .....
Second dose:- .....
Third dose:- .....

4.4 At what time do you apply compost/FYM in the field ?

Transport of manure to the field ……..days before crop seeding

Mixing of manure in the soil. at the time of .....

4.5 What animal manure do you apply and which one you think better?

S.N	Manure	Rankin
1.	Cow	
2.	Buffalo	
3.	Goat	
4.	Sheep	
5.	Poultry	
6.	Pig	

4.6 Is the available manure adequate to your requirement? Yes No

If no, why? .....

4.7 Is there any change in fertilizer application in last 5 to 10 years?. Yes No

If Yes, what were the changes?

Item	**10 Years ago**	**5 Years ago**	**At present**
Quantity of fertilizer			
Type of fertilizer			

Reasons for change: .....

4.8 Is there any change in Compost / Manure application in last 5 to 10 years ?

Yes No

If Yes, what were the changes?

Item	**10 Years ago**	**5 Years ago**	**At present**
Quantity of Compost			
Type of Compost			
Quantity of FYM			
Type of FYM			

Reasons for change: ……

5. Livestock Population and their Management

5.1 Livestock number and their feed.

S.N.	Animal Type	No.	Feed given	Feed Availability		
				Ample	Adequate	Inadequate
1. 2. 3. 4. 5. 6.	Cow Buffalo Goat Pig Poultry Others					

5.2 Are there any changes in livestock number and feed type used in last 5 and 10 years?

Yes No

If Yes, what were the changes?

Item	10 Years ago	5 Years ago	At present
No. of livestock			
Quantity of feed given			
Type of feed provided			

Reasons for change: .....

5.3 What are the livestock management practices you have followed?

Animals	Grazing Type		Shed		Treatment	
	Free grazing	Stall feeding	Temp	Perm	Local	Clinic
1. Cow 2. Buffalo 3. Goat 4.Pig 5. Poultry						

5.4 Is there any change in livestock management practices in last 5 to 10 years?

Yes No

If Yes, what were the changes?

Item	**10 Years ago**	**5 Years ago**	**At present**
Type of Grazing			
Type of Shed			
Type of Treatment			

Reasons for change ..... :

6.Labour

6.1 Labour Involved in Soil Management Activities.

Activities	**Labour Involved (Days/Year)**			
	Male		**Female**	
	Adult	**Children**	**Adult**	**Children**
-Compost making Transportation Application - FYM making Transportation Spreading on the field - Fertilizer Procurement Transportation Application - Growing Green Manure Crop - Turning / Ploughing				

6.2 Is there any change in labour use for soil management activities in last 5 to 10 years?

Yes No

If Yes, what were the changes?

	10 years ago	**5 years ago**	**At present**
Labour availability			
Example: Labour shortage due to construction work, children going to school, division of labour, educated people do not stay and work in village.			

7. Income and Expenditure.

7.1 Every farmer needs more income these days to meet household requirements. How do you earn ?

S.N.	Income Sources	Rank	Remarks
1.	Farming		
2.	Business		
3.	Service		
4.	Wage		
5.	Pension		
6.	Others		

7.2 What are the priorities of your expenditure?

S.N.	Items	Rank
1.	Food	
2.	Social events (marriage)	
3.	Festivals	
4.	Clothes	
5.	Salt, Kerosene, Oil.	
6.	Education (Schooling)	
7.	Fertilizer/Manure	
8.	Others	

8. Gathering of Forage and Managing Manure.

8.1 Time consumed in gathering forage.

1. How far is the forest (2 ways) in hour .....

2. How much time (days) is spent in a week for forage collection .....\

8.2 How many compost pits were dug last year? No .....

8.3 How much time is required in managing compost?

S.N	Activities	Time in days/ it	Male (days)	Female (days)
1.	Collection of forage			
2.	Compost making			
3.	Turning of compost			
4.	Transportation			
5.	Application			

8.4 How much manure humps were prepared last year? No……..

8.3 How much time is required in managing FYM?

S.N	Activities	Time in days/ it	Male (days)	Female (days)
1.	Collection of forage			
2.	Arranging bedding materials			
3.	Cleaning of Shed			
4.	Making of Manure hump			
5.	Carrying of manure to the field			
6.	Spreading of manure on the field.			

Annex III

EMPLOYED SCORING METHODS 1.

Methods of Scoring for Priorities

Scoring method was applied particularly for the questions seeking more than one answer in priority basis. Such questions related to household survey include sources of income, sources of expenditure and priority given to different animal manure considering their nutritive value. The scoring method is explained below with an example related to sources of income.

Example of scoring method

The respondents were asked to indicate their major sources of income and rank them based on the priority out of six items provided in the questionnaires. The responses were computed in percentage of household indicating first, second and third source etc. as priority. Thus the data were assigned the scores using the following formula.

Method

Score assigned

Priority 1 = 6	Priority 4= 3
Priority 2 = 5	Priority 5 =2
Priority 3 = 4	Priority 6 =1

Scoring Formula

{(No. of respondents selecting farming as income source of first priority)*6 +
(No. of respondents selecting farming as income source of second priority)*5 +
(No. of respondents selecting farming as income source of third priority)* 4+
(No. of respondents selecting farming as income source of fourth priority)*3 +
(No. of respondents selecting farming as income source of fifth priority)*2 +
(No. of respondents selecting farming as income source of sixth priority)* 1)}/6

Considering an example of data base (responses) as below

Priority	Farming	Wage	Service	Business	Pension	Others
Priority 1	119	167	113	53	29	22
Priority 2	136	52	37	54	23	40
Priority 3	15	12	8	15	3	12
Priority 4	3	5	0	2	3	2
Priority 5	0	0	0	1	3	0
Priority 6	0	0	0	0	0	3
Total						

Then according to the formula; score for first column in farming

$=\{(119*6) + \{(136*5) + \{(15*4) + \{(3*3) + \{(0*2) + \{(0* 1)\}6$

$=(714 + 680 + 60 + 9 + 0 + 0)16 = 146316 \bar{}244$

In the same manner the score points for other variables are also calculated. The resulting tabular output of scores indicates the farming as the most important source of income as presented below.

Farming	Wage	Business	Pension	Service	Others
244	221	149	109	53	65

The maximum score can not exceed 512.

Interpretation

The income source having higher score is the important source for the respondents in the surveyed area.

Annex IV

Local and Latin names of Green Manure Plants and Fodder Trees

S.No.	Local name	Latin name
1	Amlesho (Amliso)	*Thysolaena maxima*
2	*Asuro*	*Adhatoda vasica*
3	Banmara	*Eupatorium adenophorum*
4	Chaibhango	NA
5	Chilaune	*Sctima Wallichii*
6	Dhaincha	*Sesbania robusta*
7	*Ghursur*	*NA*
8	Karuki	*Pogontherum incans*
9	Khirro/or Khira	*Spium spp*
10	Padke	NA
11	Sirise	*Albizia spp*
12	Titepati (or Pati)	*Cordia spp*
13	Uits	NA

* NA = Not Available