CHAPTER V

FARMING SYSTEMS CHARACTERISTICS OF THE STUDY AREA

Permanent agriculture in the hills of Nepal was started perhaps before the eighteenth century. This might have led by the ever increasing population pressure and the then state policy of creating incentive to convert hill forest to agriculture in order to reap the taxes (Bajracharya, 1983.b). As a result, in the latter half of the eighteenth century, especially in the mid hills more forest and pasture that were not cultivated before and managed by the community for the benefit of the property holding group were brought into cultivation (Gibbon and Schultz, 1991).

The interaction of climate, topography, altitude, social and religious beliefs, access to land ownership, and the extent and access to markets has given rise to a wide varieties of farming systems in the hills of Nepal. The limited transport and communication infrastructures, unavailability of produce and inputs market, high variations in microclimates accompanied by large family size and small fragmented farms on hill terrace and precipitous slope have led the hill farmers to adopt subsistence farming (Shrestha and Yadav, 1990). As a result of adaptation of changing political, economic and social circumstances over the time, the hill farming systems of Nepal has therefore became a diverse and complex entity (Gibbon and Schultz, 1991). In this connection, this chapter will discuss different characteristic features of the existing farming systems of the study area with especial emphasis on systems components, their interrelationship, production and productivity, and their relations on household food security.

5.1 Farming systems components and their interrelationship

Traditionally, farmers in the hills have been integrating crops, livestock and forestry components in their farming systems in order to satisfy their demands for food and cash. A farmer or household maneuvers those farming components with his/her management skills in order to extract output that can be generated from each component. These components are intertwined in such a way that one can hardly think of a farming system in the absence of any one component. Undoubtedly farming being a single most sector of absorbing ever-increasing labor force in the rural hills, it is labor intensive and less productive per unit of labor employed (Shrestha and Yadav, 1990.). Although, the system provides food, fuel, timber, cash and employment to the households, all the subsistence-farming households in the study area are not able to produce sufficient food to meet their consumption requirement.

Even though, the farming systems of the study area possess the same components of representative farming systems of the hills, the degree and magnitude of interrelationship among and between the components may vary basically determined by the biophysical and socioeconomic specificity. Figure 5.1 shows interrelationships among different farming components in the study area. In this interactive relationship, the crop sector provides feeds and bedding materials to livestock and in return receives power and manure. Forests directly influence crop production providing compost materials and agricultural equipment (ploughs and poles); and indirectly by supporting livestock which provide manure and draught to the crop production systems. In addition, forests act as safeguard to cropland against soil loss through erosion and landslides. There is not much grazing area in the study site, therefore, interrelationship between livestock and grazing land is not prominent. Because of increasing population pressure and declining natural resources availability, the trend of decreasing livestock population has mentioned. Decreasing livestock number in the hills due to decreased grazing land

has also been reported in a number of literature in the context of hill farming systems of Nepal. (Yadav, 1990, Shrestha and Yadav, 1992, Bajrachaya, 1993).

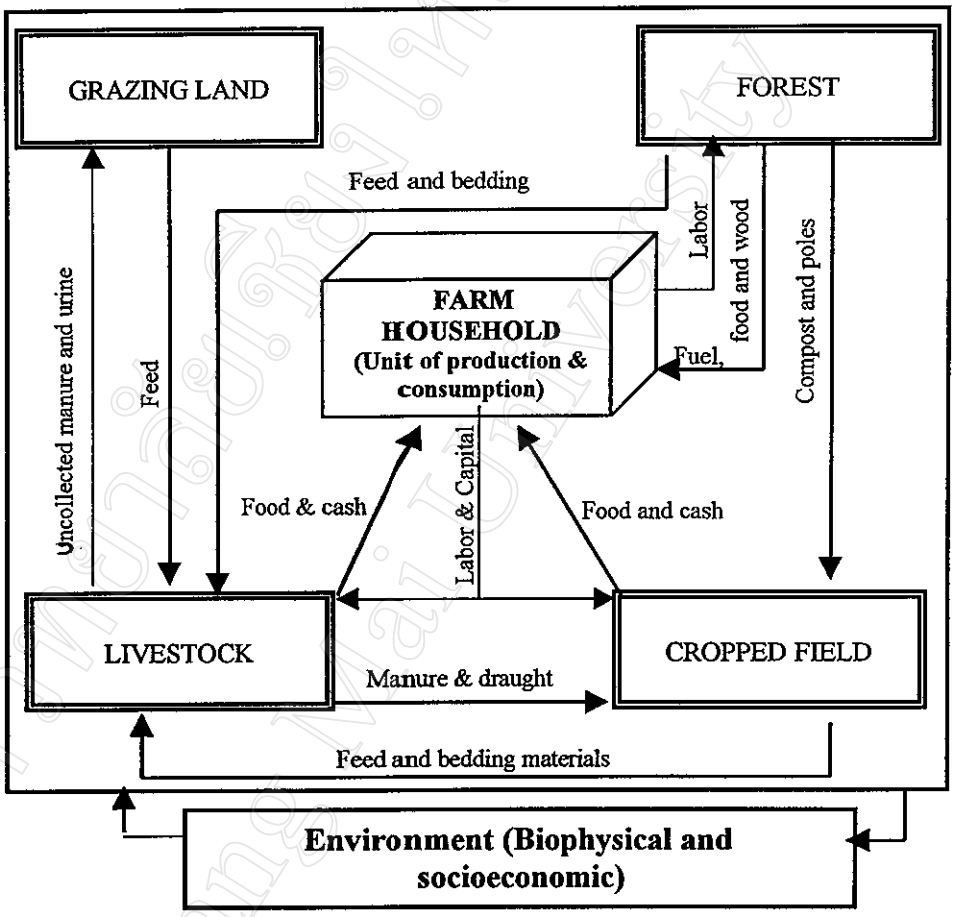

Figure 5.1 Interaction among the farming system components
(Source: Thapa (1989) and Pearce *et al.* (1994), and Poudyal (1997) with modification)

Household being the basic unit of production and consumption all those farming components directly or indirectly are influenced by the verdict of household's demands for goods and services. Farming household is virtually linked with all those components and plays key role in the overall operation of the systems as a system manager and decision-maker (Yadav, 1990). Since household's activities always revolve around the household welfare of providing food and nutrition to its members through rationale use of

available resources, it contributes to the system in number of ways providing labor and investment for the long-term sustainable use of the resources.

Socioeconomic and biophysical environment within and outside the systems are equally important for the smooth and viable existence of the farming systems. Government policy like subsidy in fertilizers and other agriculture inputs, bank interest rate and priority of landing, market, technologies etc. directly or indirectly influence agricultural activities. Inaccessibility to market could be the single most reason of adopting subsistence farming with low input and low output in the study area. Because of market inaccessibility, unlike other eastern mid hills with access to market and transportation network, this area has no cash oriented cropping. Therefore, the prominent high value cash crops of the eastern hills like cardamom, ginger, tea etc. were almost absent in this area. Other important social factors governing the characteristic feature of farming in the study area are weak social infrastructure like farmers groups, non-government organizations (NGOs), cooperatives, credit and saving schemes etc. Biophysical factors like climatic variations, erratic rainfall, recurrent draught and hailstone, incidence of diseases and pest, and many other vagaries have directly and indirectly influenced on the choice of farming activities in the study area.

5.2 Crops and cropping pattern

Farming systems of the study area is subsistence oriented and predominantly crop-based in nature. Although, the maximum households derive their livelihood primarily from agriculture, agricultural production is still traditional and takes place with the minimal cash flow. Cereal crops dominate the agricultural activities, which contribute the major part of the total agricultural production.

5.2.1 Cropping pattern

Wide range of crops and cropping patterns are adopted in the study area depending upon biophysical and socioeconomic settings of the farms and the households. Although, the sample households are confined within 1100 to 1700 masl, their farmlands start from the foot hill of 400 masl to the altitude of up to 1900 masl; locally call *Besi* and *Lek* respectively. Large combinations of cropping pattern are practiced by the farm households, which are basically determined by land type and the elevation. On *Bari* land it is common to grow maize followed by millet, while on *Khet* land rice is the predominant crop. The most dominant cropping pattern on *Bari* land is maize intercropped with bean relayed by millet. It accounts for about 60 per cent of the total *Bari* land. On less fertile upland, called *Pakho,* sole maize is grown, and after maize some other minor crops like sesame, black gram, buckwheat etc. are sown on some parts. But most of the *pakho* remains fallow after the maize harvest. Since various type of pulses like gram, bean cow pea etc., are often intercropped with maize, there are many variations on maize based cropping pattern (Figure 5.2). In the higher elevation potato interplanted with maize is the dominant cropping pattern on the *Bari* land. In the case of *Khet* land the main crop is monsoon rice. More than 70 per cent of farm households grow only monsoonal rice on the *Khet* land. Under the favorable irrigation facility at the lower elevations some farm households take two seasons rice crops: the early season rice (March transplanting) and the main season rice (June transplanting). Unlike other mid-hills, wheat cultivation in this area is almost negligible; only five households amongst the total sample households were found growing wheat. On the *Khet* land monocropping was found overwhelmingly practiced, which is basically due to lack of irrigation and strayed-animal problem during the winter.

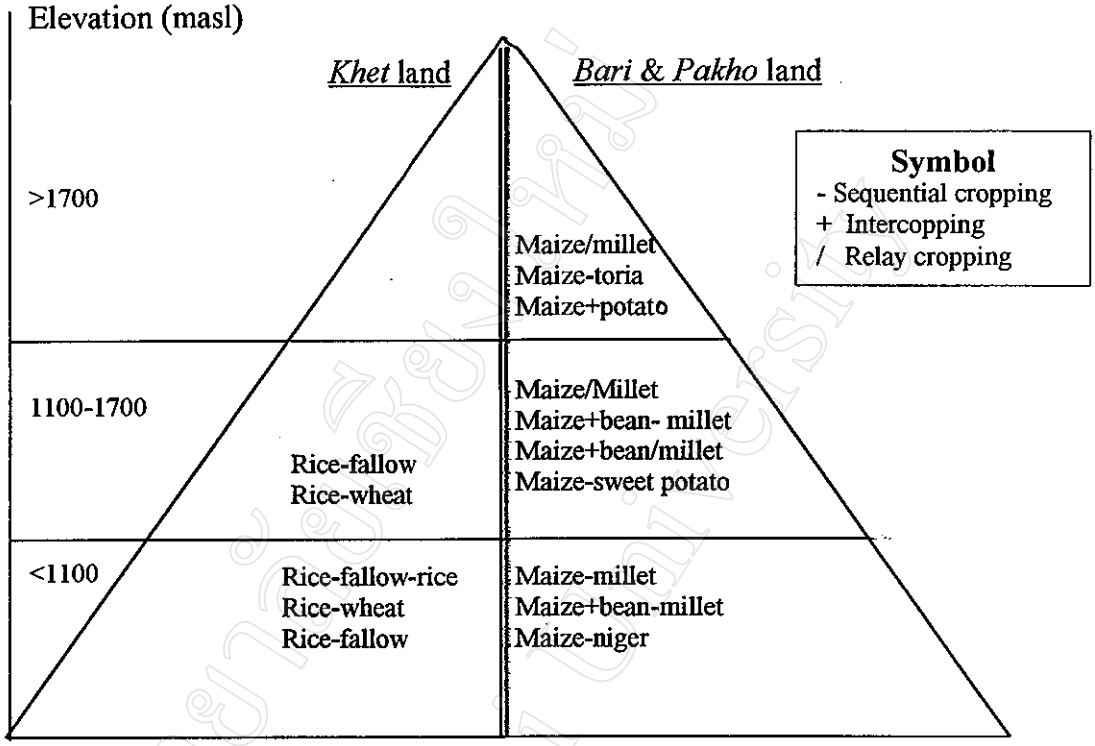

Figure 5.2 Dominant cropping patterns of the study area
(Source: Group discussion and PRA, 1998)

As mentioned earlier, because of lack of irrigation upland farming is the major attribute of farming systems in the study area. Maize is the most dominant crop cultivating from lower hills to higher hills during the summer. Winter cropping on the upland is almost negligible except near the homestead, which is usually fenced by the bamboo slits. Particularly in the dry area, where moisture retention is very low, even the homestead area remain fallow during the winter.

5.2.2 Cropping intensity

The aggregate cropping intensity of the study area showed decreasing land use intensity with increasing farm sizes (Table 5.1). Furthermore, land use intensity was found lower on *Khet* land than *Bari* land. Conlin and Falk (1979) had also reported lower

cropping intensity on the *Khet* land in the eastern hills of Nepal. The possible reason behind lower cropping intensity on *Khet* land could be that larger farmers own substantial proportion of *Khet* land, and having no market opportunity of agricultural produce they are reluctant to cultivate extra crops. On the other hand, *Khet* lands in the study area are mostly rainfed with no opportunity to grow winter season crop. Other possible reason responsible for lower cropping intensity might be the tenancy systems. Sharecropping system is the most common practice, which provides no incentive to the tenant for growing multiple crops as he/she has to share fifty per cent of the total produce with the landowner bearing the entire cost of required inputs by the tenant.

Table 5.1 Cropping intensity (CI) by farm size category and land type

Farm size (ha)	Land type		Sample average (CI%)
	Khet land (CI %)	*Bari* land (CI %)	
≤0.50	104	195	173.70
0.51-1.0	101	192	151.00
1.01-1.50	107	175	144.78
1.51-2.0	110	179	140.28
> 2.0	104	177	134.62
Overall	105	182	147.11

(Source: Survey data, 1998)

5.2.3 Crop production and productivity

Cereals are the main staple food crops in the study area. Rice, maize and millet are the major cereals contributing more than 80 per cent of the total food production and cover more than 95 per cent of the total cultivating land. Almost all farm households

cultivate maize but the area under maize accounts less than that of rice. Of the total cultivating land, rice covers 51 per cent, and the area under maize accounts about 47 per cent (Figure 5.3). This indicates that rice being the most preferred staple grain, even under the poor environmental condition farmers prefer to grow rice in order to meet their food requirement. Buckwheat, sesame, niger, sweet potato, black gram etc. are other minor crops grown on the *Pakho,* which is unfertile marginal land. Almost about 95 per cent of the sample households were found growing those minor crops but area coverage was barely about 10 per cent of the total cultivating land. Wheat cultivation in the study area is extremely low, and less than five per cent of the total sample households cultivate wheat, which covers less than one percentage of the total cultivating area. Millet on the other hand is the third important crop in terms of area and production. As millet is least desired food, only the poor farm household considered it as staple food. Therefore, a large share of millet is processed into alcoholic drinks such as *Jaand* (local beer) and *Raksi* (local sprite). Nevertheless, millet in the rural hills is considered as high value cash crop which fetches higher price than rice and maize, and is easy to sell. The poor households also consume millet flour as staple food, and millet straw is an important source of forage for animal during the winter.

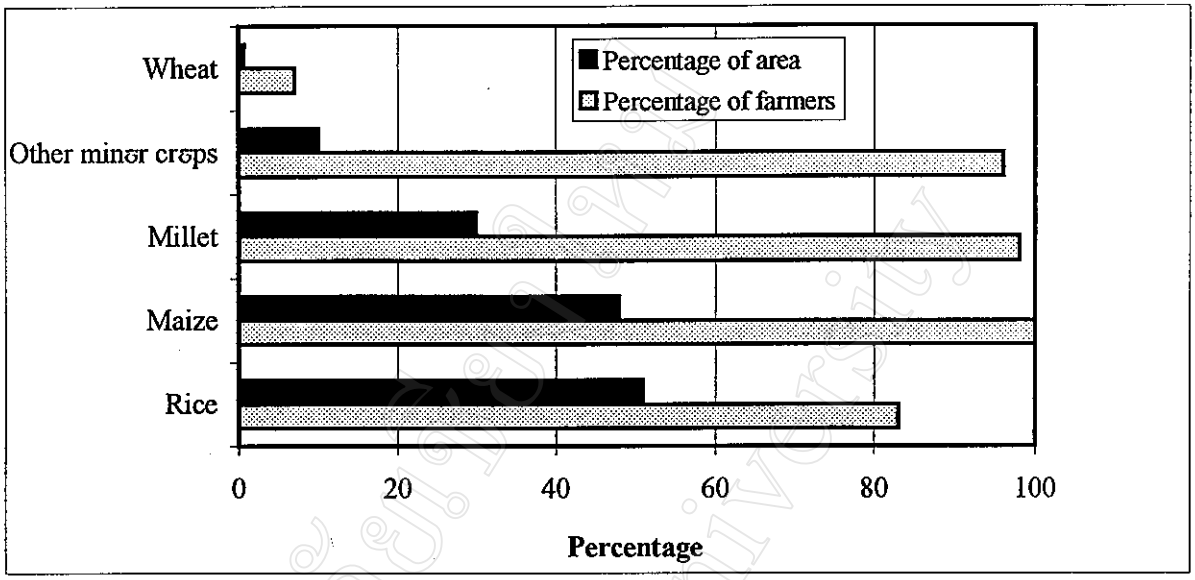

Figure 5.3 Percentage of area and farm households growing major crops (Source: Survey data, 1998)

Although, only a small proportion of rice cultivating land are fully irrigated, rice production is the prime concern of all farm households as it is considered the superior staple food grain. Being a traditional crop with cultural importance during festivals, farmers in the past, when there was no accessibility to buy rice in the market (before the construction of Dharan -Basantpusr road) had converted their possible *Bari* land into *Khet* land. Since, rice cultivation is done even under the poor environmental condition the average production per unit area seemed relatively low. Maize and millet are also traditional cereals in the hills. Maize has diversified uses: maize grits and flour as staple meals, roasted maize as snacks, maize flour as livestock feed etc., which reflects its immense importance from the household food security perceptive. In contrast to the significant role of those major cereals in achieving household food security, their production per unit area except that of millet, was found relatively lower than that of regional as well as national average (Table 5.2).

Table 5.2 Average area, production and productivity of major cereals

Crops	Study site			National and regional yield (Kg/ha)	
	Area (ha/Hh)	Production (Kg/Hh)	Yield (kg/ha)	National Average	Eastern hills Average
Rice	0.93	1,255.54	1,498.00	2,450	2,020
Maize	0.74	784.93	1,253.42	1,660	1,610
Millet	0.47	511.90	1,258.74	1,110	1,030

NB: Hh = household; ha = hectare

(Source: Survey data, 1998; Central Bureau of Statistic, 1996/97)

5.3 Livestock management and production

Livestock is an integral component of farming in the study area. A range of livestock species (buffalo, cattle, goat, sheep, pig and chicken) are kept by the farm households. Almost every household has a few heads of cattle and buffalo. As there is a little use of chemical fertilizers, because of its high cost and transportation difficulties, livestock keeping is considered essential for maintaining soil fertility. Livestock management is entirely dependent on the crop by-products, farm-forest and grazing. In this crop-livestock interaction, the crop sector provides residues and harvest stubble left on field after harvest for grazing to the livestock. Therefore, there is a complementary relationship existed between crop and livestock sectors. The crop residues and hay are kept to feed the animal in the fodder scarce period, particularly during pre-monsoon season. Integrating livestock into the crop production system has therefore enabled farmers to maintain their animals as well as crop production.

Livestock, particularly small stock like goat, pig and chicken are the main source of cash for most of the poor households. Therefore, livestock keeping particularly small animals was found objectively related with hedging against possible risk of cash deficit for the day-to-day household expenses. Almost all households irrespective of ethnic variations kept cattle and goat. Despite the lower productivity of aged cattle, farmers generally are reluctant to sell them (particularly cow) because of their religious taboo. This could be one of the main reasons responsible for larger livestock population per household.

Households with larger area of cultivating land prefer buffalo to cattle, since the local buffalo produces higher milk and manure than that of local cattle. It is mentioned that the average milk production of a local buffalo is almost double than that of a local cow. The average milk production of buffalo was mentioned about 780 litters per year, whereas in the case of cow it was only 390 liters. Due to lack of milk market in the study area, refined butter (ghee) is the final produce of milk and about 40-60 per cent of the total milk produced is converted into the ghee.

Since, the livestock production system is entirely based on fodder, forage and grazing, there is seasonal variation in milk yield. During the pre-monsoon season milk yield falls, and rises gradually towards the rainy season. Seasonality in milk production might be directly related with the availability of fodder and feed stuff. With the increasing farm size increasing milk yield was found in the case of both cow and buffalo, which might be due to larger farm size holders are able to dispose more feed and fodder than the small farm size holders. The present level of livestock density and productivity indicates that even though livestock being a vital component of farming, the farm households in the study area are not able to support their livestock properly in the absence of required feed and fodder.

Even it is not legally accepted, caste restriction on livestock keeping has direct implication on livestock production systems in the rural area. The *Brhamin/Chhetri* households, which are considered the highest in the Hindu caste hierarchy, do not rear pig and poultry in general. But in the case of poultry, the caste restriction has gradually been relaxed in the recent years. Therefore, almost all farm households irrespective of ethnic variations were found keeping poultry as an important source of nutrition and petty-cash needed for day to day household expenses. Exception in few households, who have improved poultry breed received as the test materials from PAC, almost entirely the poultry keeping in the sampled households was found with local breed, having lower egg and meat productivity. Egg production was mentioned erratic with the annual production of 60-120 eggs per hen with three laying periods. Table 5.3 shows annual livestock produces per household by farm size category

Table 5.3 Livestock products per household by farm size category

Livestock products	Farm size (ha.)					Overall
	≤0.50	0.51-1.0	1.01-1.50	1.51-2.0	>2.0	
Milk (Litre/year)	538.00	932.90	1,005.20	950.00	1,039.60	958.80
Chicken (No)	3.94	5.15	5.28	5.92	6.48	5.47
Egg (No./year)	236.40	309.00	316.80	355.20	388.80	328.20

(Source: Survey data, 1998)

5.4 Forestry and agroforestry management

Farming in the study area was found closely entangled with forest resources to a greater extent; nevertheless dependency on public forest for fodder, food and fuel wood has been reported extremely decreased for the last few years. From the forest, farm

households collect fallen leaves, fuel wood and even fodder. Even though forest under the community management has been increasing, very few households residing near forests have been reaping the products from the community forest, as for most of the farm households community forests are beyond their carrying distance even when they are the members of community forest users' group. Consequently, having no alternatives for energy and fodder, farm households have been keeping a patch of their farmland for tree plantation as a 'household forestry' particularly to meet the needs of firewood and fodder.

Fodder tree growing along the edge of *Bari* land is traditional practice in this area. Almost every farm households have at least 2-3 fodder tree species on their farmland, and up to 15 fodder tree species in some farm household have been recorded during the survey. Almost all tree fodder species were indigenous and naturally grown and or transplanted from the other places. The most common fodder tree species in the area are Nivaro (*Ficus roxburghii*), Dudhilo (*Ficus nemoralis*), Khanyu (*Ficus semicordata*), Gogan (*Saurauia nepaulensis*), Tanki (*Bauhnia purpurea*), and Kutmiro (*Litsea polyantha*) etc. Under the present livestock density per unit of cultivated land, fodder shortage during the pre-monsoon season was mentioned by majority of the farm households, however, severity of fodder shortage was reported amongst the small farm size holders. The average number of fodder in the study site was estimated 15 trees (excluding bamboo bush) per household, which came out to be 4.2 fodder tree per ruminant,

5.5 Homestead gardening

Homestead gardens comprising diverse species of vegetable, fruits and fodder tree were found in the study site. The area under home gardening varied from the minimum of about 100 m^2 to the maximum of about 1000 m^2 depending on available water supply, farm size and the household size. The structure and features of each homestead garden differed, nevertheless, the common goal of homestead gardening was to be self sufficient

in year round vegetable requirement. The functional diversity in homestead gardening in the study area found supplying food, fodder, firewood and mulching materials for agricultural production. As a component of traditional farming systems, homestead gardening were essentially combined with the livestock production systems. They were found located mostly on the down terrace of the dwelling near the livestock shed so that sewage from livestock shed and kitchen could be supplied directly to the garden. Since the gardens were subsistence oriented with the need-based production as a self-provisioning system, they were exclusively organic and labor intensive.

Traditional vegetables species were found commonly grown in the homestead garden. 'Traditional vegetables' mentioned here is defined as those vegetable species which have been growing in the areas over the many years and are adapted in the local environmental niche (Baral *et al.*, 1994). During the field survey it was found that farmers in the study area have been growing a maximum of 21 vegetable species. Among them the most common were pumpkin *(Cucurbita moschata)*, Chayote (*Sechium edule*), colacasia/taro (*Colocasia spp*), tree tomato (*Chphomandra betacea*), balsam apple (*Momordica balsamina*), broad-leafed mustard (*Brassica junci var. rugosa*), cucumber (*Cucumis sativus*), yam (*Dioscorea esculenta*) and Snake gourd (*Trichosanthes anguina*) etc.. Since vegetables are mostly used as relishes in the daily meal and are grown on a small plot of land and they are mainly grown for home consumption, importance is given to the household preference rather than market. Since most of the traditional vegetables are grown in the rainy season, the vegetable consumption pattern has been mentioned highly seasonal. Farm households with small farm size mentioned that they could not spare their land for separate homegarden for vegetable cultivation. Therefore, intercropping of pumpkin and broad bean in maize-millet cropping pattern is a common practice among the small farm households, which perhaps is their major source of fresh vegetable supply. Although, vegetable production was meant primarily for meeting the household requirements, some households sold a part of their total produce in the local *haat* to meet their daily household cash requirement.

Even though, the homestead gardening is an integral part of farming systems, only about 20 percentage of the sample households in the study area were found maintaining year-round fenced homestead gardening. Water scarcity for irrigation during winter and strayed-animal problem were mentioned as the major limiting factor for maintaining year-round homesteads gardening in this area. Because of those constraints it is common practice to keep rainy seasons' surplus vegetables for the dry season consumption. The most common vegetable species stored for future consumption are chayote, radish, rayo, and balsam apple. Chayote is stored in pits between the layers of dried plant materials (e.g. straw, millet husk etc.), radish and rayo are fermented and dried to prepare what is locally called *sinki* and *gundruk*, and the balsam apple are kept by sun drying.

Citrus are the major fruit species growing on the homestead garden. The most common citrus species growing in this area are madarin *(Citrus nobilis)*, sweet orange *(Citrus sinensis)* and lemon (*citrus spp.*). Except some traditional fruits species like guava, peach, plum, pear etc., fruit cultivation was found concentrated in the large farm size holders. Citrus plantation was found virtually nil in the farm households having less than 0.5 hectare of cultivating land (Table 5.4). This scenario implies that the small farm holders under the subsistence farming are not able to sacrifice their farmland for other crops except staple. Having no established market, the surplus fruits particularly non-citrus after the household consumption are either distributed to the neighbor or converted into animal feed. Whereas in the case of citrus, after the household's requirements are met, sold either in the local *haat* or to the fruit collectors who resell in the other external markets. There is a common practice of making *Amilo* (similar to vinegar) and selling them in the local *haat* and/or community or sending to their relatives living in the *terai*, where it is recognized as an important ingredient of pickle making amongst the hill-migrants.

Table 5.4 Households growing main fruit species by farm size category

Farm size (ha)	No. of Hh	% of households growing		
		Mandarin	Orange	Lemon
≤0.50	17	0	0	0
0.51-1.0	27	33	7	37
1.01-1.50	36	31	14	47
1.51-2.0	26	30	8	50
> 2.0	29	52	24	58
Overall	135	32	12	43

NB: Hh = households.

(Source: Survey data, 1998)

5.6 Seasonality and food situation

Seasonality in the agricultural production has direct implication on households' food situation and consumption behavior. Most of the crops grown in the study area are monsoonal implying a seasonal variation in household food supply. As consumption is primarily based on own farm production, it was found that about half of the total sample households in the study area face food deficit during June-July (Figure 5.4) from their own farm production, which is considered as the most food scarce period in the year. Therefore, food sufficiency situation was found decreasing towards the beginning of cropping season. Therefore, pre-monsoon season reflects the food deficit season and the post-monsoon season as food sufficient season in general. November-December, are the most prosperous months from the food availability point of view. However, level food of sufficiency above all depends upon the individual household resources endowment.

Lack of irrigation is one of the most important reasons responsible for the large-scale winter fallow in the study area. Because of no agricultural activities during the winter, poor households who are unable to sustain their living from their own on-farm production are heavily dependent on non-farm laboring during the winter. Therefore, the adult males from poor households move elsewhere out for the temporary labor works. Some of them do vending in different periodic markets (*haat* bazaar) during the whole winter in order to earn for their household sustenance. Similarly, some of them do portering within and outside the community. After storing the main season rice in December, households' main work in the village is to collect firewood for the coming rainy season, which provides some extent an opportunity of earning ways to the poor villagers, particularly women.

As agriculture is the main source of employment, most of the labor force during the agriculture off-season remains slacked. This is further intensified by the seasonal cropping calendar of the study area, which shows that winter season as a slack period for agricultural activities, implying that about 60-80 per cent of the working days during the winter season remain unused. Temporary migration of the adult male household member to *terai* and other cities or even India (Assam) for non-farm labor works during the winter was common in the past. But due to increasing population pressure and unemployment problem in the cities, the trend of temporary migration for labor works from the village, however, has been declining.

Food consumption pattern changes by the season. During the rainy season, there is abundance of green vegetable, but during the pre-monsoon season availability of green vegetable becomes extremely lower. Traditionally preserved dried vegetables: *Sinki* and *Gundruk* (fermented radish and radish/rayo leaves) are mostly used as vegetable relish during the dry season. Wild vegetables and fruit gathering from the open access public land and or forest, streams, gullies and fallow fields is done particularly during the winter and summer seasons. The gathered vegetables are used for household consumption but

the fruits are, however, mostly for individual consumption. A wide range of wild vegetable and fruit species gathered by the villagers in the study area (Appendix Table 5). Vegetable and fruit gathering is not a specified work as it is done at the time of firewood collection, fodder collection and livestock attending. Green vegetables are mainly picked during the pre-monsoon and monsoon when they flourish in the field and uncultivated land. But the wild fruits are available mostly in the winter. Because of its irregularities it is difficult to say how much fruits and vegetable each household gathers in a year. Nevertheless, there is significant role of gathered food particularly vegetables in meeting the households' food requirement and diet diversification especially during the food scarcity period. The accessibility of wild fruits and vegetables has been declining over the years due to over exploitation of available resources as a result of increasing population pressure and livestock gazing

A seasonal consumption pattern of staple food was mentioned among those households who have no sufficient rice for the whole year consumption. Households having no sufficient rice for the whole year manage consumption behavior over season. During the rainy season when there is abundance of milk and vegetables production households prefer to take maize as staple. Similarly when they have heavy workload the rice insufficient farm households take maize and rice mixed as it is considered that maize provides more energy and bulkiness (locally called *Adilo)* in the meal. Since, millet is considered as inferior cereal very few poor farm households consume it as staple food. However it is common to take millet flour occasionally in the form of porridge, irrespective of farm household's economic status.

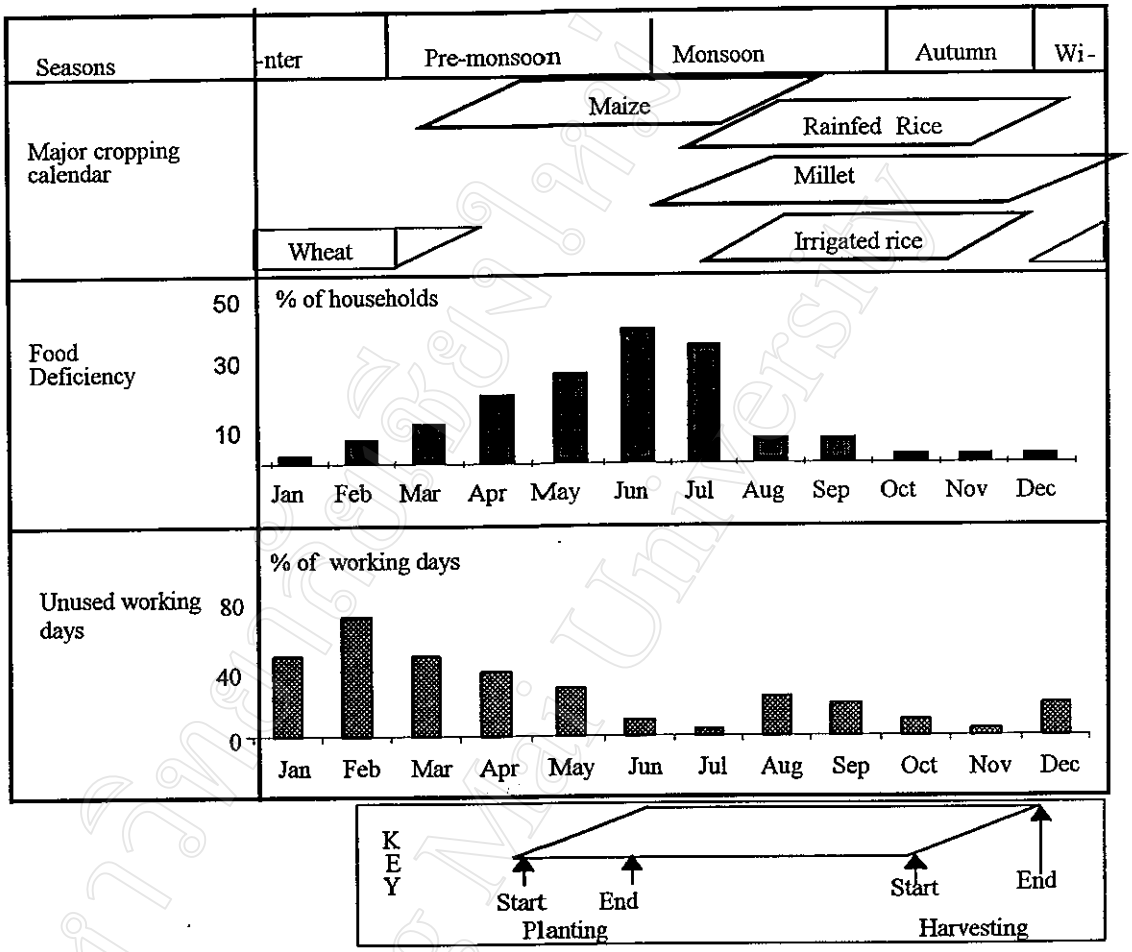

Figure 5.4 Seasonality and food situation
(Source: PRA and household survey, 1998)

5.7 Credit and extension

The network of formal credit and saving at the district level consists of Agricultural Development Bank (ADB/N), Nepal Bank Limited (NBL) and Small Farmer Development Project (SFDP) located at different parts of the district. Except for the few approachable households, ADB/N, sub branch office located at Sukrabare Bazaar, is only the source of formal sector credit for the study area. From the data source of agricultural

development bank, it came to understand that the loan for cereal production, which is smaller in amount and short-term in duration, was the major component of agricultural credit for this area. The outstanding amount of loan for the study are till January 1998 showed that the share of cereal production loan was 42 per cent followed by livestock and horticultural crop (Figure 5.5).

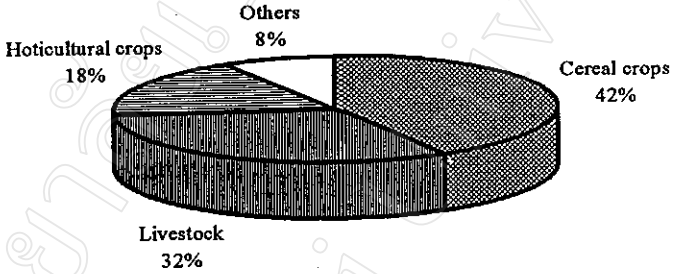

Figure 5.5 Agricultural credit in the study area by sector
(Source: ADB/N Sukrabare, 1998)

Other than agricultural credit, ADB/N also provides credit for rural enterprises, however, the amount and number of borrower of such loans were found negligible. Due to lack of targeted credit program majority of the small farmers who are unable to give collateral (land right certificate) to the bank are therefore deprived of institutional credit. Apparently lack of capital has made the poor difficult to undertake productive investment, which further decreased their labor productivity and consequently the total production extremely pushing them into the vicious cycle of poverty and food insecurity.

Participation in different extension activities plays important role in adoption and adaptation of agricultural technologies in the rural area where there are no opportunities of agricultural information other than conventional government extension services. Despite the important role of government extension services in the rural area, it has been

reported that there is extremely low intensity of agricultural extension services provided by the government extension agents. It is important to mention here that more than 50 per cent of the sample households even do not know about the existence of agricultural extension service center in their area. Furthermore, the survey results indicate that knowingly or unknowingly the extension and research activities in the study area found to be concentrated among the influencing large farm size holders (Table. 5.5). Among the sample households with less than 0.5 hectare of cultivated land, only one household has ever participated in agricultural extension activities viz. demonstration, training and visit. The possible interpretation of such disparity in participation could be either the technologies are not suitable for the small holders or there might have some influences from the large farmers on extension personnel. The similar result was reported by Khadka (1987) indicating inefficient performances of government extension services in the eastern hills of Nepal. The fundamental reason behind poor extension services might be due to the lack of sufficient trained manpower, and large area of their working. An Agricultural Service Center with two technical staff has to cover about 7-10 VDCs with approximately 2,000-3,000 farm households, which seems extremely difficult for them to provide efficient technical services to all farm households. Furthermore, agricultural technicians working in the hills have no sufficient technological background on hill farming systems as they are mostly trained in those institutes located in the tropical environment, where agricultural production systems are different than that of hill. This could be another important reason responsible for inefficient agricultural extension services in the rural hills.

Table 5.5 Participation in agricultural research and extension by farm size category

Response on	Farm size (ha.)				
	≤0.50	0.51-1.0	1.01-1.50	1.51-2.0	> 2.0
	----------Responses in %----------				
Participation in demonstration:					
• Yes	6	15	14	12	28
• No	94	85	86	88	62
Participation in farmers' visit:					
• Yes	0	11	14	10	10
• No	100	89	86	90	90
Participation in research:					
• Yes	6	11	33	31	34
• No	94	89	67	69	66
Participation in agricultural training:					
• Yes	6	7	8	15	21
• No	94	93	92	85	79

(Source: Survey data, 1998)

5.8 Adoption of modern varieties

Cereals being the primary source of food, adoption of improved varieties of cereal crops is often consider important to increase food production and productivity. The promising varieties of maize, wheat and rice recommended for the eastern hill condition was included in the study. In the case of millet none of the improved millet variety was found recommended in the eastern hills context. Therefore, adoption index for improved varieties (described in Chapter III, p.35), included only three major crops, namely rice, maize and wheat. The overall adoption index by farm size category is given in Table 5.6.

Table 5.6. Adoption index of modern varieties (MV) of major cereal crops

Farm size category	Percentage of households using MV	Average adoption index
≤0.50	28.5	13.55
0.51-1.0	33	26.90
1.01-1.50	51.8	32.10
1.51-2.0	69.3	38.09
> 2.0	68.7	44.94
Overall	60.2	32.64

(Source: Survey data, 1998)

As there are limited choice of varieties in each crop, the adoption index was found ranging from 4 per cent to the maximum of about 87 per cent. Based on the individual household's resource base, access to information, land type etc. the level of MV adoption was found varied. However, looking at the trend of MV adoption in relation with farm size, there was a significant correlation (r =0.42) between adoption index and farm size.

5.9 Characteristic features of farming systems of the study area

The choice of agricultural activities within the farm households particularly under the subsistence production systems heavily depends on the type of land the farm household owned. Therefore, the characteristic features of the individual farm were found basically determined by the land type. In the hills of Nepal, the agricultural lands are primarily divided mainly into two types: *Khet* and *Bari*. The distinction between the two rests on the production of rice. The *Khet* lands are carefully terraced in order to make them possible for water retention, so that rice could be planted. Moreover, *Khet* lands are more valuable than *Bari* land even though the total production from *Bari* might

be higher. Assuming that different proportions of two distinct land type determine the overall production level, resource utilization and finally the choice of farm activities, three different types of farm typologies have been defined for the purpose of this study, namely: mainly *Khet*, *Khet-Bari* and mainly *Bari*. The principle characteristic features of those farm types are summarized in Table 5.7

Table 5.7 Principal characteristic of farming systems of the study area by farm typology

Characteristic	Farm type		
	Mainly *Khet*[1]	*Khet-Bari*[2]	Mainly *Bari*[3]
Objectives	-Food and cash sufficiency	-Food and cash security	-Food security
Farm size	Relatively large	Medium	Relatively small
Cropping intensity	Low	medium	high
Market orientation	-Few	-Very few	-Almost none
Crop Production system	Mixed farming Rice dominant Diversified home garden with mixed fruits and vegetable species	-Mixed farming -Maize dominant -Home gardening with one or two fruit species and seasonal vegetable	-Mixed farming -Maize dominant -Home garden almost absent
Livestock production systems	-Mixed herd -Large animal dominant	-Mixed herd -Both large and small animal	-Mixed herd -Small animal dominant
Resource utilization	-Local resources -External inputs relatively higher -High level of resource recycling	-Local resources -External inputs -relatively lower -High level of resource recycling	-Local resources -Negligible external resources -Low level of resource recycling
Productivity	-Medium	-Relatively high	-Relatively low

[1] *Khet* land over 60 %
[2] *Khet* land 31-60 % and *Bari* land 40-69%
[3] *Khet* land less than 30 %
(Source: Conlin and Falk, 1979)

Biodiversity	-Moderate	-Relatively high	-Relatively low
Linkage among the system components	-Strong	- strong	-Relatively weak
Economic Risk	-Low	-Medium	-High
Cropping intensity	-Relatively low	-High	-High
Strategies	-Long-term investment -Land acquisition -Improved breed and varieties	cost minimization -Increase on-farm biodivesrity -Use of different agroecological niche	-Diversification of off-farm income sources -Risk minimization (use of local cultivars)

The supporting capacity of farm is improved if substantial proportion of *khet* land is held. As a result, the farm households' objectives and strategies of farming shifted from mere food security to food and cash security when farm productions sufficed their household food consumption requirement. The cropping intensity, on the other hand, decreased as the increased proportion of *Khet* land, since most of the *Khet* lands in the study area are rainfed with single of main season rice. With the low economic risk, the farm households with high proportion of *Khet* land are of risk taking nature and thus improved technology adoption increased with the increased proportion of *Khet* land. Household with smaller proportion *Khet* land, who are unable to support their food requirement from their own farm production diversified their off-farm income for their sheer survival.