CHAPTER IV

FARMING SYSTEMS AND SITUATION OF ADOPTERS AND NON-ADOPTERS

This chapter discuss about the general farming systems of the mid hills of Nepal which is categorized into 4 major sub-systems, specifically, crop, livestock, farm fodder trees and household sub-systems. Each of them has been elaborated separately with number of sub-headings. Apart from this, comparison has also been made between adopters and non-adopters in each sub-system to understand the situation of them.

Therefore, the total sampled households have been categorized into two major parts, "adopters" and "non-adopters" in order to distinguish the characteristics features between the two . The classification has been done on the basis of plantation of fodder trees as explained in Figure 2 (Chapter II). The later one (non-adopters) further is further grouped into two classes. The first type (non-adopters1) are the one who have not planted but have natural grown fodder trees while, the second type (non-adopters2) are those who do not have even a single fodder tree on their farm land.

On the basis of this categorization, of the total sample of 216 households, there were total 90 (41.7%) adopters with highest number in VDC M (43) followed by VDC F (23) where there is availability of nurseries. While among the non-adopters 126 (58.3%), non-adopters1 were found higher 79 (36.6%) as compare to non-adopters2 (47 or 21.6%). Table 14 explains

the details on it.

Table 14. Number of Farmers in Different Groups of Household Sub-System on the Basis of Fodder Trees.

VDC	Adopters	Non-adopters1	Non-adopters2	Total Non-adopters
VDC F	23	21	10	31
VDC M	43	9	2	11
VDC K	14	14	14	40
VDC R	10	35	9	44
Total	90	79	47	126

Source: Survey, 1993.
Note: Non-adopters1=Having natural grown fodder trees
Non-adopters2=Do not have any trees

4.1 Crop Sub-System

The Crop sub-system has been explained in terms of land holdings, land use priority and crop and by-products production, sale and purchase.

4.1.1 Land Holdings and Land Use Priority

Different varieties of crops like cereals, legume, vegetables and forage were grown in the household farm land. The average land holding size of sampled household was same for all VDC except K VDC, which has quite low holdings i.e 0.6 ha only (Table 15). Irrespective of the VDC, however, the overall private holding was less than 1 ha while adopters holding was higher (1.16) than mean (0.98) and non-adopters (0.84) hectare.

Table 15 Total Holdings of Different Types of Land in Hectare

Land Types (N=54)	Village Development Committees F		M		K		R	
	mean	range	mean	range	mean	range	mean	range
Khet1	0.2	0-0.8	0.4	0-2.5	0.24	0-0.7	0.3	0-2.2
Bari2	0.7	0.05-2.5	0.6	0.1-2.5	0.3	0-1.2	0.6	0.1-1.8
Forest	0.05	0-1.1	0.1	0-1.4	0.05	0-1.1	0.03	0-0.8
Fallow	0.2	0-1.5	0.1	0-1.5	0.02	0-0.5	0.13	0-1.3
Total	1.16		1.18		0.6		1.05	

Source: Survey, 1993
Note: 1 = Low land area; 2 = Up land area

Similarly, on an average 63% of the households own less than 1 ha of land. However, adopters were lesser by approximately 10% i.e (53.3) in this group but conversely non-adopters were higher by 7% (69.8%) from the average. Only around 10% of the households own greater than 2 ha. of land. Mostly, the priority of land use is determined by the land holding size, land types and needs.

Thus it was observed that majority of the farmers (>75%) of each VDC preferred to cultivate paddy on low land, as rice being a major staple food crops for daily life. In contrast diversified cropping pattern was followed in bari land (cultivated upland). But preference of maize for upland crop was the most (>79%) as used for dual purpose, food as well as feed purpose and also a substitutional diet to paddy for the low income group people (Table 16). The terrace and risers of bari land around the homesteads were fully utilized by growing of trees for fodder and fuel wood purpose. Apart from the cultivable land, the non-cultivable land

(forest and fallow) was also used by forest trees for fuel woods, timber and grasses for fodder and thatching purpose. Such type of pattern was consistent with the findings of different studies (Gajurel, 1987; Gatenby, 1990; and Robinson, 1989).

Table 16 Private Land Holding and Priority of Land Use

VDC	% of Farmer own Land (ha)			Farmers' Priority of Land Use (%) Low Land			UpLand		
	>1	1-2	<2	PA	PO	MA	PA	PO	MA
VDC F	44.4	44.4	11.1	75.9	-	-	-	-	85.2
VDC M	59.3	25.9	14.8	77.8	11.1	1.9	-	9.3	81.5
VDC K	83.3	14.8	1.9	92.6	1.9	-	-	1.9	85.2
VDC R	64.8	24.1	11.1	75.9	1.9	1.9	1.9	9.3	79.6
Total 216	63.0	27.3	9.7	80.5	3.7	0.95	0.47	5.1	82.8

Note: PA = Paddy; PO = Potato; MA = Maize

4.1.2 Crop Production

Since the holdings of upland was higher than the low land in all VDCs, the coverage area for maize was comparatively higher than the other crops in all the sites. Irrespective of the total area under production, the production performance largely depends on the types of land used. Looking at the production performance of paddy (7.3/ha) and potato (3.3/ha), low land quality of VDC M showed up best, followed by VDC K (Table 17).

Table 17 Crop Production, Consumption and Sales

Major Crops	F				M				K				R			
	A[1]	P/ha[2]	%S[3]	%C[4]	A[1]	P/ha[2]	%S[3]	%C[4]	A[1]	P/ha[2]	%S[3]	%C[4]	A[1]	P/ha[2]	%S[3]	%C[4]
Rice	12.6	3.1	22.4	77.6	17.5	7.3	35.7	64.3	13.0	4.9	22.4	77.6	18.2	4.3	29.2	70.8
Wheat	29.7	0.63	2.5	97.5	8.0	2.0	42.7	57.3	6.7	11.4	2.6	97.4	12.5	15.3	7.1	92.9
Corn	36.7	19.7	11.0	89.0	30.0	2.4	6.7	93.3	14.7	16.7	4.0	96.0	27.7	23.1	4.8	95.2
Millet	1.5	0.33	0	100.0	6.5	1.2	25.6	74.4	0.5	0.9	0	100.0	0.6	1.2	0	100.0
Potato	0.3	2.9	0	100.0	9.7	13.3	88.4	11.6	5.8	13.2	84.3	15.7	7.3	7.3	81.6	18.4
Soybean	9.0	0.2	25.8	74.2	2.8	0.5	28.3	71.7	1.0	0.3	0	100.0	3.1	0.1	25.9	74.9
Mustard	7.7	0.3	15.0	85.0	2.3	0.6	42.4	57.6	7.5	0.4	0	100.0	7.7	0.6	15.3	84.7
Tomato	-	-	-	-	0.2	5.2	79.5	20.5	-	-	-	-	0.9	6.9	90.8	9.2
Vegetables	0.1	0.6	0	100.0	0.2	2.2	39.2	60.8	1.6	2.4	63.5	36.5	0.1	1.0	0	100.0

Source : Survey, 1993
Note: Unit used
1. Area (A)[1] : hectare
2. Production/hectare (P/h)[2]: tons/hectare
3. Sold (S)[3] : Percentage of total production
4. Consumption (C)[4]: Percentage of total production

Conversely, maize production performance turned out low as compare to others, representing poor upland quality. In this sense, VDC R was found better off than other VDCs'.

The crops cultivated were mainly for consumption purpose and if surplus then sold for income generation. However, cash crops like potatoes (>80%) and tomatoes (79-90%) were grown for the selling purpose rather than consumption purpose as these were highly market oriented crops. The study conducted in Majhigoan and Dumerechour of Kavre district also brought out potato as the top in net benefit per hectare (New Era, 1990). Comparing to the percentage sold to the total production of staple food crops (rice), VDC M was better off (35.7%) followed by R, F and K

respectively. However, considering maize as substitute for paddy to low income group, it was found that percentage of maize consumption was higher in VDC R related with production level. On the basis of percentage sold of the crops to the market, the flow of commodity to the market was highest in VDC M, followed by K. The variation confined on percentage share of market among the VDCs reflects that the outlet is dependent upon the accessibility to the market.

4.1.3 Farm Feed Production

By-products of the crop constitute the major portion in the diet of livestock. Especially, crop residues (rice straw, maize stover, millet stalk, husks of crops) called dry fodder were stored and fed during the dry seasons. In addition, the grinned and processed product of crops (maize flour, mustard cake, rice polish) called concentrate were fed mainly to the productive and milching animals. Considering the percentage of the feed supplied Table 18 depicts that, livestock of VDC R were highly dependent on farm land (91%). Whereas VDC M and K due to the market facilities, greater percentage of feed i.e. concentrate, 44% and 37% were purchased as compare to 19% and 24% in VDC F and R respectively.

Table 18 Percentage of Farm Feed Production, Purchase and Expenses per Annum

Feeds	VDC F				VDC M				VDC K				VDC R			
(N=54)	mean (kg)	farm (%)	pur (%)	exp (%)	mean (kg)	farm (%)	pur (%)	exp (%)	mean (kg)	farm (%)	pur (%)	exp (%)	mean (kg)	farm (%)	pur (%)	exp (%)
Concentrate	892	81.5	18.5	25.7	1032	56.2	43.8	28.2	540	62.8	37.2	23.4	762	76.0	24.0	19.6
Straw	1206	78.0	22.0	53.2	3090	93.4	6.6	59.3	1668	96.6	3.4	65.2	2274	81.7	18.3	69.6
Maize Stover	2415	62.7	37.3	21.0	1515	100	-	5.9	819	100	-	6.4	1584	97.3	2.7	9.7
Millet Stover	18	100	-	0.06	294	99.4	0.6	1.1	4.5	100	-	0.03	184	100	-	1.1
Husks	-	-	-	-	-	-	-	-	-	-	-	-	117	100	-	-
Forage	-	-	-	-	24	100	-	5.5	10.6	100	-	4.97	-	-	-	-

Source: Survey, 1993
Note: mean (kg) = average feed supply per household in kilogram
farm (%) = percentage produced from farm per household
pur (%) = percentage purchased of the total feed supply
exp (%) = percentage of the total expenses of feed spent in Rupees (Rs.)

Looking at the household expenses in feed, VDC M had the highest expenses in concentrate (28%) but lowest in dry fodder (66.3) among the VDCs. Contradictory to this, the greater (79.3%) expenses was in dry fodder of VDC R where both nursery and market is lacking.

4.2 Livestock Sub-System

Holding of livestock, herd compositions, feeding pattern, demand and supply of fodder and value of tree fodder in feed ration have been discussed in livestock sub-system.

4.2.1 Livestock Holding Size

The average holding of livestock was found in F>M>R>K pattern with mean holding of 3.71, 3.4, 3.0 and 2.1 lu respectively (Table 19).

Table 19. Average Livestock Holding in Livestock Unit (lu)

Livestock Types	Village Development Committees (N=54)							
	F		M		K		R	
	mean	sd	mean	sd	mean	sd	mean	sd
Cattle	1.64	1.2	1.15	1.17	1.2	0.86	1.64	1.47
Buffalo	1.7	1.2	1.96	1.2	0.55	0.86	0.94	1.07
Goat	0.4	0.3	0.3	0.32	0.3	0.25	0.41	0.4
Swine	-	-	-	-	0.02	0.017	0.03	0.13
Poultry	0.01	0.02	0.01	0.03	0.008	0.014	0.005	0.01
Ruminant	3.7	1.9	3.4	2.0	2.1	0.97	3.0	2.0
Non-Rum.	0.01	0.02	0.01	0.03	0.01	0.025	0.04	0.14
Total lu	3.71	1.92	3.4	2.0	2.1	0.99	3.0	2.1
Adopter lu	4.2	1.91	3.7	2.1	2.2	0.97	3.2	2.9
Non-adp lu	3.4	1.88	2.4	1.3	2.1	0.96	3.0	1.9

Source: Survey, 1993.
Non-Rum. = Non Ruminants

Considering the species in the herd, the average buffalo holding was greater compare to cattle in VDC F and M, reflecting the preference of buffalo over cattle but vice versa for R and K. The lowest holding of VDC K (2.1 lu) explains that large ruminants holding was not much prevalent in village household. However, non-ruminants holding was similar for VDC F, M and K with average mean of 0.01 lu but highest in VDC R (0.04 lu).

From the assessed result the influence of nursery in the VDC M and F could be visible. Comparing the adopters and non-adopters, the greater livestock unit was found in adopters of all the research sites reveals the cause of adoption of fodder trees.

4.2.2 Herd Composition and Distribution Related to Socio-Economic Characteristics

For the multiple aspects, there was diversification in livestock herd composition. However, the composition was governed by strong socio-economic characteristics of the household. Table 20 presents very distinque characteristics in rearing of livestock that, Brahmin and Vaisya caste households did not rear swine at all. Only 12.5% of the Chettri household rear it. Whereas 87.5% of Sudra households kept swine with very few percentage (<10%) kept large ruminants (cattle, buffalo).

Looking at the family size and livestock composition it was observed that majority of medium family size (5-9) own all types of livestock than the small family size. Similarly majority of the households with high income group reared ruminants (42-56%), whereas medium income group (50%) reared swine. In the low income group, percentage of household rearing poultry (38.7%) was highest. It was interesting that all most all of the households whose land holding was less than 1 hectare had greater diversification in herd composition and holding size compare to large holdings.

The herd holdings (lu) shows negative relationship with the land size. The non-ruminants like swine and chickens were kept by majority of the small farm size 75% and 64% respectively. The results support the findings that small farmers over looked risk while large farmers perceive risks (Caveness *et al*, 1993).

Table 20 Herd Composition Classified by Socio-Economic Characteristics

Animal	Family size			Caste				Income			Land Holding		
Species	1	2	3	1	2	3	4	1	2	3	1	2	3*
Cattle	19.6	63.2	17.2	39.9	30.7	23.3	6.1	23.9	34.4	41.7	58.9	30.7	10.4
Buffalo	9.8	69.9	20.3	52.4	16.8	27.3	3.5	11.9	22.2	55.9	53.1	32.2	14.7
Goat	18.2	65.3	16.5	38.1	26.0	29.5	5.7	22.7	34.7	42.6	60.2	29.0	10.8
Swine	-	100	-	-	12.5	-	87.5	37.5	50.0	12.5	75.0	25.0	-
Poultry	16.0	65.3	18.7	5.3	22.7	58.7	13.3	38.7	26.7	34.7	64.0	24.0	12.0

Source: Survey,1993.
Note: *
Family size 1= <5 (small); 2= 5-9 (medium); 3= >9 (large) members in the household
Caste 1= Brahmin; 2= Chettri 3= Vaisya; 4= Sudra (Occupational class)
Income 1= <26,000 (low); 2= 26-50,000 (moderate) 3= >50,000 (high) income in Rs.
Land 1= <1 (small); 2= 1-2 (medium) 3= >2 (large) holding size in ha.

4.2.3 Feed and Prevalent Feeding Pattern to the Livestock

Farmers usually feed in the stall itself to their livestock all the year round. The ration of the livestock feed was composed of both feeds (concentrates or byproducts) and fodder (green or dry).

Looking at the total quantity of feed fed per lu, VDC K and M provided more or less the same quantity, over 4 thousand kg/lu/annum, followed by R (3.8) and F (2.7) thousand kg/lu/annum respectively. In which, the proportion of grass constituted highest approximately (>50%), followed by roughage in all the VDCs, except VDC M (31%). Figure 6 and Appendix 9 provides the details.

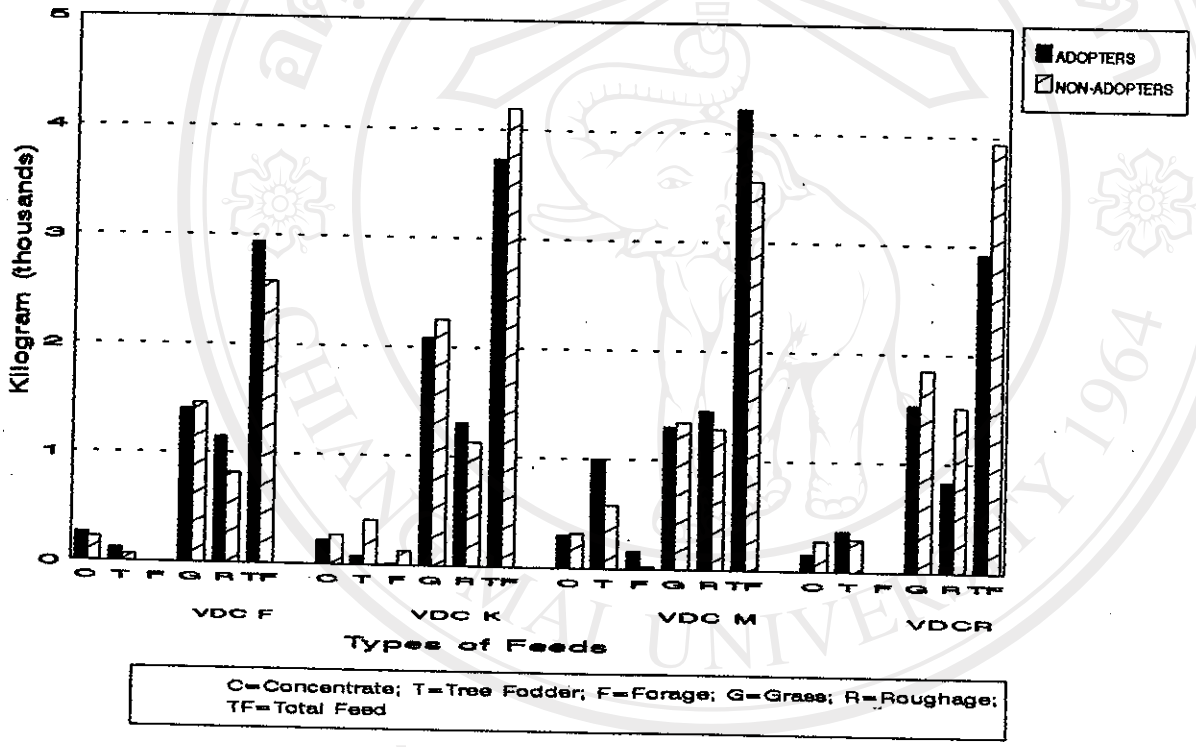

Figure 6 Quantity of Feed Fed per Livestock Unit per Annum
Source: Survey, 1993

However Dixit (1985) reported only 17% of grass contribution in feed. The percentage of tree fodder, concentrate and forage in the ration was found comparatively higher in VDC M around 22.8%, 7% and 3.4 % respectively. Furthermore the least proportion of forage was restricted to only VDC M and K where nursery and market exist. While comparing the quantity of feed fed to livestock, it was assessed that adopters of VDC F and M provided greater quantity of feed per lu than non-adopters, while vice versa in VDC K and VDC R.

Especially, the feeding of tree fodder was greater among adopters than non-adopters in all VDC except K where it was vice versa. For the later case, looking at the farthest distance to forest, moreover prohibition for use, explains that the supply of tree fodder was from the greater number of natural grown trees on the farm land, since the natural grown fodder trees were higher number than planted in this VDC (Appendix 4). The small holding of livestock unit accompanied with mostly small ruminants were other causes explains the more quantity of feed supply among non-adopters as compare to adopters.

On the basis of the availability of the by-products and seasonal fodder, the animals were nourished. Majority of the household (80%) fed concentrates (maize flour, rice-bran, mustard-cake etc.) on an average of 11 months through out the seasons. Nutritional forage cultivation, was still not much familiar in the study sites and hardly enough for half a month. Green grass were fed on the basis of cut and carry during rainy

season for more or less 4-5 months. Figure 7, provides an overview of the feeding pattern.

Items	SEASONS												Res.	Avg.
	S	O	N	D	J	F	M	A	M	J	J	A	no.	Months of Feeding
	1			2			3			4				
Concentrate	*	*	*	*	*	*	*	*	*	*	*	*	192	10.9
Tree Fodder		*	*	*	*	*	*						85	2.4
Forage					*	*							17	0.3
Rice Straw		*	*	*	*	*	*	*	*				135	8.3
Maize Stover		*	*	*	*	*							90	5.2
Millet Stover											*	*	34	0.8
Grass									*	*	*	*	184	4.6
Husk									*	*			4	0.3

1 = Early Winter 2 = Late Winter 3 = Summer 4 = Rainy Season

Figure 7 Dominant Feeding Pattern in the Study Sites.
Source: Survey, 1993

In this context, tree fodder and by-products were the main source of fodder especially during dry season. Particularly, tree fodder constitute the essential part of the maintenance ration and fed around 2-3 months of dry season. March- May was reported as the peak scarcity period of fodder, similar to the others findings (Hawkins, 1983). Maize stover, millet stalk and husk were generally stored and fed when there is no availability of paddy straw. A similar type of feeding pattern was reported by Gatenby (1990) in his study.

4.2.4 Demand and Supply of Fodder for the Ruminants:

The short fall of demand of feed and fodder to the livestock of the Nepalese hill farming system has been reported by the numbers of researchers elsewhere (Hopkins, 1983; Leutel, 1991; Abell, 1979; Pandey, 1982 and others). Inspite of the availability of fodder from the various resources, fodder deficit in feed ration was obtained as a general norm in all the study sites. Table 21. presents, an overall average of 2.3 thousand kg/annum of green fodder (grass+ forage+ tree fodder) was deficit in the research sites that ranges from 0.5 to 5 thousand kg/annum.

Table 21 Average Quantity Availability, Production and Requirements of Fodder for Ruminants per Household

VDC		Green Fodder[1] (000 kg)			Energy[2] (000 Mega Joules)		
(N=54)		Demand[3]	Supplied[4]	Deficit	Required[5]	Supplied	Deficit
VDC F		10.6	5.65	-5.0	36.5	33.4	-3.1
VDC M		9.8	8.2	-1.6	33.7	46.4	+12.7
VDC K		6.0	5.5	-0.5	20.8	27.1	+6.3
VDC R		8.6	6.3	-2.3	29.6	21.4	-8.2
Total	216	8.7	6.4	-2.3	30.1	36.1	+6.0
Adp.	90	10.1	7.4	-2.7	34.8	42.6	+7.8
Non-Adp.	126	7.8	5.7	-2.1	26.8	31.5	+4.7

Sources: Survey, 1993
Demand[3] (Agricultural Diary 1993)
Supply[4] (Survey, 1993)
Required[5] (Hopkins, 1983)
Note: Green Fodder[1] = Tree fodder + forage + grass
Energy[2] = Calculated for both green and dry fodder
For Calculation (see Appendix 5)

However, considering the dry fodder (straw and stover) while computing in terms of energy (Metabolic energy), there was surplus energy in VDC M (12.7) and K (8.2) thousand mega joules energy for maintenance/lu. Where as in VDC F and R livestock were raised in considerably low nutrients supply i.e deficit of 3.1 and 6.2 thousand mega joules/lu respectively. Hence the demand and supply of green fodder as well as energy calculation depicts that VDC M as a whole kept livestock in better condition with adequacy in quality and quantity of feed.

Irrespective of VDCs, while considering the adopters and non-adopters, the green fodder was in deficit greater by 0.6 and 0.4 thousand kg in adopters than the non adopters and mean of the total sampled households. But in terms of energy supply both adopters and non-adopters had surplus with 3 thousand mega joules for the former. This implies there was huge supply of green grass in non-adopters as compared to adopters, which can also be proved from Figure 6 shown in earlier. While the adopters balanced it through by-products. This results urged the need of green fodder in the ration which is highly nutrient, since poor livestock nutrient is considered as the most important constraint to livestock production (Chand, 1990).

4.2.5 Fodder Trees in Feed Value

While concerning about the feed and fodder, the role of fodder trees become apparent. Most of the authors have mentioned about the

crucial role of the tree fodder in livestock feed, however to understand the most important role from the farmers' perspective point of view ranking and scoring test was carried out (Table 22). Variation was observed in the opinion of farmers while incorporating the tree fodder in feed value. Value of tree fodder in milk production aspect was the most frequently stated (93%) and scored 82.8 as the most significant impact to the household farming system. Feed supplement with 71.7 and animal nutrition 67.4 score were ranked into second and third respectively.

Table 22. Farmers' Opinion about Tree Fodder Value in Livestock Feed

Opinion of Farmers	Number of Farmers in Rank							NR	Farmers Response %	Score
	1	2	3	4	5	6	7			
1. Feed Supplement	43	6	8	9	7	9	-	8	91.1	71.7
2. Increase milk Yield	32	41	8	2	1	-	-	6	93.3	82.8
3. Maintain Animal Health	8	31	31	6	1	-	-	13	85.5	67.4
4. Supply in Lean Period	1	4	29	28	11	7	-	9	90.0	53.1
5. Makes Feed Palatable	1	1	3	19	8	5	1	51	43.3	22.1
6. Save Searching Time	2	3	6	13	30	4	-	28	68.9	33.8
7. Others	1	3	3	1	3	1	-	78	13.3	8.7

Source: Survey, 1993.
NR= Not Responded

4.2.6 Livestock Production

Livestock and livestock products have an indispensable role in household cash generation, nutrition and crop production. The performance of such farm animal can be attributed to a large degree from the fodder they are getting (Pandey, 1982). However, productivity of the livestock is also associated with a number of factors such as; nutrition

breed, spatial and temporal dimensions. For instance, the average milk production per lu was highest in VDC M (446 lts/annum), followed by (380 lts/lu) in VDC K despite the lowest holding of cattle and buffaloes.

Considering the production level and proportion flow to market level, the highest percentage was found in VDC M (69%) and lowest in VDC K (35%) with 0.3 and 0.65 as production-consumption ratio (P/C) respectively (Table 23).

Table 23. Livestock Products Production, Percentage Sold and Consumption per lu per Annum

Items	Unit	F			M			K			R		
		Prd.	Sold	Con.	Prd.	Sold	Con.	Prd.	Sold	Con.	Prd.	Sold	Con
Milk*	lt	300	40	60	446	69	31	380	35	65	238	55	45
Ghee*	lt	0.5	0	100	0.3	42	58	0.3	37	63	0.06	100	0
Manure	kg	66	0	100	67	0	100	62	0	100	61	0	100
Animal	Rs.	1060	87	13	1617	98	2	442	59	41	555	97	3
Egg	no.	3601	0	100	2516	41	59	2818	0	100	1485	0	100

Source: Survey, 1993
Note: * Milk and Ghee from Cow and Buffalo
Prd= production; Con= Consumption

It was found that greater than 60% of income was from the milk production with invariably greater percentage from the buffalo milk through out the research sites (Table 24). The reason behind this is the pricing system of milk on the basis of fat percentage, where buffalo milk contains comparatively 2-3% higher than cow (Chamberlain, 1989). Consistent findings i.e performance of buffaloes in terms of milk production is reported by Shrestha (1992) and Pradhan (1987).

Apart from milk, ghee, was also prepared certain amount from the milk kept for consumption and used mostly for cooking purpose. Despite the less ghee production compare to VDC F (0.3 lts per lu per annum) only VDC M (42%) and K (37%) sold the ghee for cash generation, implies the role of market for livestock products.

Table 24 Percentage of Income from the Livestock

Livestock	Source of Income	VDC F	VDC K	VDC M	VDC R
	Milk	11.5	37.5	9.9	25.2
Cattle	Ghee	1.1	1.9	0.6	0.3
	Manure	1.2	1.7	0.63	2.1
	Livestock Sales	0.9	-	0.9	0.2
	Milk	59.0	46.4	61.6	51.2
Buffalo	Ghee	0.5	-	0.08	-
	Manure	1.5	0.85	1.24	1.3
	Livestock Sales	15.3	1.2	19.7	9.0
	Livestock Sales	6.4	8.0	3.7	8.0
Goat	Manure	0.3	0.41	0.15	0.5
	Livestock Sales	-	-	-	1.2
Pig	Manure	-	-	-	0.07
	Eggs	0.43	0.6	0.25	0.15
Poultry	Poultry Sales	1.6	0.97	0.1	0.5
	Manure	0.2	0.15	0.13	0.07

Source: Survey, 1993
Note: Market Price of Livestock Products (from interview, 1993) are: cow milk = Rs.10.0/lt; Buffalo milk = 12.5/lt (Rs. 1.8/fat%); Ghee=140 Rs./lt; Livestock Manure = 2 Rs/ml; Poultry manure = 60 Rs/ml

Livestock were sold or slaughtered for consumption generally in the occasions and ceremony. The livestock sale to total income came out

in second position everywhere from buffaloes except VDC K, where goat income was greater by 10% especially from meat. In spite of presence of market the percentage sold to consumption, of VDC K was low than the other VDCs (>87%). The biggest contribution of the farm animal was their manure production, which was found more or less similar within the average range of 60–67 ml/annum/lu)[1] in each VDC. The non ruminants (pigs and chicken) contribution was negligible as these were kept only in few household in non-commercial way.

4.3 Tree Sub-System

Discussion of prevalent species, farmers' opinion in terms of preferences and purpose of fodder trees are done in Tree Sub-System.

4.3.1 Availability of Fodder Tree Species

Diversification was found in the species of fodder trees so as in the period and the length of harvesting. In terms of feed supplement consequently these support to the farmers in economic point of view. Diversified species have advantage over the monoculture. It can be said from the picture of lopping season (Figure 8) of the research sites that most of the fodder trees are harvested during winter and summer season and least in mid summer and rainy season.

[1] ml= man load = 1 full bamboo basket i.e 1 doko = 20-25 kg (Tulachan, 1984)

Majority of the farmers (106) responded that kutmiro provides fodder during scarcity period. Similarly, 46 respondent out of 169 mentioned that ipil could be harvested through out the year. The results confirm the role of fodder trees which, supply fodder during the dry period (Pandey, 1982 and Amatya, 1992). Similarly, Gautam (1987) also reported these species as the most appropriate in his study at Matipanchayat of Dolakha district.

Species	SEASONS												Res. no.
	S	O	N	D	J	F	M	A	M	J	J	A	(N=170)
	1			2			3			4			
kimbu	*	*	*	*	*	*	*	*	*				20
koiralo			*	*	*	*	*	*					54
kutmiro	*	*	*	*	*	*				*	*		106
khanayo	*	*	*	*	*	*							31
khasreto		*	*	*	*								15
ipil	*	*	*	*	*	*	*	*	*	*		*	46
gogan				*	*								6
hatipile		*	*		*								11
tanki	*	*		*									9
timilo		*	*	*	*	*	*	*					16
dudhilo	*	*						*	*				8
painyu				*	*	*	*	*					37
chiple				*	*								5
bakaino							*	*					17
budhar								*	*				2
others							*	*					8

1 = Early Winter; 2 = Late Winter; 3 = Summer; 4 = Rainy

Figure 8 Lopping Season of Fodder Tree Species
Source: Survey, 1993

4.3.2 Existing Fodder Tree Species on Farm Land

The fodder trees that were planted on the farm land were not survived all, some of them died because of the number of reasons. A computation of survival rate and mortality rate of a particular species are presented in Figure 9 and Appendix 6. It was observed that VDC K had highest mortality rate (91%) succeed by VDC F (27.3%) then M (16%) and R (4%). The overall mortality rate was (32.7%) irrespective of the species. Among the species *kimbu* had lower survival rate (47.5%), followed by *budhar* (49.8%). *Ipil* survival rate was found considerably higher 76% than reported in LAC study i.e 53% (Balagun *et al.*, 1986).

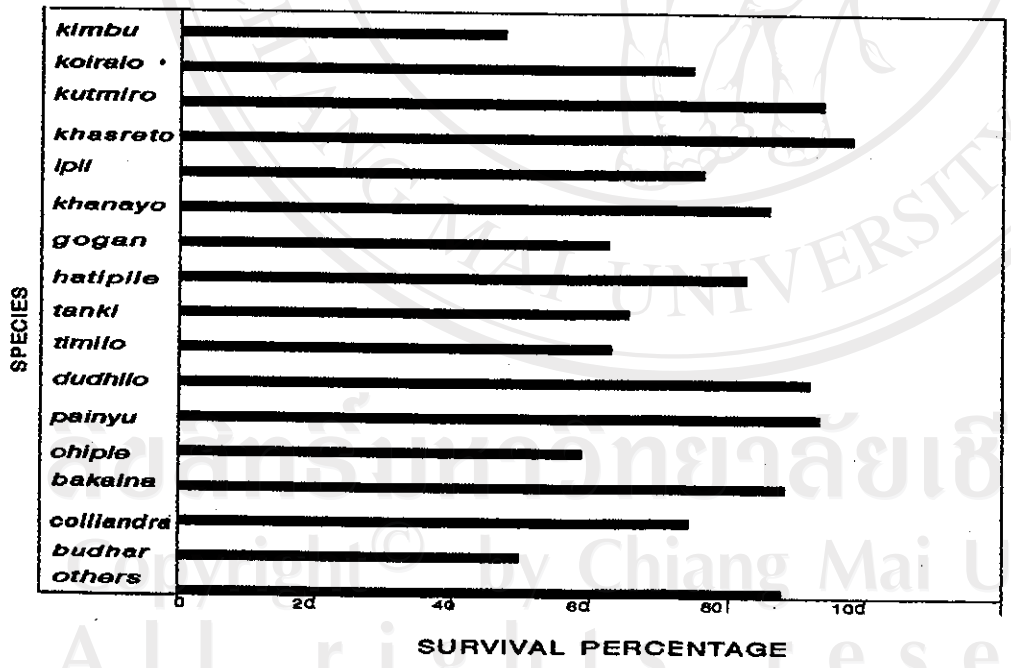

Figure 9 Survival Rate of Fodder Tree Species
Source: Survey, 1993

As mortality of the fodder trees were mentioned, the reason for the same is also necessary to raise which may be the probable constraints for the adoption. However, most of the non-adopters did not response so only adopters response is presented (Figure 10).

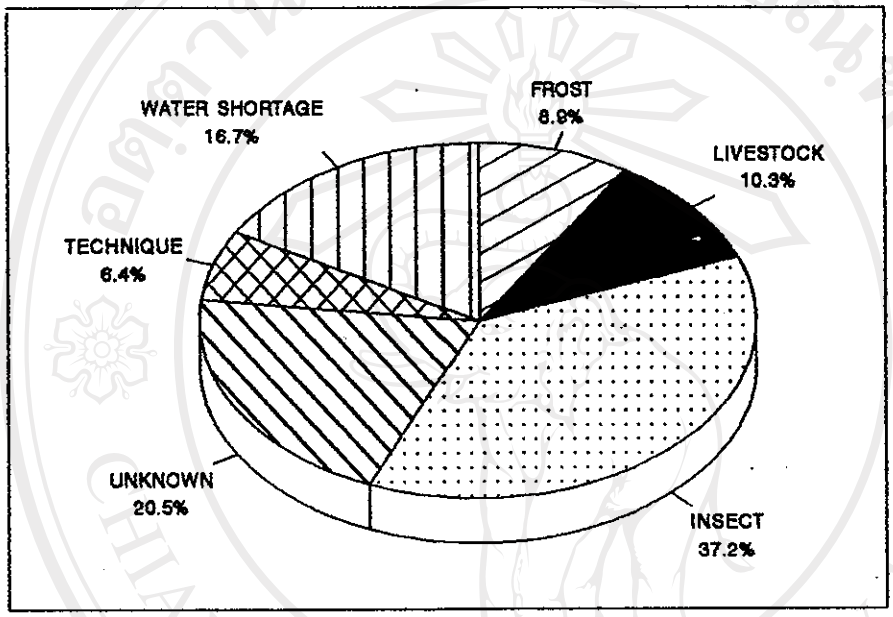

Figure 10 Reasons of Mortality of Fodder Trees Given by Adopters (N=78)
Source: Survey, 1993

From the Figure 10, insect damage was one of the main cause responded by 37.2% of the farmers, agreeable with Amatya (1992) study. The other five more reasons stated were unknown (20.5%), water shortage (10.7%), livestock damage (10.3%), frost (8.9%), un familiar with technique (6.4%) respectively. Similar type of reasons were mentioned in the survey conducted by Thapa *et al.*, (1990) but majority of the farmers responded frost as the major cause of mortality.

4.3.3 Purpose of Growing Fodder Trees on the Farm Land

Despite the fodder trees are mainly for fodder purpose to feed livestock (ruminants), a number of other multiple objectives were listed out from the farmers. The listed objectives were asked to rank and scored by preference score technique (Adopted by Bajracharya, 1993; Leutel, 1991). Fodder was ranked as first most important objective achieving 96.5 performance score, followed by fuel wood (Table 25).

Table 25. Farmers Purpose of Growing Fodder Trees on Farm Land (N=90)

Objectives	Number of Adopters in Rank								Farmers Response	
	1	2	3	4	5	6	7	NR	%	Score
1.Fodder	82	6	1	-	-	-	-	1	97.78	96.51
2.Fuel wood	2	67	19	1	-	-	-	1	98.89	81.73
3.Multipurpose	1	9	50	21	3	-	-	6	93.33	64.10
4.Soil Conservation	-	1	4	36	4	-	1	31	65.56	39.82
5.Utilize Waste land	1	-	1	3	11	2	-	72	20.00	9.67
6.Increase Crop Yield	-	1	-	2	2	2	-	83	7.78	3.81
7.Wind Breaks	-	-	-	3	3	1	-	83	7.78	3.65
8.Animal Protection	-	-	-	1	1	1	2	85	5.56	1.75
9.Staking	1	2	1	2	1	7	-	76	15.56	7.78
10.Free Available	-	1	1	-	1	-	1	86	4.44	2.38
11.Others	1	1	1	1	6	3	1	73	15.56	7.46

Source: Survey,1993.
Note: NR= Farmers not response in number

The result obtained supports the statement of Amatya et al. (1993 pp 117.) that "*single most important use of trees of Nepal is for fodder*". However, vice versa result was reported by Osemeobo (1989) while evaluating the small holder tree planting participation in Nigeria. The

various other aspects were also mentioned by the farmers that were considered as important for the household use (Table 25).

4.3.4 Preference of Fodder Tree Species

Because of similar agro-climatic condition most of the fodder tree species being distributed in all the 4 VDCs. However, as the term indicates "preference" farmer's choice among the number of fodder tree species may differ from others. There may be a considerable overlap in the preference for the same species. The preference of tree species may include a number of reasons, which are socially acceptable, economically viable, technically feasible and institutionally available in production and management. Considering this, the scope of the research was extended to this level, so that the findings could be generalized for the possibilities of improvement in future. Both informal (PRA) and formal (questionnaire) survey technique were applied for the accuracy and comparison. From the former technique a matrix ranking method was conducted in the VDC F and M. Whereas for the later, a ranking and scoring technique of preference was used and species were categorized into 1st, 2nd and 3rd degree of preference. The methodology applied is given as below:

Rank of Preference	Score	Calculation
1	100	No. of farmers in 1st rank*100/N
2	67	No. of farmers in 2nd rank*67/N
3	33	No. of farmers in 3rd rank*33/N

The cumulative score was calculated by adding all the three rank scores. Out of 16 different species except the others, *kutmiro* was ranked in 1st preference securing overall 60.1 score, *ipil* and *kimbu* were placed into 2nd and 3rd preferred species by securing 18.4 and 14.1 popularity score (Table 26).

Table 26 Farmers Preference of Fodder Trees (N=169)

Species	Respondent		Number of Farmers Ranking			Preference Score
	no.	%	1	2	3	
koiralo	18	10.6	4	5	9	6.2
badhar	12	7.1	5	6	1	5.6
kutmiro	1207	1.0	73	38	9	60.1
dudhilo	16	9.5	10	1	5	7.4
panyu	22	13.0	5	11	6	9.2
timilo	13	7.7	1	7	5	4.4
gogan	7	4.1	1	5	1	2.8
hatipile	15	8.9	9	3	3	7.1
ipil	38	22.5	20	12	6	18.4
kimbu	29	17.2	17	8	4	14.1
khanayo	22	13.0	4	10	8	8.0
laharepipal	2	1.2	1	1	-	1.0
bakaina	11	6.5	2	5	4	4.0
chiple	2	1.2	-	1	1	0.6
khasreto	15	8.9	5	5	5	6.0
tanki	16	9.5	6	5	5	6.6
others	4	2.4	-	-	4	0.8

Source: Survey, 1993.

Looking at the spread among the household and highest number among the species, *kutmiro* showed dominance in both aspects in all VDC except VDC K where *painyu* was grown by majority of people (30%). The most interesting point documented in this analysis is that exotic species (*ipil, kimbu*) existence and dominance could be observed where there is

nursery (VDC M and F). Appendix 7, depicts the scenario of the above mentioned feature.

When the results obtained from the preference score were compared with matrix scoring method, in VDC F, *budhar, kutmiro and khanayo* and in VDC M *kimbu, ipil* and *khasreto* were ranked in 1st, 2nd and 3rd degree of preference respectively (Appendix 8). Inspite of not matching in rank categories, the preferred species were found similar with the preference scoring technique. Similar type of result was obtained by Bajracharya (1993) conducted in Salle village, eastern hills of Nepal.

The reason behind the selection of the first three major species on the basis of score is presented in Table 26. According to the stated reasons, kutmiro was preferred the most because of the high biomass (69%), livestock preference (25%) and increase milk yield and fat % (20%) as first 3 major reasons. For the 2nd preferred species (*ipil*), nutritious quality, multiple use were the major reasons whereas availability throughout the season (37.9%) was the major reason of preference of kimbu. The species preferred and the causes were found similarity with Upadhaya (1991) in the Dhading district of Nepal.

Table 27 Preference Reasons for the Species

Reasons	Farmers Response no. and (%)		
	kutmiro (N=120)	*ipil* (N=38)	*kimbu* (N=29)
1. Increase milk and fat	20 (16.7)	7 (18.4)	2 (6.9)
2. High Biomass	69 (57.5)	-	4 (13.8)
3. Livestock Preferred	25 (20.8)	3 (7.9)	1 (3.4)
4. Multipurpose	1 (0.8)	10 (26.4)	6 (20.8)
5. Nutritious	2 (1.7)	11 (28.9)	5 (17.2)
6. Throughout fodder	3 (2.5)	7 (18.4)	11 (37.9)
Total	120 (100)	38 (100)	29 (100)

Source:Survey,1993.

4.4 Household Sub-System

Explanation of household sub-system has been done on the basis of holding size of different resources, income from farm and off-farm activities, perception about the activities, participation and decision making in fodder tree plantation and management.

4.4.1 Household Categorization by Holding Size

Table 28 gives a brief picture of size of holdings of different types of resources (land, livestock, income and human) by 3 major groups of farmers. The categorization was done on the basis of holding of total land i.e. small (<1 ha), middle (1-2 ha) and large (>2 ha). It was inspected that majority of the sampled households (63%) were small farmers owned less than 1 ha. of land. However the other resources were not in measurable condition.

Of the total small farmers a half of them kept 1 to 4 livestock unit and 29.2% kept over 4 lu. Whereas most of the medium and larger farmers hold large herd (>4 lu). The small farmers were more or less equally distributed in all the income groups. However majority of the medium (15.3 of 27.3%) and large (9.2 of 9.7) holdings farmers have earnings >50,000 Rs./annum. Majority of small and medium farmers have 5 to 9 family size but 50% of the larger farmers have more family members i.e more than 9.

Table 28 Households Distribution in Different Resources

Farm Size	Land Size (%)	Livestock Unit (%)			Income (%)			Family Size (%)		
		1	2	3	1	2	3	1	2	3
Small	63.0	2.8	31.0	29.2	22.7	22.7	17.6	15.7	49.0	4.2
Medium	27.3	0.9	19.4	6.9	1.8	10.2	15.3	0.93	19.4	6.9
Large	9.7	0.0	1.8	7.9	0.0	0.47	9.2	0.92	4.2	4.6

Source: Survey, 1993

Note:		1=Small	2= Medium	3=Large
Farm size	(ha) :	<1	1-2	>2
Livestock Unit	(lu) :	<1	1-4	>4
Income	(Rs.):	<26,000	26,000-50,000	>50,000
Family Size	(no.):	<5	5-9	>9

From the analysis a positive relationship could be drawn especially, land size with other resource holdings except family labor. Therefore large farmers were mostly higher caste with large holdings and higher income. While antagonistic relationship was observed in the small farmers where, diversification in herd composition is very common.

4.4.2 Household Income Source

Both on farm (crop+livestock) and off-farm were the immediate source of cash generation for farm households in all the study sites. However, the contribution to the household income from various activities of the farming system vary from one area to other. Table 29 shows that the estimated total annual gross income per household was highest (Rs. 751 thousand) in VDC M. This was mainly because of the high income generation from the crop sector (>50%). The livestock and off farm each contributed about 22.4 and 11.5 thousands Rupees respectively to the total income.

Table 29 Average Gross Margin & Total Gross Income of Household

VDC		Crop				Livestock				Off-farm	Total			
		IN	EX	GM	R/C	IN	EX	GM	R/C		IN	EX	GM	R/C
VDC F		17.7	3.9	13.8	4.5	16.3	7.9	8.3	2.1	5.7	39.6	11.8	27.8	3.4
VDC K		23.1	6.9	16.2	3.3	8.9	6.4	2.5	1.4	16.8	48.9	13.3	35.5	3.7
VDC M		41.1	13.3	27.8	3.1	22.4	12.4	10.0	1.8	11.5	75.1	25.7	49.4	2.9
VDC R		29.3	14.7	14.5	2.0	9.0	12.4	-3.4	0.7	10.2	48.6	27.1	21.4	1.8
Total	216	27.8	9.7	18.1	2.9	14.2	8.9	5.3	1.6	11.1	53.1	18.8	43.4	2.9
Adp	90	32.7	10.0	22.7	3.3	19.1	10.6	8.6	1.8	13.2	65.1	20.6	44.5	3.2
Non-adp	126	24.3	9.5	14.8	2.5	10.6	7.7	2.9	1.4	9.5	44.5	17.2	27.3	2.6

Source: Survey, 1993
Note: IN=income; EX=Expense; GM=Gross Margin; R/C=Return to cost of the respective column.

Despite the total gross income of VDC K and R was more or less similar i.e. 48.9 and 48.6 thousands, the share of crops and livestock to total cash income was different, estimating 23.1 and 8.9 in VDC K and in VDC R 29.3 and 9 respectively. Similarly, in VDC F, the crop, livestock

and off-farm sectors contributed 17.7, 16.3 and 5.7 thousand respectively to the total gross income 3.96 thousands.

While gross margin is computed with consideration of the expenses of each sector, the similar result was obtained for VDC M and K i.e. highest and 2nd highest gross margin income, 49.4 and 35.5 thousands respectively. However, for VDC F and R, VDC was better off than VDC R. It was noted that the VDC having nursery (M and F) have greater percentage of livestock share 22.4 and 16.3 with more return to cost ratio (1.8 and 2.1) respectively. Similarly, VDC having market (K and M) got greater percentage of income (49.4 and 35.5) respectively, with greater percentage of share from crop gross margin. VDC K received the highest off farm income 16.8 thousands compare to other VDC.

Irrespective of the VDCs, Table 29 also indicates that among the total sampled households, adopters gross income was greater by Rs. 10,000 and 20, 000 than average and non-adopters. It was found that the greater share was from crop, followed by livestock and off-farm with greater return to cost ratio. Similarly, adopters economic condition was realized better than non-adopters due to the high return to cost (3.2) from each sector.

4.4.3 Perception of Household about Activities Performed

Considering, the various farming system activities, the farmers were involved, they were asked to prioritize the activities performed.

Table 30 indicates that greater percentage of the farmers (63.5 %) gave 1st priority to crop. Livestock was preferred as 2nd choice (57.9%) and off-farm as third (75.8%). Similar result appeared in the all VDCs. However, in VDC K, the percentage of farmers preferred off-farm as first rank (31.5%) were comparatively higher than other VDCs. Matching this priority with the income from each sector as shown Table 29, it could be conveyed that the priority is associated with the total income earned by the farmers.

Table 30 Household Perception about the Activities Performed

VDC	Number of Households in Each Rank of the Activities Performed								
	Crop			Livestock			Off Farm		
	1	2	3	1	2	3	1	2	3
VDC F	30 (55.6)	22 (40.7)	2 (3.7)	17 (31.5)	26 (40.1)	11 (20.4)	7 (13.0)	6 (11.1)	41 (75.9)
VDC M	33 (61.1)	19 (35.2)	2 (3.7)	18 (33.3)	32 (59.3)	4 (7.4)	3 (5.6)	3 (5.6)	40 (88.9)
VDC K	35 (64.8)	15 (27.8)	4 (7.4)	2 (3.7)	29 (53.7)	23 (42.6)	17 (31.5)	10 (18.5)	27 (50.0)
VDC R	39 (72.2)	13 (24.1)	2 (3.7)	10 (18.5)	38 (70.4)	6 (11.1)	5 (9.3)	3 (5.6)	46 (85.2)
Total N=216	137 (63.4)	69 (31.9)	10 (4.6)	47 (21.8)	125 (57.9)	44 (20.4)	32 (14.8)	22 (10.2)	162 (75.8)

Source: Survey, 1993.
Note: 1,2 and 3 are the rank of the activities. Figures in () refer to %

4.4.4 Participation of Household in Livestock Related Activities

To achieve the greater productivity and corresponding income from

the livestock, farmers' involvement in special expertise and training and organization plays a significant role. With this, farmers could make right decision at right time. For instances, in livestock developmental activities, selection of species either tree or breed suited to the agro-climatic condition of the area and their management is essential to harvest the production for long period in sustainable basis. Because such activities broaden the arena of farmers' knowledge and keep attention in feeding and rearing system.

Regarding the percentage involvement in training and membership in group organization, it was observed that less than 36% of farmers had opportunity to participate in training and below 60% at farmers group organization. Of which, majority of them received nursery training and RAHS (rural animal health and milk production). It was also noticed that the percentage of adopters involvement in training especially, nursery was greater than non-adopters (Table 31).

The farmers of the VDC M were found members of buffalo and co-operative while K of buffalo, co-operatives and cattle group respectively. Majority of the farmers were involved in buffalo group, especially of VDC M, K and R (Table 32, Figure 11).

Table 31 Respondent Participation in Training

VDC	Types of hh	Res. no.	% Participation		% Obtained Types of Training				
			Yes	No	1	2	3	4	5
	Both*	54	20.3	79.7	13.0	5.5			1.9
VDC F	Adopter	23	14.9	27.7	13.0	1.9	-	-	
	Both	54	35.2	64.8	9.2	12.9	3.7	1.9	7.4
VDC M	Adopter	43	31.5	48.1	7.4	11.1	3.7	1.9	7.4
	Both	54	11.1	88.9	1.9	7.4	1.9	-	-
VDC K	Adopter	14	5.6	20.3	1.9	3.7	-	-	-
	Both	54	11.1	88.9	1.9	3.7	-	-	5.6
VDC R	Adopter	10	1.9	16.7	1.9	-	-	-	-

Source: Survey, 1993.
Note: Both* =Adopters+Non-adopters
1=Nursery
2= Animal Health and Milk Production
3=Farmers Group+Nursery
4=1+2
5=Other agricultural

Table 32 Sampled Households Member in Farmers' Groups

VDC	Types of hh	Res. no.	% Member		% of Member in Farmers' Groups Types			
			Yes	No	(1)	(2)	(3)	(4)
	Both *	54						
VDC F	Adopter	23						
	Both	54	59.3	40.7	51.9	3.7	3.7	-
VDC M	Adopter	43	55.6	24.1	48.2	3.7	3.7	-
	Both	54	16.6	83.4	5.6	-	3.7	7.4
VDC K	Adopter	14	11.1	14.8	3.7	-	-	7.4
	Both	54	11.1	88.9	-	-	11.1	-
VDC R	Adopter	10	1.9	16.7	-	-	1.9	-

Source: Survey, 1993.
Note: Both* = Adopter + Non Adopter
1=Buffalo group
2=Buffalo+Goat group
3=Cooperative group
4=Cattle group

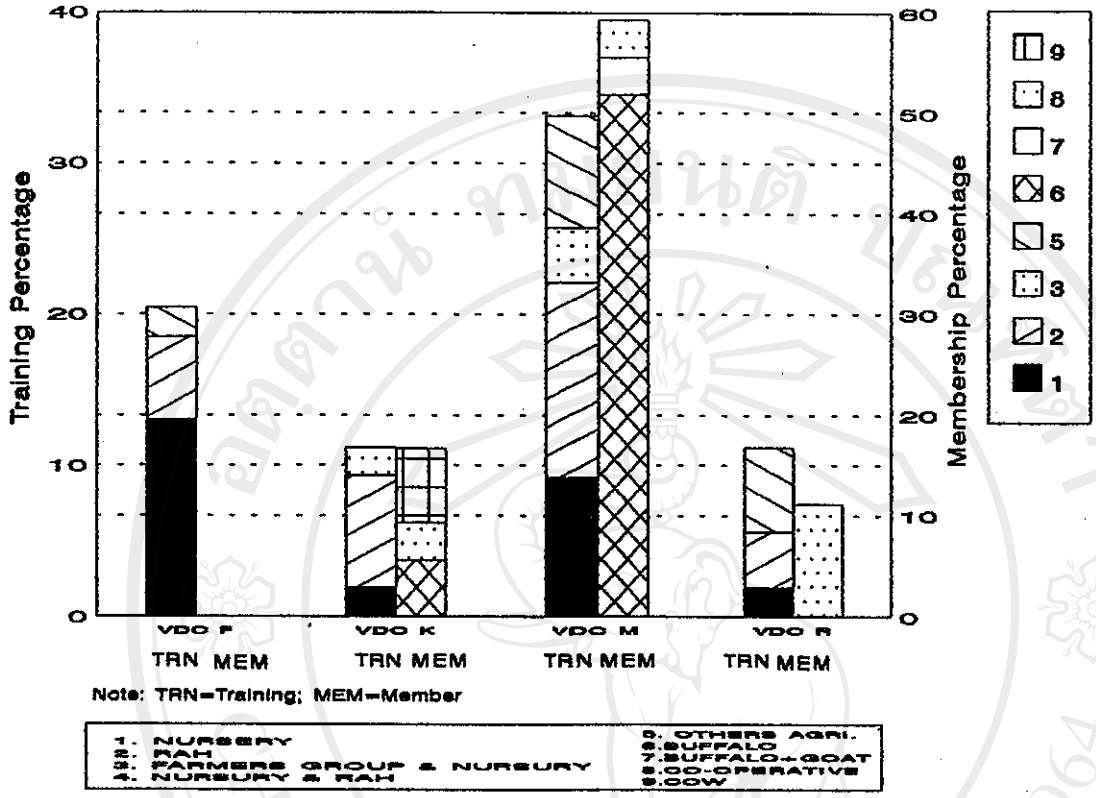

Figure 11 Percentage of Respondent Received Training and Membership
Source: Survey, 1993

4.4.5 Decision Making in Fodder Tree Management

In Nepalese context generally, the head of household has the highest status in the family, hence all most all decisions were carried out by household head. However, Dixit (1989) argued that the decision maker may be any member in the household i.e a grand son to a grand father and emphasized for identification of a decision maker especially for introduction of agroforestry.

Therefore, in this study interview was also taken with the decision maker instead of household head. Considering this, in case of decision making of fodder tree plantation and management (timely harvesting) male role was greater around 82% and 62% respectively compare to female (7% and 12%) among the adopters (Figure 12).

Similarly, in the combined group of adopters and natural growers (169) households, male decision making was found higher by 28.4% compare to female in management of fodder trees. Indeed the situation is realistic to Nepalese context where male dominance is very strong. Similar type of report was stated in LAC by Balagun (1986).

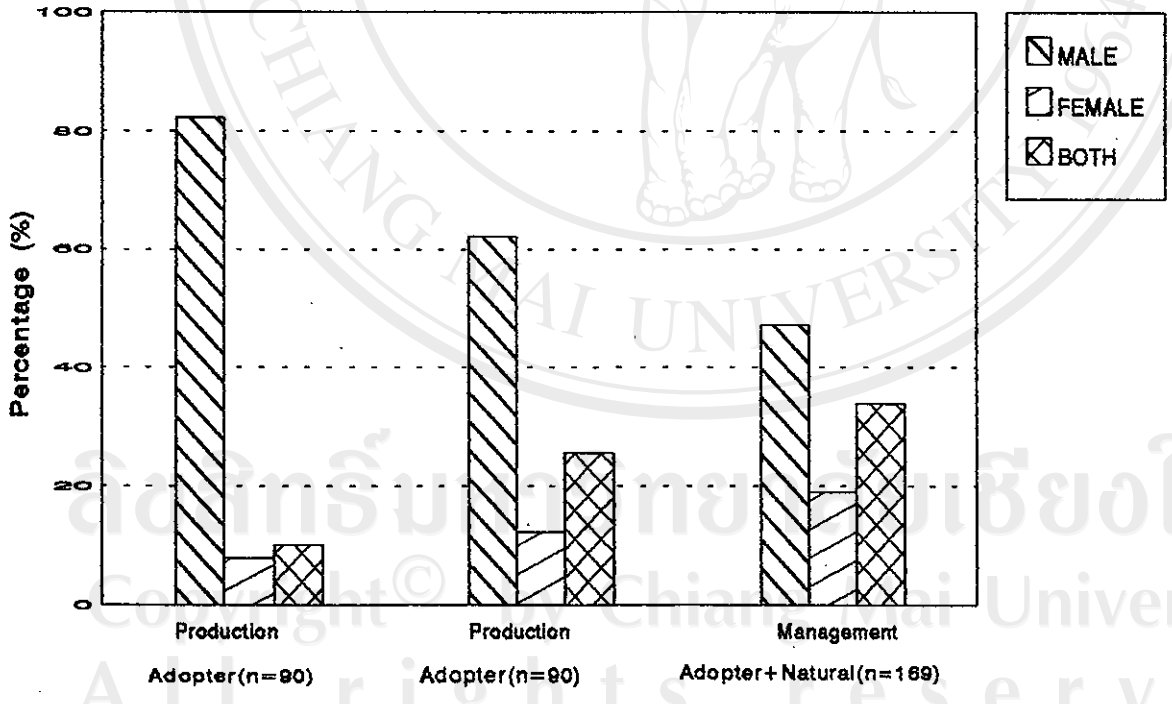

Figure 12 Percentage of Farmers in Decision Making of Fodder Tree Production and Management
Source: Survey, 1993

4.5 Integration of System Components on Farm Household

From the assessment, observation and evaluation of the research sites integrated crop, livestock and tree on the farm household stand out as an indispensable, self sustaining farming system. Because these sub-systems were found inter-wounded to each other by a strong linkage that the existence of one sub-system without the other is either impossible or unsustainable. Farm households were found playing a key role in interlining of all these three components together through their knowledge, skill and socio-economic background. Apart from these, the external factors like institutions (GOs and or NGOs) and market had great influence on the stability of the system as it is a media of production flow (inputs<--> outputs) from one component to others.

Such type of complementary relationship have been reported elsewhere in most of the farming system study (Shrestha *et al.*, 1992; Amatya, 1993; Osemeobo *et al.*, 1989). A major significant impact of farm land was seen in supplying farm by-products (concentrate and crop residues) for feed of livestock which was ranging 56%-100% in each VDC. Supply of crop residues (dry fodder) as a supplement of livestock feed reflected a positive interaction between the two sub-systems.

A reversible interaction was assessed from the close association between livestock and other components of the farming system. In general, it is reckoned everywhere that livestock play a subsidiary role to crops

in the small holder mixed farming systems (Reynolds, 1991). Regardless of primary and subsidiary enterprises, livestock serve as a buffer, a saving account with off-spring as interest (Gang *et al.*, 1989). Supporting this, farm livestock were considered as one of the major assets of the research sites (Figure 13).

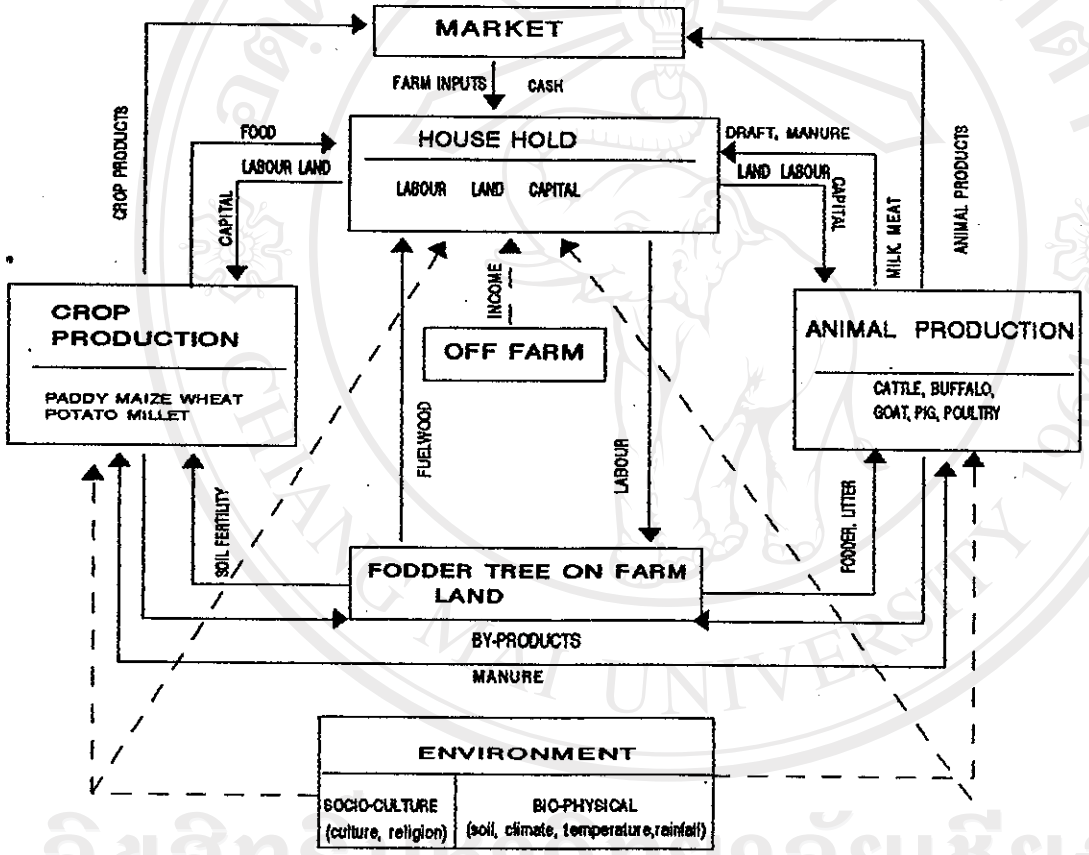

Figure 13 Integrated Farming System Components of the Study Area
Source: Survey, 1993

The ultimate goal of keeping these livestock in the farm household was mainly for cash generation, which was obtained directly as well as indirectly. Selling of livestock products like milk, ghee, eggs, meat or livestock provided cash generation directly. However the indirect method was conceptualized from the earnings of the crop productivity through manure.

A cyclic interaction of the farm fodder tree with other system components was realized in terms of fodder, fuel wood and soil erosion protection. But the most significant interaction exist between tree and livestock about feed and fodder especially during the scarcity period (dry) when the shortage of fodder was in peak. Households with its major inputs (land, labor and capital) were the major objects for meeting the stability of the whole farming system. Apart from internal factors, a combination of external factors like institutions (GOs and NGOs policy) and market had also the indirect influence in the system.

An investigation of the research sites in system analysis perspective revealed that, the per hectare holding of ruminant livestock (lu) was ranging from 3.5 to 2.8 lu (Table 33). However, over all ruminants lu/ha was computed more or less similar between adopters and non adopters. The figure was found low in VDC F by 1.07 than the survey carried by Gilmour (1991) and Oli *et al.* (1985) i.e 6.3 lu/ha.

Table 33 Availability of Fodder Trees per Livestock Unit of Household

VDC	lu/ha			Fodder Trees/ha			Fodder Trees/lu		
	Total	Adp	Non-adp	Total	Adp	Non-adp	Total	Adp	Non-adp
VDC F	3.2	2.9	3.6	16.4	24.4	7.0	5.1	8.5	1.9
VDC M	2.9	2.9	2.6	309.0	361.4	27.2	106.6	122.4	10.5
VDC K	3.5	3.4	3.6	20.3	35.0	14.6	5.8	10.4	4.1
VDC R	2.8	3.2	2.8	11.1	18.6	9.6	3.9	5.9	3.4
TOTAL	3.06	3.0	3.1	101.9	197.2	11.5	33.3	65.7	3.7

Source: Survey, 1993.
Note:
TOTAL=Total(216 hh); Adp(adopters 90 hh); Non-adp(non-adopters 126 hh)

The density cover of fodder trees/ha of land were computed as 16.4, 309, 20.3 and 11.3 for VDCs F, M, K and R respectively. It was observed that an average of 33.3 fodder trees was available for 1 lu of the sampled households. While the ratio was found higher in adopters (65.7 trees/lu) and distinctively, low in non-adopters (3.7 trees/lu). The finding holds true in each VDC. Table 33, clearly depicts that the condition of livestock of VDC M and adopters were better off than other VDCs and non-adopters.

The obtained findings seem contradict with Table 21 result where greater deficit of green fodder has been shown in adopters compare to non-adopters. However, this can be explained that the supply of green fodder among the non-adopters was from grasses rather than tree fodder. Further, it also reflects the immature adoption stage where the adopted fodder trees are not mature enough to harvest.

The result obtained of VDC F was found much difference than the findings reported by Gilmour (1989) in the same VDC, i.e 183 fodder trees/ha. Conversely, the figure was lesser than findings of VDC M (309 trees/ha) however, higher (8.5 in >1 ha of land) than the research carried out in Lumjung district by Gajurel (1987). This figure was found higher than the ratio reported by Pandey (1 tree/lu in 1976), Hopkins (<4 trees/lu in 1983) and Wyht and Smith (5.3 trees/lu in 1982). This reflects probably the plantation has been increasing over time.

4.6 Highlights

The chapter highlights the general farming system of the mid hills which was diversified and integrated with the system components. The intimate association between crop and other subsystems like livestock, tree, household were for feed, compost, food and income. The household system was found playing key role in system interrelationship as it is the center of management of the resources.

The research sites where there was availability of nursery and market, for example, VDC M condition in terms of feed, tree fodder supply to livestock was found in better condition. Therefore, keeping of ruminants especially buffalo was prevalent and consequently get higher income by the greater share of market was observed. Similarly, the existence of species of *ipil, mulberry* could also be assessed in the study sites as well as in VDC F. However, the study site where there was only

market no nursery availability like VDC K, small ruminants (goats) were common and the scarcity of fodder was maintained by natural grown fodder trees. The major cash generation was from off-farm activities as greater percentage of people were literate in this site.

Apart from comparison among VDCs, the chapter also focus the differentiation between adopters and non-adopters in some aspects. The higher deficit of green fodder in adopters compare to the non-adopters (Table 21), despite the availability of fodder trees/lu was 17 times greater than the non-adopters (Table 33) was explained due to the early stage of adoption. No such variation was observed in per hectare lu of adopters and non-adopters.

However, returns to cost in terms of farm and off-farm activities is higher for adopters inspite of high expenses than the non-adopters (Table 29). This reflects tree fodder adoption must have some positive impact in overall farming system activities. The opinion of the farmers about the tree fodder in feed value for increment of milk yield also confirm the findings. *Kutmiro, ipil and mulberry* were recognized as preferred species by the majority of the households for high fodder, nutritious and availability. Despite female contribution was comparatively higher in farming system activities, the decision making especially, in plantation and management of fodder trees was found over ruled by male of the households.