

DAIRY PRODUCTION AND ITS IMPLICATION IN HOUSEHOLD INCOME IN THE TARAI REGION OF NEPAL: A CASE STUDY OF CHITWAN DISTRICT

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Introduction

Nepal is a mountainous country with agriculture as its economic mainstay. The percentage of people dependent on agriculture has declined gradually from 81% in 1991 to 76 % in 2002 (CBS, 2002). Only about 20% of the total land area can be cultivated in a mountainous country like Nepal. With the typical geographical condition and other natural reasons, the government of Nepal has to face many challenges in providing basic infrastructure facilities and services in most part of the country. Due to the lack of agricultural infrastructures such as roads, irrigation and so on, agriculture has remained almost stagnant. Its share in the gross domestic products has been constantly decreasing. Although the nature and the form of the problem of farming system in the Tarai are different from those in the hills and the mountain, they are no less severe. The Tarai is highly influenced by migration from the mountains, the hills and neighbouring country India. The phenomenon of migration has been the most striking reason for the rapid population growth in the Tarai region. The National Census 1991 reports that the population in the Tarai is increasing at a rate of 4.2% per annum contrasting with that of 1.6% in the hills and a national average of 2.2%. Such a rapid increase in population density in the Tarai has considerably increased population pressure on the existing land and forest resources; consequently the surpluses of food grains have been rapidly declined. Thus, the production of food grains alone has not been able to meet the ever-increasing food needs for the people. Hence, people have been practicing different economic activities to maintain their livelihood.

Livestock farming being a major component of Nepalese farming system is becoming one of the important occupations in the rural area of Nepal. It contributes 31% of agriculture gross domestic product (GDP), among this, 53% derived from the hills, 38% from the Tarai and 9% from the mountains (APP, 1995). Livestock farming, especially, dairy farming alone contributes 78% in total AGDP. It is presently undergoing a transition phase from subsistence to commercial dairy farming in the various places of the Tarai region due to the increase of milk marketing facilities in the area. Dairy farming has been helping the farmers to earn cash income to fulfill their basic needs, at the same time they can get manure as by-product and draft power

for agricultural production. One of the other important aspects of dairy farming is to generate energy in household level for cooking and heating in terms of biogas, which is produced by decomposition of animal dung into an airtight digester. Biogas technology is one of the technologies that is renewable and is regarded as directly contributing in minimizing the over use of traditional energy sources² in the rural area where only 1% of the people have access to the commercial energy sources. In the other hand, numerous people are involved in the production, processing and trading of dairy and dairy products. This provides the employment opportunities for the rural people. Sales of dairy animals, milk and milk products make up a considerable proportion of the average farmer's income. Dairy is also a source of supply of animal protein (cows for milk, and buffalo for milk and meat) through the consumption of milk and milk products and meat, which can positively effect in improvement of the health of people. Hence, the analysis of contribution of dairy production and its implication to the household income in the rural setting is a research issue. Further, the analysis of occupational structure and their contribution in household income is also becoming important. Consequently, the main objective of this study is to analyze contribution of dairy production to household income and examine the occupational structure of the rural households. This will further examine socio-economic characteristics of dairy farmers, dairy production costs and net return to farm from dairy production and examining the share of different economic activities among the dairy farmers.

Methodology

Multistage sampling techniques were used to select district, Village Development Committee (VDC) and household for the empirical study. District and VDC were selected with purposive sampling process among dairy pocket areas, having relatively high numbers of dairy animal holdings and high milk production. Households were selected randomly among the dairy farmers. In order to collect primary data in household level, detail survey was conducted within 104 households from two VDCs (dairy pocket areas) in Chitwan district. It comprises 4% of the total households of surveyed villages. A semi-structured interview approach was also conducted to collect additional data. The collected data will be divided into three farmer's group according to farm size; large, medium and small farmer. Information on socio-economic characteristics of those dairy farmers, agricultural land distribution, dairy animal holdings, income from dairy production were compiled and analyzed according to three farmers groups by using statistical tools; Excel and SPSS. Information on income and percentage share from different economic activities other than dairy production were also analysed to evaluate their significance to the total household economy.

Dairy Farming in Nepal

Dairy animals that include cow and buffalo evenly distributed throughout the country, with some predominance of cow on the Tarai and lower hills. About 75% of Nepalese household keep cow and 47.8% keep buffalo mainly for milk, draught power and manure for their farmland. There is about 7.0 million heads cow with the annual increment of 0.05% and 3.4 million heads of buffalo, growing at a rate of about 1.6 % per annum in the year 2001 (Table 1). The raising of buffalo occurs mainly in the Hills (56.7%) and the Tarai (34%). Share of both cow and buffalo is comparatively higher in the hills followed by the Tarai and the mountain.

Table 1: Number of Cattles in Nepal according to Geographical Regions

| Region | Animals | Average Animal | Growth Rate | Share in Total(%) |
|----------|---------|----------------|-------------|-------------------|
| Mountain | Cow | 819,243 | -0.43 | 11.66 |
| | Buffalo | 313,500 | 1.17 | 9.18 |
| Hill | Cow | 3,447,598 | 0.12 | 49.06 |
| | Buffalo | 1,939,134 | 1.17 | 56.77 |
| Tarai | Cow | 2,760,302 | 0.11 | 39.28 |
| | Buffalo | 1,163,435 | 2.56 | 34.06 |
| Nepal | Cow | 7,027,143 | 0.05 | 100.00 |
| | Buffalo | 3,416,069 | 1.64 | 100.00 |

Source: CBS, 2001.

Cow and buffalo are the main grazing dairy animals for a farm household in the Tarai region. The main cow breeds found in the region are *Bos taurus Jersey*, *Holstein*, *Bos indicus Haryana* and *Sahiwal*. Buffalo breeds are crossbred Murrah from India as a result of direct importation from India. It is also supported by the upgrading programme implemented by the Department of Agriculture Development (DAD) using both natural services and artificial insemination. Murrah crossbred are more common in the mid-hills and the Tarai particularly where access to milk market is good. Dairy animals are reared in the region mostly to get manure for their farmland and the draught power used in cultivation. Female calves are reared as herd replacements while male calves are either reared for replacement of draught oxen for ploughing and for pulling carts, or they are neglected, killed, or sold to buyers from India and local people. Buffalo is also used for ploughing in the Tarai region. Female buffalo calves receive more care than males due to the milk. Male buffalo calves are neglected and die, or are weaned very early and slaughtered for meat or sold to buyers from India and the local market. Buffalo milk, which contains high amount of milk fats, is preferred by both

producers and consumers over cow milk. This results in the lactating buffaloes in the farm household herd being fed better than the lactating cows. Buffalo milk is a more valuable product than cow milk and so lactating buffalo are the first animal to be stall fed when grazing is insufficient. As a result of having less grazing land and forest, more crop residues (paddy, wheat, maize, cotton, sugar cane tops, lentils) are fed. It is generally supplemented with some concentrates. Concentrate feeding, locally known as '*kundo*'³ is given to the lactating animals, which is common to most farmers in Nepal. The amount of stall feeding relative to grazing is more in the Tarai than the mid-hills. The forage utilized in the region generally includes; grazing on roadsides, uncultivated land, forest (near the Siwalik), on cultivated land after harvest, and on fallow land.

Milk production varies according to geographical region. Table 2 shows the number of milking animal and milk production according to region, which is less in the Tarai compared to the hill, however, the milk yield is highest in the Tarai among the other regions. The milk yield of cow and buffalo is 450 kg and 962 kg per year respectively, which is the highest milk yield in the region compared to the hill and mountain. Cow milk contributes only about 32% of the total milk production with average milk yield of 401 kg per year. A large share of milk production is produced by buffalo, which contributes 68% in total milk production having milk yield of 834 kg per year.

Table 2: Milk Production and Yield according to Geographical Region

| Region | Livestock | Total Population | Milking Animal | Milk Production (in MT) | Milk Yield (Kg/Year) |
|----------|-----------|------------------|----------------|-------------------------|----------------------|
| Mountain | Cow | 819,243 | 104,533 | 33,882 | 324 |
| | Buffalo | 313,500 | 81,802 | 57,632 | 705 |
| Hill | Cow | 3,447,598 | 459,703 | 178,907 | 389 |
| | Buffalo | 1,939,134 | 567,007 | 446,660 | 787 |
| Tarai | Cow | 2,760,302 | 288,347 | 129,949 | 450 |
| | Buffalo | 1,163,435 | 288,002 | 277,102 | 962 |
| Nepal | Cow | 7,027,143 | 852,583 | 342,738 | 401 |
| | Buffalo | 3,416,069 | 936,811 | 781,394 | 834 |

Source: APSD, 2001

Dairy animals are kept mainly for milk, milk product e.g. ghee, manure (fertilizer and fuel), meat and hides. They are also used for ploughing and pulling carts in Tarai region. In Tarai cow is more important than buffalo for draught as in the mid-hills. Both buffalo and cow are used for threshing by trampling, although beating paddy sheaves by hand is more common in Tarai. Milk produced by buffalo and cow is sold to Dairy Development Corporation (DDC) collection centres, private urban buyers and private dairy

farm. Ghee, a milk product, is sold mostly to India. Buffaloes are sold for slaughter in the district urban centres and Kathmandu. Male buffalo and male cow for draught purposes are sold in the locality where they are raised. Late pregnancy or early calving female buffaloes have wider market in the region.

Chronological Development and Present Situation of Dairy Farming in Nepal

In Nepal, dairy development activities began in 1952 with the establishment of a small-scale milk processing plant on an experimental basis in Tusal, a village in the Kavreplanchok district, under the Department of Agriculture (DoA). After that few yak cheese factories were started with an assistance of Food and Agriculture Organization (FAO) of the United Nations in 1952/53. With the growing prospect of expanding the dairy sector, the First Five-Year Plan (1952-57) emphasized the need for developing a modern dairy industry. It had programmes to establish milk collecting centres and central milk processing plant in Kathmandu valley, cheese making plants, using yak milk, in high hills and ghee purification centre at the exporting points in the Tarai. In order to streamline the dairy development activities, Dairy Development Commission was formed in 1955, and it was then converted into the Dairy Development Board in 1962. In accordance with the Corporation Act of 1964, the board was again converted into the Dairy Development Corporation (DDC) in 1969 in order to meet the growing milk demand in the Kathmandu valley. The main objectives of DDC are to provide guaranteed market, fair price to the rural milk producers, supply pasteurized milk and other standard dairy products to the urban consumers. When DDC started its operation it had only Kathmandu Milk Supply Scheme (KMSS) and one Cheese Production and Supply Scheme with four Cheese Production Centres. Over the years, DDC gradually extended its activity area outside Kathmandu Valley, and established various milk supply schemes in different parts of the country to meet the growing demand for processed milk and milk products. There are six milk supply schemes and one Milk Production and Distribution Scheme shown in Table 3.

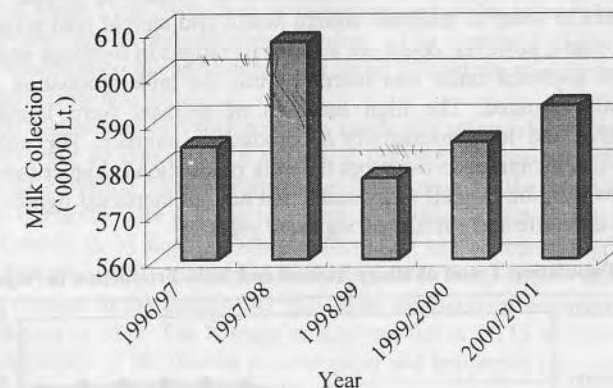
Table 3: Different Milk Supply Schemes Established by DDC

| Milk Supply Scheme | District | Date of Establishment | Production Capacity (Per Shift) |
|---|------------|-----------------------|---|
| Kathmandu Milk Supply Scheme (KMSS) | Kathmandu | 1978 | 75,000 ltrs. |
| Biratnagar Milk Supply Scheme (BMSS) | Morang | 1973 | 25,000 ltrs. & 3 metric ton powder milk from 40,000 ltrs. of milk per day |
| Hetauda Milk Supply Scheme (HMSS) | Makawanpur | 1974 | 15,000 ltrs. |
| Pokhara Milk Supply Scheme (PMSS) | Kaski | 1980 | 10,000 ltrs. |
| Lumbini Milk Supply Scheme (LMSS) | Rupandehi | - | 2,500 ltrs. |
| Madhay Paschimanchal Milk Supply Scheme (MPMSS) | Banke | - | - |

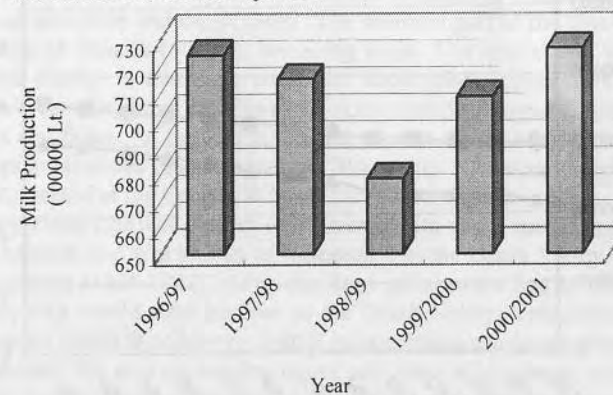
Source: DDC, 2003

There is a mini processing plant recently established under the LMSS. Thus, the scheme has just started selling pasteurized milk in the local market. Since the sales volume is small, the scheme is transshipping raw milk to KMSS and PMSS to supply in those areas. Madhay Paschimanchal Supply Scheme (MPSS) has recently been established in order to supply pasteurized milk in the local area. Since MPSS has not yet established milk-processing plant (under way), it also has been transshipping raw milk to KMSS. Hetauda Milk Supply Scheme supports KMSS by supplying excess milk that is above their local requirement, where as BMSS manufactures skimmed milk powder from its excess milk and that of other milk supply schemes as well.

Dairy Development Corporation collects cow, buffalo and Yak/chaury milk from different districts. Milk is collected through the farmer owned organizations such as Milk Producer's Associations (MPAs) and Milk Producer's Cooperative Societies (MPCS). The present milk collection network of DDC has spread from Panchthar in the East to Surkhet in the west. The collection network under different Milk Supply Schemes is presented in Annex A. All these schemes have a responsibility of collection of milk and processing of milk products. At present, the DDC has a milk collection network in 39 districts throughout the country. Figure 1 and Figure 2 shows the annual milk collection and production of the DDC from 1996 to 2001.

Figure 1: Total Milk Collection by DDC

Source: DDC, 2003

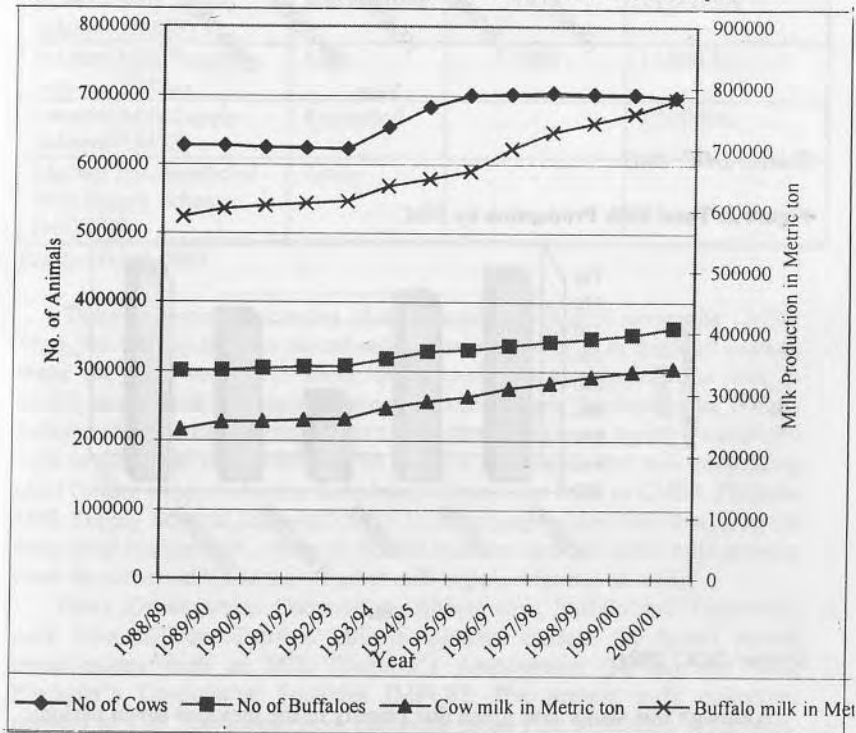
Figure 2: Total Milk Production by DDC

Source: DDC, 2003

Although this sector was given due priority in the previous seven periodic Five-Year Plans, it could not achieve much success as targeted. Consequently, it has not been possible to maintain an adequate supply of necessary milk and milk products for the growing population. Figure 3 shows the trend of dairy animal population and milk production from respective animals during 1988 to 2001 in Nepal. The cow population has increased continuously during the year 1992/93 to 1995/96. The Eight Five-Year Plans encouraged the

participation of private sector to establish animal hospitals. It also launched various programmes such as introduction of improved breed, vaccine programmes in order to maintain animal health and animal feed programme. The eight plans, however, could not achieve its targets in livestock sector. The number of livestock units was increased but the milk production has not significantly changed. The high numbers of animals were found to be unproductive and low productivity of productive animals. The number of buffalo is low compared to cattle but the milk production is higher than that of cattle. However, the over all milk production has not increased significantly in both the case cattle and buffalo during these years.

Figure 3: Population Trend of Dairy Animal and Milk Production in Nepal



Source: APSD, 2002

General Features of Chitwan District

Chitwan district lies in the Tarai (Plain) region, which is often called "Grain Basket" as it has more capacity to grow crops and other farming products. The district is agriculturally significant as it is endowed with very fertile

alluvial soil from the Rapti River. The district is one of the biggest districts in the Central Inner Tarai⁴, which is an important part of the country both from the settlement and economic point of view. The economy of the district mostly depends upon the agriculture, and about 73% of the workforces derive their income from this activity.

The district is located 146 kilometers south of Kathmandu, the capital of Nepal, covering an area of 2218 sq. km in the central development region. The district elevation ranges from about 200 meters in the south to 2000 meters in the north. The average temperature of this district ranges from 18 degrees Celsius to 31 degree Celsius. According to the record prepared by Rampur Station in 1994 the minimum temperature of the district recorded is 2 degree Celsius in December and maximum temperature recorded is 38.2 degree Celsius in May. The average annual rainfall is 2,133 milliliters. The climatic condition of the district is subtropical and temperate type depending upon the topography of the district.

From geographical point of view, the district consists of three major topographic divisions; Mahabharat Hills in the north, Siwalik Hills in the south and inner Tarai region in the centre and the west. The northern mountainous parts of the district, about 2000m in height are inaccessible due to the steep elevation and dense forest. The southern part of the district is in the foothills of Siwalik (600 m), bordering India. The central and southern part of the district is the basin along the Rapti River known as Chitwan valley. Between the plains and Siwalik lies the dense subtropical forest, rich with flora and fauna. Administratively, the district is divided into 36 VDCs and two municipalities (Ratnanagar and Bharatpur). Bharatpur, headquarter of district, located in the Central Western part of the district.

Before 1950, Chitwan district was covered with dense subtropical forest prone to Malaria and was known as *Kalapani* i. e. the Death Valley. During the Rana period (1855-1951), when the Rana government had to punish an individual, they would send him/her to the Death Valley. This implies that when a person enters the Chitwan district he/she would surely not return. The rulers also used this area for hunting tigers, and other wild animals, often as a state event with foreign dignitaries. At that time people did not like to go there for settlement. However, after launching of simultaneous programme of planned settlement and malaria eradication in late 1950s, people started going there for settlement. To encourage the *Pahadis* (hilly people) to permanently settle in Chitwan, government offered land and free tractor service as incentives. Chitwan then became an attractive place for the *pahadis*. Gradually people from all over the country composing of different ethnic groups, culture and religions started migrating to the district. Not only over all the country but also from the neighboring country especially India started migrating to the district because of no restrictions whatsoever in crossing the inter-national boundary between India and Nepal. During the harvest season,

many Indian labours would come to work and finally settled in the district in most cases. However, still some forests are secured along *Char koshe Jhadi* (8-mile long dense subtropical forest between the plains and Siwalik Hills) and most of the Chitwan National Park.

Due to the high influence of migration, the population of the district increased sharply after 1950s. Table 4 shows the number of population and population growth within the given time. The maximum percentage of growth is after eradication of malaria in 1954, 250% during 1954-1961. Then after the percentage growth during each decade has decreased gradually compared to 1950s. However, the average growth rate is about 3.5% annually in each decade, greater than the regional average growth of 2.9% and national average growth of 2.7%.

Table 4: Population and Percentage Growth in Chitwan District

| Year | Total Population | Total Percentage Population Growth | |
|------|------------------|------------------------------------|-----|
| 1954 | 42,822 | - | - |
| 1961 | 107,394 | 1954-1961 | 250 |
| 1971 | 183,644 | 1961-1971 | 171 |
| 1981 | 259,571 | 1971-1981 | 141 |
| 1991 | 354,488 | 1981-1991 | 137 |
| 2001 | 470,713 | 1991-2001 | 132 |

Source: Based on Pradhan & Routray, 1992

Compared to other parts of the Tarai region, Chitwan District is relatively more accessible. Markets, hospitals, and educational centres are within accessible distance and the transportation facilities are easily available. It has two airports and two highways connected to the district with all other districts of the Tarai and some districts of the central and western Hills. The Institute of Agriculture and Animal Science at Rampur plays a key role in development of dairy farming in the district. Other institutions such as horticulture farm, cooperative, division of women development and financial institutions directly related to agricultural development in the district.

The total arable land area of Chitwan district is 46,894 ha, of which 44,391 ha of land are cultivated. There are 142,422 ha of forestland, 18,882 ha of pastureland, and 13,602 ha of land are covered by rivers, mountains and so on. Among cultivated land only 28% is irrigated throughout the year while rest of the cultivated land is irrigated only partially. Since the district has more capacity to grow crops, it exports food grains to India and other parts of Nepal. Table 5 shows the cultivated area, production, and yield of major crops in Chitwan comparing to the country as a whole.

Table 5: Cultivated Area, Production and Yield of different Crops in Chitwan District for 1999/2000.

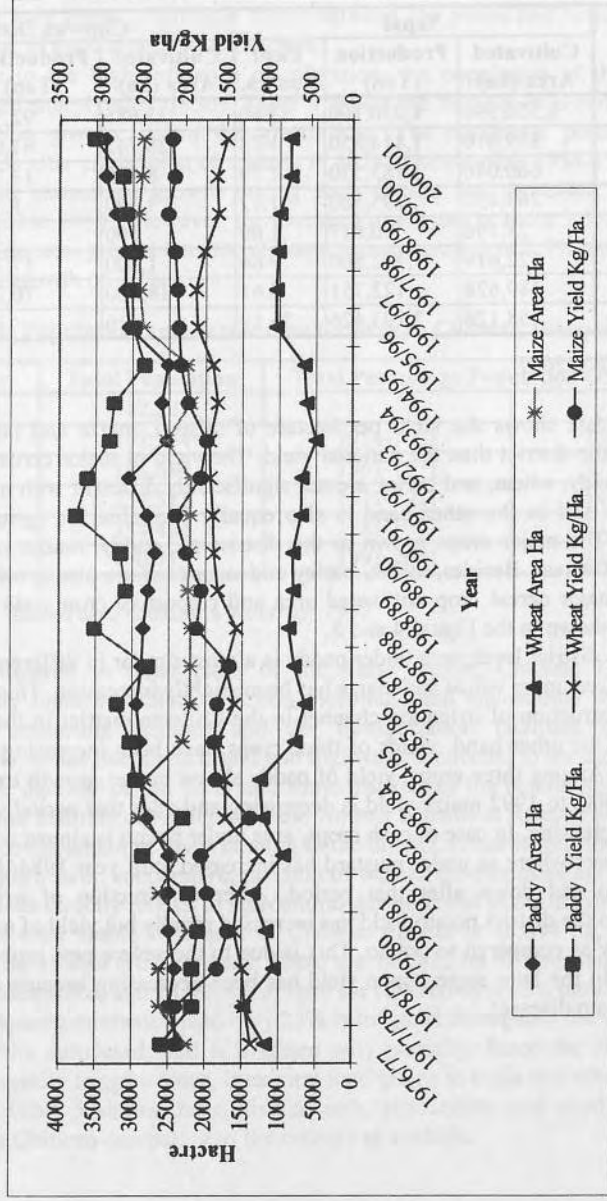
| Crops | Nepal | | | Chitwan District | | |
|-----------|----------------------|------------------|---------------|----------------------|------------------|----------------|
| | Cultivated Area (ha) | Production (Ton) | Yield Ton/ha. | Cultivated Area (ha) | Production (Ton) | Yield (Ton/ha) |
| Paddy | 1,550,990 | 4,030,100 | 2.60 | 33,685 | 92,500 | 2.75 |
| Maize | 819,010 | 1,414,850 | 1.73 | 28,742 | 61,083 | 2.13 |
| Wheat | 660,040 | 1,183,530 | 1.79 | 8,500 | 13,770 | 1.62 |
| Millet | 263,450 | 295,380 | 1.12 | 1,500 | 1,375 | 0.92 |
| Barley | 28,196 | 30,817 | 1.09 | 400 | 360 | 0.90 |
| Potato | 122,619 | 1,182,500 | 9.64 | 1,600 | 17,750 | 11.09 |
| Oilseeds | 189,628 | 122,751 | 0.65 | 18,000 | 70,200 | 3.90 |
| Sugarcane | 58,126 | 2,103,426 | 36.19 | 10 | 320 | 32.00 |

Source: CBS, 2001

This data shows the yield per hectare of oilseed, maize and potato is higher in the district than the national yield. The yield of major cereal crops such as paddy, wheat, and barley are not significantly different with national yield. The soil in the other hand is also equally favorable for agricultural products. The major crops grown in the district are paddy, maize, oilseed, potato and wheat. Besides, millet, barley and sugarcane are also grown. The trend of major cereal crop cultivated area and respective crop yield of the district is shown in the Figure 4 and 5.

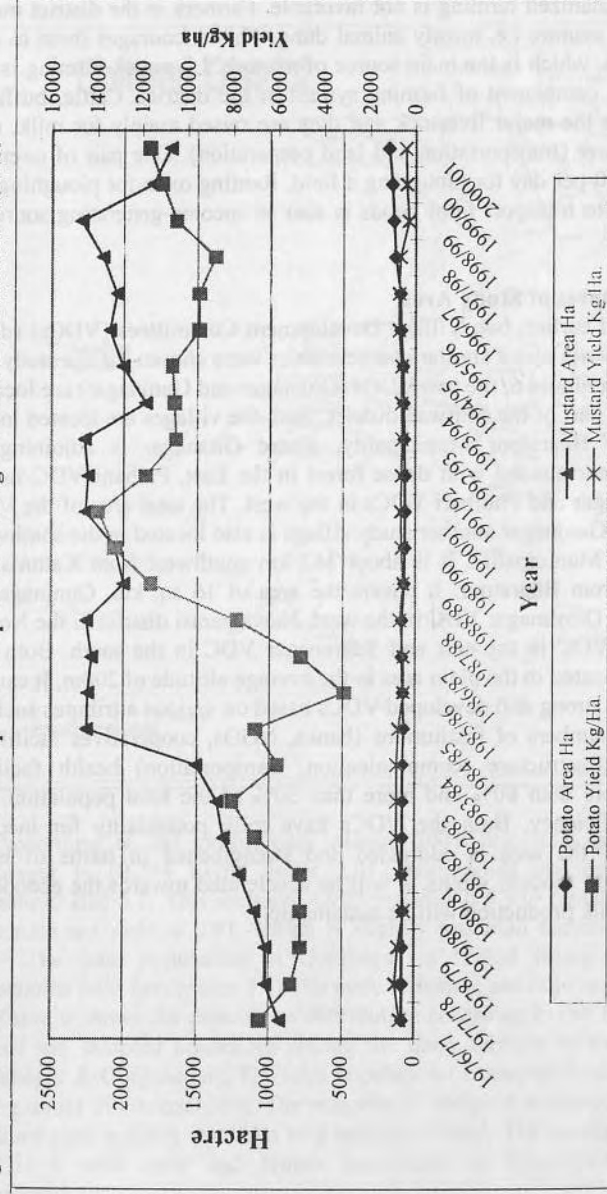
In the district level, area under paddy is almost similar in different years where as area under wheat and maize has been slightly increasing. This is due to the construction of irrigation channel in the Chitwan district in the latter period. In the other hand, yields of three crops have been increasing but in slow rate. Among three crops, yield of paddy shows higher growth trend. In the year 1985 to 1992 maize yield is decreasing and after that period yield is slightly increasing. In case of cash crops, area under potato is almost constant over 25 years where as under mustard has increased until year 1984/ 85 and slightly up and down after that period. After construction of irrigation channels in the district potato yield has increased rapidly but yield of mustard is very low as compared to potato. This is due to the severe pest problem in this crop. In the later stage potato yield has been decreasing because of late blight (potato disease).

Figure 4: Estimated Area for Selected Cash Crop and Crop Yield During 1976-2001 in Chitwan district



Source: CBS, 1993, 1997 and 2002

Figure 5: Estimated Area for Selected Crop and Crop Yield During 1976-2001 in Chitwan District



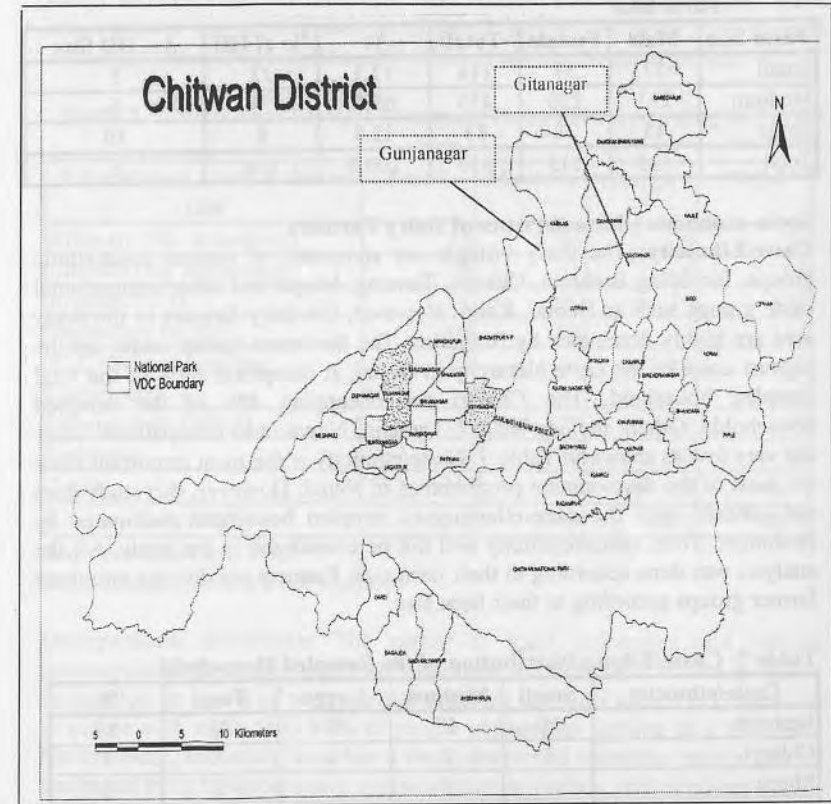
Source: CBS, 1993, 1997 and 2002.

The farming system is traditional and based on human labour and animal power, and depends mostly upon the rain for irrigation. Since the landholding is small, mechanized farming is not favorable. Farmers in the district mainly use compost manure i.e. mostly animal dung. This encourages them to raise dairy animals, which is the main source of manure. Livestock farming is also an important component of farming system in the district. Cattle, buffaloes and goats are the major livestock and they are raised mainly for milk, meat and draft power (transportation and land preparation). One pair of oxen can earn NRs. 210 per day for ploughing a field. Renting oxen for ploughing and pulling carts to transport farm goods is also an income-generating source in the district.

General Features of Study Area

As mentioned earlier, two Village Development Committees (VDCs) (dairy pocket area), with about similar characteristics were chosen for the study. As can be seen in Figure 6, the two VDCs (Gitanagar and Gunjanagar) are located in the central part of the Chitwan district. Both the villages are located in the southwest of Bharatpur Municipality, where Gitanagar is adjoining it. Gitanagar is surrounded with dense forest in the East, Pathani VDC in the south, Shivnagar and Phulbari VDCs in the west. The total area of the VDC is 16 sq. km. Gunjanagar another study village is also located in the southwest of Bharatpur Municipality. It is about 162 km southwest from Kathmandu and 16 km from Bharatpur. It covers the area of 16 sq. km. Gunjanagar is delineated by Dibyanagar VDC in the west, Nawalparasi district in the North, Saradanagar VDC in the east and Sukranagar VDC in the south. Both the villages are located in the plain area in the average altitude of 200m. It can be considered as strong and developed VDCs based on various attributes such as presence of numbers of institutions (banks, NGOs, cooperatives facilities) and other infrastructure (communication, transportation) health facility, electricity more than 80% and more than 50% of the total population has food self-sufficiency. Both the VDCs have milk potentiality for income generation. If the area is addressed and strengthened in terms of milk production with modern inputs, it will be accelerated towards the economic growth and milk production will be sustainable.

Figure 6: Map of Chitwan District showing Study Villages



According to the preliminary census 2001, the total population of Gitanagar is 10,244 living under 2,012 households making an average household size 5.1. This includes 4,905 males and 5,339 females. The male to female sex ratio is 0.91, which is slightly less than national average of 0.99. The total population in Gunjanagar is 12,868 living under 2,499 households with family size 5.1. The male to female sex ratio is 0.93.

Table 6 shows the population distribution according to the farm size and sex of the sampled household among the dairy farmers in the study area (Gitanagar & Gunjanagar). The total population of sampled household is 650 living under 104 households. The majority of sampled household belongs to medium size, holding less than two hectare of land. The average household size is 6 with male and female population is approximately equally distributed.

Table 6: Population Distribution of the Sampled Household according to Farm Size

| Farm Size | Male | Female | Total | % | No of HH | Av. HH Size |
|-----------|------|--------|-------|-------|----------|-------------|
| Small | 57 | 57 | 114 | 17.5 | 22 | 5 |
| Medium | 233 | 220 | 453 | 69.7 | 74 | 6 |
| Large | 45 | 38 | 83 | 12.8 | 8 | 10 |
| Total | 335 | 315 | 650 | 100.0 | 104 | 6 |

Socio-economic Characteristics of Dairy Farmers

Caste/Ethnicity: The study villages are composed of various caste/ethnic groups, including Brahmin, Chhetri, Tamang, Magar and other occupational caste groups such as Damai, Kami. However, the dairy farmers in the study area are highly dominated by Brahmins. The Brahmins (priest caste) are the highest caste in the caste hierarchy in Nepal. It comprises 89% of the total sampled household. The Chhetri are occupying 4% of the sampled households. Others include Magar, Tamang, Newar and occupational caste are very low as shown in Table 7. Caste/ethnicity is the most important issue for most of the development programmes in Nepal. However, this study does not concern with the caste/ethnicity as sampled household dominated by Brahmins. Thus, castes/ethnicity will not be considered in the study. All the analysis was done according to their farm size. Farmers are divided into three farmer groups according to their farm size.

Table 7: Caste/Ethnic Distribution of the Sampled Household

| Caste/ethnicity | Small | Medium | Large | Total | % |
|-----------------|-------|--------|-------|-------|-----|
| Brahmin | 20 | 67 | 6 | 93 | 89 |
| Chhetri | 1 | 2 | 1 | 4 | 4 |
| Magar | | 3 | | 3 | 3 |
| Others | 1 | 2 | 1 | 4 | 4 |
| Total | 22 | 74 | 8 | 104 | 100 |

Source: Field Visit, 2002

Others: Tamang, Newar, Mahato, Kamali

Education Status: Education is one of the important human capitals, which plays important role in determining household status in the society. In the research area, there are ten primary, five secondary and four higher secondary schools in the various ward. Most of the schools are privately funded. With the presence of number of educational institution, the literacy rate is as high as 88.5% among the sampled household members including those who are just literate with no schooling. The large percentage of the sampled household members has education in the range of primary to intermediate level. The highest percentage of graduate people belongs to large farmer

(13%). This implies better-educated people are generally not involving in dairy farming due to the fact that better education provides more opportunities for the services in different sectors. However, the average education status is not significantly different among the three groups.

Table 8: Educational Status of Sampled Household According to Farm Size

| Educational Level & Farm size | Small | Medium | Large | Total |
|----------------------------------|-------|--------|-------|-------|
| Illiterate (No Schooling) | 15 | 46 | 9 | 70 |
| Literate (No Schooling) | 8 | 51 | 6 | 65 |
| Primary (1-5) | 33 | 90 | 19 | 142 |
| Secondary (6-10) | 19 | 90 | 12 | 121 |
| SLC (School Leaving Certificate) | 11 | 31 | 10 | 52 |
| Intermediate (10+2) | 16 | 77 | 12 | 105 |
| Graduate | 6 | 36 | 10 | 52 |
| Total | 108 | 421 | 78 | 607 |
| Literacy Rate (%) | 86.1 | 89.0 | 88.5 | 88.5 |

Source: Field Visit, 2002

Note: Under 6 (43) are not included

Occupational Structure: The nature of local economies and various commercial and employment opportunities are reflected in the people's occupation. In terms of occupational structure the study area is very agrarian in nature with more than 90% of people engaged in farming as a main job. Nevertheless, the study area has a more developed economy, which can be attributed to its location along the trade route to various market places within and outside the district. Table 9 shows different trends in the diversity of income sources among small, medium and large farmers. All the three groups of farmers have approximately similar range of income sources (4 economic activities) for income generation. The most important occupation is farming that includes crop and livestock production. It provides income to about 77.3% of them, which is far greater figure than the second largest clerical job (13.1%), professional (7.1%), and business (2.5%). The given economic activities are the main livelihood strategies of the sampled household that represent the whole district. If we see the occupational structure according to farm size, all the large farmers engaging in farming including dairy as they endowed higher proportion of land with annual food self-sufficiency and also surplus. As the small and medium farmer, having small proportion of land, though they have annual food self-sufficiency, they have to depend on other activities to manage other non-food items. However, the majority of

households has farm-based activities; crop and dairy farming as their main occupation for living.

Table 9: Occupational Structure of Sampled Household According to Farm Size

| Occupation Category | Small | Medium | Large | Total | % |
|---------------------|-------|--------|-------|-------|-------|
| Farming | 44 | 168 | 31 | 243 | 77.3 |
| Business | 1 | 7 | | 8 | 2.5 |
| Clerical Job | 10 | 24 | 7 | 41 | 13.1 |
| Professional Job | 2 | 18 | 2 | 22 | 7.1 |
| Total | 57 | 217 | 40 | 314 | 100.0 |

Source: Field Survey, 2002

Note: Above 65 (14), under 6 (43), Student (279) is not included

Clerical Job: Government/non government service, Officer

Farming: Crop & livestock, Business: Shopkeeper, Trade; Clerical Job:

Service, Officer, computer operator

Professional: Teacher, Politician, Writer, Driver, Nurse, Police, Army, and Overseer

Small: 0.2 to under 0.5 ha; Medium: 0.5 and under 2 ha; Large: 2 ha and above

Landholding: Land ownership within the agrarian economy of the study area provides a major source of income, which is an important natural asset that farmers have. The inequity in land distribution translates to economic disparity among the farmers. The land size of the holding and type of land available in the study area can have a large impact on the ability of farmers to earn a living. Table 10 shows the land distribution of the sampled household according to land type and farm size. It shows the average land holding of small, medium and large farmers is 0.3, 1.0 and 2.4 Ha respectively. The large farmers are endowed with higher natural asset status than medium and small farmers. The land in the study area is categorized in two types *Ghol* and *Tandi* as district as a whole. Paddy is the main crop cultivated in the *Ghol* or it can also understand as paddy land. Mainly maize and mustard are grown in *Tandi*. It can be seen that average *Ghol* (paddy irrigated land) owned by large farmers (1 Ha.) is almost twice as large as that of medium farmers and 4 times larger than that of small farmers. Larger size of *Ghol* owned by large farmer means that they have higher potential to grow crops such as modern variety rice and other crops. It is considered that they have utilized this in higher potential for commercial crop farming. It can also be proved from the income earning from various sources (section 8.3), in which the maximum income comes from crop farming in case of large farmers. It seems they have higher tendency in engaging in crop farming.

Table 10: Land Distribution among Sampled Household by Farm Size and Land Type

| Land Type | Farm Size | HH | Total Land Holding | Total Land Holding/HH |
|---|-----------|----|--------------------|-----------------------|
| <i>Ghol</i> (Paddy Irrigated Land) | Small | 22 | 4.2 | 0.19 |
| | Medium | 74 | 44.8 | 0.61 |
| | Large | 8 | 8.33 | 1.04 |
| <i>Ghol</i> (Paddy Non-irrigated Land) | Small | 22 | 1.07 | 0.05 |
| | Medium | 74 | 15.75 | 0.21 |
| | Large | 8 | 7.79 | 0.97 |
| <i>Tandi</i> (Terrace Irrigated Land) | Small | 22 | 0.51 | 0.02 |
| | Medium | 74 | 1.66 | 0.02 |
| | Large | 8 | 0 | 0.00 |
| <i>Tandi</i> (Terrace Non-irrigated Land) | Small | 22 | 0.64 | 0.03 |
| | Medium | 74 | 6.72 | 0.09 |
| | Large | 8 | 2.34 | 0.29 |
| Homestead, Animal Shed and Other Land | Small | 22 | 1.13 | 0.05 |
| | Medium | 74 | 4.72 | 0.06 |
| | Large | 8 | 1.1 | 0.14 |
| Total Land | Small | 22 | 7.55 | 0.34 |
| | Medium | 74 | 73.65 | 1.00 |
| | Large | 8 | 19.56 | 2.45 |

Source: Field Survey, 2002

Small: having 0.2 & under 0.5 ha land, medium: 0.5 & under 2 ha land,

Large: above 2 ha land

Note: Land Unit in Ha, Others include few cases of holding of fodder/forest land.

Tandi, a terrace land, homestead, forestland and fodder are not significantly difference among the small, medium and large farmer. *Tandi* is a dry field, which usually does not have irrigation facility and is used for the cultivation of maize, millet and wheat. Other land is not suitable for cultivation but can produce fodder, grasses and trees.

Livestock Holding: Livestock ownership is one of the other major financial assets that people have. The production of manure through livestock is a major contributor to traditional soil management practices. And dairy provides an important source of income. The main animals rearing in the study area are cow, buffalo, goat, ox and chicken. Table 11 shows the ownership of dairy animals and its composition in the study area. The

average number of dairy cow and buffalo in small, medium and large farmer is 4, 5 and 6 respectively. The highest number of average dairy animals is owned by large farmers. It implies that the large farmers have more potential to produce dairy products for their own consumption and for the sale. When checked with the income from dairy, it is interesting to note that it is one of the minimum compared to small and medium farmers. This shows dairy farming for large farmer may be mainly for self-consumption and for the farmyard manure to maintain the soil productivity, which tends to be more easily degraded by pest, disease and nutrition deprivation. Another farmer groups owned less numbers of dairy animals compared to that of large farmers. Similarly, number of milking cow holding per household in small, medium and large farmers is 1.1, 1.2 and 0.9 respectively and that of buffalo holding is less than one in all the cases.

Table 11: Dairy Animal Holding of Sampled Household

| Description | Small (22) | Medium (74) | Large (8) | Total |
|----------------------------|------------|-------------|-----------|-------|
| Milking Cow | 25 | 92 | 7 | 124 |
| Dry Cow | 9 | 28 | 4 | 41 |
| Heifer | 6 | 42 | 2 | 50 |
| Female Calf | 10 | 29 | 3 | 42 |
| Male Calf | 3 | 14 | 2 | 19 |
| Bull | 5 | 37 | 4 | 46 |
| Milking Buffalo | 14 | 46 | 4 | 64 |
| Dry Buffalo | 1 | 16 | 10 | 27 |
| Heifer | 7 | 26 | 6 | 39 |
| Female Calf | 2 | 17 | 2 | 21 |
| Male Calf | 4 | 14 | 7 | 25 |
| Total Animals | 86 | 361 | 51 | 498 |
| Holding/HH | 4 | 5 | 6 | 5 |
| Milking Cow Holding/HH | 1.1 | 1.2 | 0.9 | 1.2 |
| Milking Buffalo Holding/HH | 0.6 | 0.6 | 0.5 | 0.6 |

Source: Field Survey, 2002

Small: having 0.2 & under 0.5 ha land, medium: 0.5 & under 2 ha land, Large: above 2 ha land

Milking animal: cow, producing milk

Dry animal: a cow usually in the latest part of pregnancy, whose lactation has been terminated and who is being prepared for the next lactation, or stop milking

Heifer: young female bovine from birth up to the time she gives to a calf

Calf: young male or female animal

Bull: adult male animal

Survey Results and Discussion

Dairy Animal Production Cost: In this study different variable costs⁵ were calculated for the net household income from dairy farming. The variable costs for individual households in dairy production were computed by summing the expenditures on self and purchased feed, dairy animal health, electricity and cost for labour, which were reported by farmers. The average purchased feed value is very high due to the high market price of ready made feed produced by industry. The labour used in dairy production was household labour and household labour productivity is very low. This is due to the lack of labour market in the study area. The household labour value was evaluated based on the value of agricultural labour found in agricultural labour market. One man-day value varies for man, woman, and child in the study area. One man-day labour cost for man, woman and child is NRs 100, 80 and 50 respectively.

Table 12: Annual Dairy Production Cost in US\$ per Household by Farm Size

| Description | Small | Medium | Large |
|--|--------|--------|--------|
| Self Feed (Concentrate/maize/oil cake) | 123 | 655 | 2,100 |
| Self Feed (Fodder/grass/straw) | 741 | 1,682 | 3,480 |
| Purchased Feed Concentrate/maize/oil cake) | 22,395 | 22,884 | 10,463 |
| Purchased Feed (Fodder/grass/straw) | 3,691 | 2,869 | |
| Total Feed Cost | 26,950 | 28,090 | 16,043 |
| Health Cost | 1,476 | 1,496 | 2,120 |
| Electricity Cost | 39 | 61 | 100 |
| Labour Cost (Estimated) | 27,748 | 30,252 | 27,318 |
| Total Dairy Production Cost | 56,213 | 59,899 | 45,581 |

Source: Field Survey, 2002, Unit: Nepali Rupees (NRs.), \$1 = NRs. 77.00

Table 12 shows the types of variable costs included and respective average cost. The findings show that the mean value for self-feed is one of the lowest in small and medium farmer. These two groups of farmer used more than doubled amount of purchased feed compared to self-feed. While large farmers used approximately equal amount for self and purchased feed. This coincides with the low landholding status of small farmers than large farmer. Mean value for electricity used and health is very minimal in all the cases. The total production cost is not significantly different in small and medium farmer with NRs 56,213 and NRs. 59,899 respectively, whereas the production cost i.e. NRs 45,581 of large farmers is minimal. In the same table it can be seen that large farmer uses less amount of intensive and less amount of labour compared to other two groups of farmer. It may be due to the

composition of animals, in which large farmers own less number of milking animals. Generally milking animal needs more care and quality feed.

Labour Utilization: Availability of labour in the household is another important human asset and one of the important inputs in dairy enterprises. Both quantity and quality of labour are important human assets. The knowledge of dairy animal management and the requisite skills needed in dairy farming determine the quality of labour, and input to enhance the productivity of dairy animal. But in a low productivity framework, non-professionals do the work maintaining and rearing of dairy animals, as their opportunity cost is lower. The dairy enterprise provides a gainful employment to the rural households. The number of household members available in dairy farming is an important factor for adopting labour-intensive livelihood strategies. Table 13 shows the annual labour use in various dairy activities per household. In the study area almost labour all found is family labour among the all three groups of farmers. The average number of days spent for dairy activities per year is calculated according to farm size. It shows that the average number of days, which were spent by small and medium farmer, is 310 and 332 respectively, higher than large farmers, which is 306 days per year. But in average, number of animal holding, is less in small and medium farmers. This implies small and medium farmers have higher tendency in involving in dairy activities.

Table 13: Annual Labour (AEU) Utilization in Dairy Activities per Household

| Activities | Small | | | Medium | | | Large | | |
|----------------------|-------|--------|-------|--------|--------|-------|-------|--------|-------|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Fodder Collection | 32 | 60 | 92 | 39 | 56 | 95 | 33 | 56 | 89 |
| Feeding | 35 | 37 | 73 | 35 | 33 | 68 | 40 | 48 | 88 |
| Cleaning Animal | 10 | 7 | 17 | 14 | 8 | 22 | 7 | 10 | 17 |
| Cleaning Animal Shed | 17 | 33 | 50 | 22 | 23 | 45 | 17 | 29 | 46 |
| Milking | 25 | 16 | 40 | 33 | 24 | 57 | 26 | 14 | 40 |
| Milk Delivery | 28 | 10 | 38 | 37 | 8 | 45 | 20 | 6 | 26 |
| Total | 147 | 163 | 310 | 180 | 154 | 332 | 142 | 163 | 306 |
| Labour use/animal | 37 | 41 | 78 | 36 | 31 | 66 | 27 | 30 | 51 |

Source: Field Survey, 2002

Small: having 0.2 & under 0.5 ha land, Medium: 0.5 & under 2 ha, Large: above 2 ha

Unit: Manday = Working an adult 8 hrs/day; AEU=Adult Equivalent Unit. A working child counted as a half of an adult.

Income Earning from Dairy Farming: Milk selling is the major income source for dairy farmers. Besides, selling of other items such as selling of animal itself in different stages; milking, heifer, calf and so on and selling of few dairy products also found in the study area.

Table 14: Annual Income Earning from Dairy per Household

| Description | Small | Medium | Large |
|-----------------------|-----------|-----------|-----------|
| Selling Milking Cow | 1,681.82 | 4756.76 | |
| Heifer (cow) | | 739.72 | |
| Cow Milk | 43,363.09 | 44,980.33 | 17,793.75 |
| Milking Buffalo | | 2,122.97 | |
| Dry Buffalo | 328.18 | 378.37 | |
| Heifer (Buffalo) | | 216.21 | |
| She calf | | 14.46 | |
| He calf | 100.00 | 277.92 | |
| Bullock | | 56.75 | |
| Buffalo Milk | 19,045.90 | 20,137.33 | 20,394.37 |
| Ghee | | 199.32 | |
| Manure | 1,909.09 | 113.51 | |
| Manure Self Use | 3,415.00 | 5,177.00 | 10,581.00 |
| Gross Income | 69,843.08 | 79,170.65 | 48,769.12 |
| Total Production Cost | 56,213.30 | 59,898.65 | 45,581.05 |
| Net Income | 13,629.78 | 19,272.00 | 3,188.07 |
| Net Return to Farm | 42,242.08 | 51,860.65 | 36,086.07 |

Source: Field Survey, 2002

Unit Nepali Rupees, \$1= NRs 77.00

Note: Net income = Gross Income-Total Production Cost

Net return to farm = Net Income + Self Inputs (feed + labour + manure)

Table 14 shows the highest income earning comes from selling of milk in all three groups of farmers. The gross income is about 1.5 times higher in small and medium than large farmers though large farmers owned higher mean animal. This means there is higher tendency of small and medium farmers in involving in dairy farming for income generation. Whereas in case of large farmer they have more tendency in involving in dairy is for self-consumption as their consumption pattern is higher than small and medium farmers. According to the large farmers, the main purpose of rearing dairy animals is to get manure for their farmland and for self-milk consumption rather than selling. They used to sell surplus milk occasionally.

Milk Production and Consumption Pattern: Milk production is the major income generating source of the dairy farmers in the study area. Fresh milk consumption among household is common in the study area as other parts of the country. Majority of sampled household member drink milk regularly. Children and old family member has given priority in drinking milk. The use of milk for tea is common practice in the study area.

Table 15 shows the annual milk production and consumption per household according to farm size. The average amount of milk production among the small and medium farmer is more than double that of large farmer. Similarly small and medium farmer sell more than 80% of total milk production while large farmer sell only 58% of total milk production per household. This implies small and medium farmers have high tendency to earn income from selling milk. Milk consumption is higher 42% among the large farmer where as small and medium farmer consume only 16% and 20% respectively from their total milk production. The consumption pattern among larger farmer is higher. However, per capita milk consumption is one of the lowest among the large farmer with the maximum family size compare to other two farmer's group. Since the study area is dairy pocket area, the overall per capita milk consumption is much higher than that of national average.

Table 15: Milk Production and Consumption per Household by Farm Size

| Farm Size | Milk Production (Kg) | Milk Sale (Kg) | Milk Consumption (Kg) | Per Capita Milk Consumption (Kg/head) |
|--|----------------------|----------------|-----------------------|---------------------------------------|
| Small | 3117.5 | 2609.8 (84%) | 507.7 (16%) | 101.3 |
| Medium | 3145.1 | 2521.4 (80%) | 623.7 (20%) | 106.5 |
| Large | 1743.8 | 1004.6 (58%) | 739.1 (42%) | 76.2 |
| Total | 3037.8 | 2423.4 (80%) | 614.4 (20%) | 103.1 |
| National Per Capita Milk Consumption (Kg/head) | | | | 48.4 |
| Basic Need Level Recommended by WHO (Kg/Head) | | | | 57.8 |

Source: Field Survey, 2002

Annual Income from Different Occupations: Household level income information on income from different occupation is important for policy analysis and improvement of people's livelihood. Although agriculture is the mainstay of the village economy, some people have shifted to trading and government/private services as their main occupation to maintain livelihood. During the off-farm season, people migrate to towns and market centre in the same district such as Narayanghat, Bharatpur Bazar and so on for income. The main income generating activities found in the study area can be characterized in two sectors; farming and non-farming. Farming includes

crop farming, livestock farming and other farm related activities. Non-farming includes clerical job, business and professional job. The percentage of engaging in farming is as higher as 77% of the total economically active sampled population. It is followed by clerical job (13%), (7%) professional and 3% business.

Table 16 shows the mean income earned from dairy production is one of the lowest in large farmers, i. e. NRs. 38,722 though they own higher number of dairy animal compared to medium and small farmer. While nearly double and two-third income from the same source was earned by medium and small farmers respectively. One reason for this difference can be landholding size. Some of large farmers also reported that they did not have to be fully engaged in commercial-scale dairy farming because they obtained a sufficient amount of income from crop farming as well as non-farm based activities. They are rearing dairy animal for the reason of self-consumption of milk and manure for their farmland. The same Table shows income earning of large farmer from crop farming and clerical job is one of the highest compared to other two groups about i. e. NRs. 63,000 and NRs. 96,000 thousand respectively. Medium and small farmer earned very less income from non-farm based activities, as their education level is also lower than that of large farmers.

Table 16: Annual Income from Different Income Sources per Household

| Farm Size | HH | Farm Based | | Non-farm Based | | | Total HH Income |
|-----------------------------|----|-----------------|-----------------|----------------|-----------------|------------------|-------------------|
| | | Crop | Dairy | Business | Clerical Job | Professional Job | |
| Small | 22 | 9,239 (11%) | 42,242 (52%) | 2,273 (3%) | 23,045 (29%) | 4,364 (5%) | 81,163 (100%) |
| Medium | 74 | 18,578 (16%) | 51,861 (45%) | 4,460 (4%) | 27,216 (24%) | 13,068 (11%) | 115,183 (100%) |
| Large | 8 | 44,499 (25%) | 36,086 (20%) | | 80,250 (44%) | 19,500 (11%) | 180,335 (100%) |
| No of HH member engaging in | | 77% | | 7% | 13% | 3% | 100% |

Source: Field Survey, 2002, Unit: Nepali Rupees (NRs.), \$1 = NRs. 77.00

Farming: Crop & Livestock;

Business: Shopkeeper, Trade.

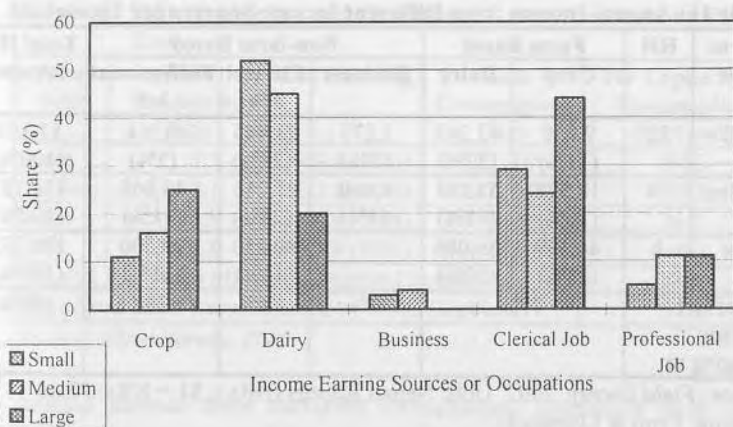
Clerical job: Service, Computer Operator, and Meter Reader.

Professional Job: Teacher, Writer, Driver, Nurse, Police, Army, and Technician.

Share of Different Household Occupation in Total Household Income

In order to calculate the contribution of income from dairy farming to the total household income, it is important to know the share of other income sources as well. The percentage share of income from different income sources is presented in Figure 7. It shows the percentage share of dairy farming is decreasing according to the farm size of the sampled household. Small farmers have maximum share of dairy income in their total household income. It is followed by medium and large farmers. The share of dairy income is found to be significant in small and medium farmer, which contributes 52% and 45% in small and medium farmers respectively to their total household income. The rest of the share come from crop farming and non-farm activities. The share of income from clerical job is higher in the case of large farmer compared to small and medium farmers. It may be because of their higher education level compared to other farmer groups, which provides them better opportunities in non-farm activity like clerical job. There is also little contribution to their total household income from non-farm based activities such as clerical job and professional job in case of small and medium farmers. These are, however, mostly come from jobs abroad.

Figure 7: Percentage Share of Different Income Sources According to Farm size



Source: Field Survey, 2002

Conclusion

Nepal is an agrarian country and its economy strongly depends on agriculture and related activities. The livelihood of large proportion of people depends

on this business. High population growth causes declines in size of farmland that is leading to the decreasing trend of productivity of food grains. Dairy farming is regarded as an important income generating activity for the rural people where livestock is integral part of farming system and majority of people is living in subsistence level. Dairy farming is such an activity, which does not require large resources, labour intensive and can generate income within short period of time.

In this case study, the economy of households in the study area depends upon the agriculture and related business. Most of the farm households in the study area have small size of land holdings so this has direct impact on crop yields. Besides this, people are also engaging other different economic activities, which includes non-farm based, such as business, professional job and clerical job. The most viable business that is closely related to agriculture in the study area is dairy farming. Most of the farmers are keeping cows and buffaloes for milk as well as organic manure for crop cultivation in their own farmland. The finding shows that the contribution of the dairy farming to the total household income is found to be significant in household level. This contribution is higher in small farmers and medium farmers as compared to large farmers because large farmers have other economic opportunities as compared to small farmers. Dairy farming is consuming household labour more efficiently as almost all labour use in the dairy is family labour. This indicates that dairy sector development has direct impact on the contribution of household income in rural areas. The demand of livestock products like milk and milk product is increasing day by day as population increasing. Therefore, this sector can contribute for the betterment of the rural livelihood particularly to the small household, which has less opportunity to engage in other economic alternatives. Development of livestock sector such as provision of extension services; introduction of improved breed, good animal health service, and provision of cheap feed to the farmers, can enhance dairy production in the rural area.

Notes

1. Geographically, Nepal is divided into three regions, Mountain, Hill and Tarai. The Tarai, being an extension of the Gangetic plains of India, forms a low flat land, ranging from 22m to 600m above, mean sea level. It stretches along the southern boundary of the country. It comprises only 23 % of the total land of the country and accommodates 47% of population. This region includes most of the fertile land and dense forest. About 40% of land is suitable for cultivation.
2. Traditional energy refers to fuelwood, agricultural residue and animal dung. Commercial energy refers to electricity, petroleum products, gasoline and so on. For further details see (Singh and Maharajan, 2003).
3. It is made at home, predominately from maize flour, rice bran, salt and kitchen waste in about 2-3 liters of water and boiled. The amount per day varies from 0.5-1 kg/day/animal given during or after milking).

4. Tarai region in Nepal is divided into two parts Inner Tarai and Outer Tarai. Inner Tarai is the river valley between Mahabharat Hills (Southern Hill-2000m) and Siwalik Hills (Tarai Hills-600m). Inner Tarai is also divided into three regions. Eastern Inner Tarai which includes Udaypur and Sindhuli Districts, Central Inner Tarai, which includes Chitwan and Makawanpur District and the western Inner Tarai that includes Dang Duckhuri districts.
5. Fixed cost such as depreciation cost for animal, animal shed and equipment used were excluded in the study. It is difficult to evaluate animal depreciation cost due to the various matters such as animal type, size, age and calving stage. In the case of animal shed and equipment, it is also difficult to evaluate the depreciation cost. Because majority of farmers are using same animal shed for dairy animals and other small animals and using same equipment for dairy as well as crop farming.

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Annex A: Milk Collection Network under Different Milk Supply Schemes in Nepal

| Scheme | MPAs | MPCs | CC | District Covered |
|---------|------|------|----|------------------|
| KMSS | 53 | 416 | 14 | 9 |
| BMSS | 4 | 126 | 9 | 7 |
| HMSS | - | 200 | 8 | 5 |
| PMSS | 16 | 93 | 6 | 7 |
| LMSS | 1 | 42 | 3 | 5 |
| MPMSS | - | 33 | 3 | 3 |
| MP & DS | - | 21 | - | 7 |
| Total | 74 | 931 | 43 | 43 |

Source: DDC, 2003

Note:

- MPAs: Milk Producer's Association
 MPCs: Milk Producer's Cooperatives
 CC: Milk Collection Centre