Milk Production Dynamics and the Animal Feed Situation in the Jhikhu Khola Watershed

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Abstract

A rapid population increase, an increasing need for cash income, and market opportunities have led to a rapid change in milk production in the Jhikhu Khola watershed in Nepal. Nine years ago a milk collection and chilling centre was established in the watershed and this provided the farmers with the incentive and opportunity to move into the market economy. Previous studies had shown, however, that there is a great shortage of animal feed and that the workload of women is very high. Approximately 80 per cent of the work involved in livestock care is undertaken by women, who are responsible for collecting feed every day. The present day dynamics of milk production and the animal feed situation were studied in detail to determine the rate of change in milk production, and the possible impacts and consequences of a rapid increase in the number of buffalo and the associated increase in demand for feed. The questions the study was designed to answer included: 'How much can the cash flow from milk contribute to easing the feed shortages?' and 'Is it cost effective to use some of the grain produced to supplement animal nutrition?'

All the animals were stall-fed. Crop residues and grass were the two main sources of feed. The majority of winter feed (69%) derived from crop residues, the majority of summer feed from fresh grass. There was a shortage of crop residues from April to July in the spring and early monsoon, and of grass between October and May. Women generally had sole responsibility for collecting grass from agricultural and forested land, although occasionally the whole family helped. Men more commonly collected fodder from fodder trees on private land, and were mainly responsible for the transportation of milk to the cooperative centres.

The farmers purchased water buffaloes in order to make money by selling milk, but they felt they were not able to benefit sufficiently from this activity. They had great difficulty maintaining the buffaloes as they require special treatment and care throughout the day—the work required for one buffalo was considered equivalent to a full time job in the city. As a result of the 25 per cent reduction in the amount of milk accepted by the TCC, 50 per cent of the farmers were forced to use more milk for home consumption than they could cope with. There were few other options for using the milk as there was a lack of fuelwood and water for processing and the poor infrastructure is not conducive to taking the milk elsewhere. Suggestions have been made that the milk be processed into other products, but at present this does not appear to be viable because of the lack of fuelwood, poor infrastructure, poor transportation network, and poor market access. Half of the farmers said that they didn't know how to cope with the milk surplus although some did make ghee (clarified butter).

Introduction

A rapid population increase, an increasing need for cash income, and market opportunities have led to a rapid change in milk production in the Jhikhu Khola watershed in Nepal. Nine years ago, a milk collection and chilling centre was established in the watershed and this provided the farmers with the incentive and opportunity to move into the market economy. Spoilage of milk was significantly reduced by the establishment of the chilling centre, and given the high demand for milk in Kathmandu, and the ease of transporting the milk to the capital city, many farmers have begun commercial milk production. There are both positive and negative short-term and long-term effects associated with this development. To assess them, we need to know how this change is influencing the number of animals, the demand for feed, the workload of women, the pressure on forests, and the crop production system. It appears that the water buffalo population has increased, but to date little attention has been paid to the implications for the sustainability of the labour, forest, and agricultural resources.

Farmers in the Jhikhu Khola watershed are poor, the land resources are under stress, and the question of how much the system can contribute to increasing milk production requires closer examination. Although livestock play a key role in farming systems in the middle mountains of Nepal by supplying the organic matter and nutrients that are critical for maintaining soil fertility, more livestock mean a higher fodder requirement, which might have a detrimental effect on the environment. From previous PRA surveys, it was evident that there is a great shortage of animal feed and that the workload of women is very high. Approximately 80 per cent of the work involved in livestock care is undertaken by women, who are responsible for collecting feed every day. The increasing emphasis on milk production will mean that more manure and animal power will be available, but at the same time feed demands will make the already critical feed supply situation worse and will add significantly to the workload for women.

The study described here was designed to determine the rate of change in milk production and to examine the possible impacts and consequences of a rapid increase in the number of buffalo and of the associated increase in demand for feed. The questions it was designed to answer included: 'How much can the cash flow from milk contribute to easing the feed shortages?' and 'Is it cost effective to use some of the grain produced to supplement animal nutrition?' Understanding the dynamics of the milk production system is a major undertaking because the changes are rapid, many different categories of farmers are involved as well as porters with different modes of transport, and there are large seasonal changes in the supply of and demand for both feed and milk.

Aims and Objectives

The goal of this study was to examine the positive and negative aspects of the increasing milk production in the Jhikhu Khola watershed, and to determine possible benefits and consequences for forestry and agriculture. The specific aims were to:

- determine the milk dynamics in the watershed with an emphasis on the rate of change of milk production and milk marketing over the past five years;
- document milk production and sources and supplies of feed;
- examine the income obtained from the milk trade, women's workload dynamics, feed demands from the forests, and feed use from arable lands; and
- evaluate farmers' perceptions regarding milk production, and identify the causes, coping strategies, and possible opportunities.

Methodology

Much of the information was gathered using Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) techniques to understand the trends, processes, and dynamics of milk production. Most of the information was georeferenced to facilitate the use of a geographical information system (GIS). GIS was used as the integration tool for all land use, forest, and agricultural resource information.

The survey was carried out during December 1998. It was conducted at three levels. First, semi-structured interviews were conducted with individual members of the cooperatives and the porters transporting milk at the Tamaghat Chilling Centre (TCC), which belongs to Nepal Dairy Corporation. Second, individual farmers were interviewed at five village cooperative collection centres. Third, information was gathered in 13 villages using participatory techniques from farmers involved in milk production, as individuals and in groups. Interviewees were selected at random. In all, 23 cooperative members and 16 porters from 39 different cooperatives in 15 different VDCs (including 10 cooperatives in 6 VDCs from outside the watershed) were interviewed at the TCC; 119 individual milk farmers were interviewed at five village cooperatives (29 in Shreerampati, Hokse VDC; 29 in Ranipani, Baluwa VDC; 26 in Kaphaledihi, Panchkhal VDC; 20 in Deourali, Rabi-opi VDC; and 15 in Upretithok, Koshi Dekha VDC—outside the watershed); and 71 farmers (six individuals and seven men/women groups) were interviewed in 13 villages in five VDCs (4 inside and 1 outside the watershed).

All data were incorporated into an Excel spreadsheet. The locations of individual farmers were marked both on aerial photos and on a 1:25,000 scale topographic map. The information was later incorporated into a GIS database.

Land use information from surveys performed in 1947 and 1981 (1:50,000 scale), and from aerial photo evaluations for 1972, 1990, and 1996 (1:25,000) were used to show the land use trends and to address the status and changes in the forests, shrubs, and grazing lands in the watershed .

The Chilling Centre

The first level of the survey was conducted at the TCC with different cooperative members and milk porters. The TCC was initially established at Lamidanda in 1978, but moved to Tamaghat

in Panchkhal VDC of Kabhrepalanchok district in 1990. The TCC plays a key role in milk collection for Kathmandu. The total capacity of the centre of 12,000 litres of milk per day is fully utilised and it is planned to increase the capacity to 15,000 litres.

Figure 23: **Tanker Collecting Milk from the Tamaghat Chilling Centre**

The Cooperative Centres

The second level surveys were conducted at the cooperative centres. The village cooperative centres were established to collect milk from selected households in the villages. The cooperative committees consist of 9 members; a minimum of 25 households are needed to register with the district cooperative board. The TCC provides cane, chemicals, and the salary for the secretary of each cooperative. Transportation, rent, and other miscellaneous costs are covered by the individual cooperatives. The TCC receives milk from 40 cooperatives within the watershed and 23 outside, of which three are close by.

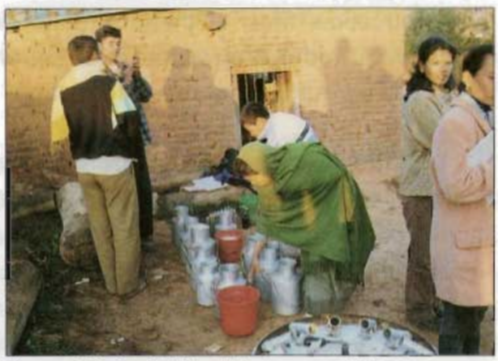

Figure 24: **Individual Farmers at the Cooperative Centre at Shreerampati**

Milk Farmers Group Survey (PRA)

The third level of the survey was conducted using participatory methods to obtain information on the geographical location, gender, ethnicity, trends, processes, and dynamics of milk production. Participatory Rural Appraisal (PRA) techniques were used to obtain a broad and rapid understanding of all aspects of the milk industry.

Figure 25: **PRA with Women Milk Farmers**

Results

Milk Dynamics in the Jhikhu Khola Watershed

There are two municipalities and twelve VDCs (Village Development Committee) in the Jhikhu Khola watershed (Figure 26). Sixty three cooperative centres bring milk to the TCC daily, 40 (63%) from within the watershed (Figure 26). The main cooperative centres within the watershed are in Anaikot, Baluwa, Hokse, Kharelthok, Maithinkot, Panchkhal, Patlekhet, and Sathighar VDCs; the main ones outside the watershed are in Jaisithok, Jyamdi, Kanpur,

Koshidekha, Sangachok, and Sarshukharka VDCs. Two cooperatives from the adjoining district of Sindhuplachok in Sangachok and Pashupati VDC also bring milk to the TCC. There are some other milk cooperatives within the watershed (in Phoolbari, Kabhre, Rabi-opi, Devitar, and Patlekhet VDCs) that supply milk directly to Banepa.

Data on the collection levels of milk from1994 to 1998 were obtained from the TCC. The results are shown in Table 21 and Figure 27.

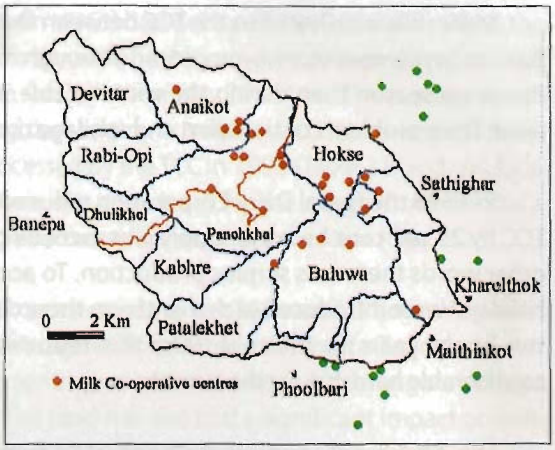

Figure 26: **Location of the Milk Cooperative Centres Whose Members were Interviewed at the TCC**

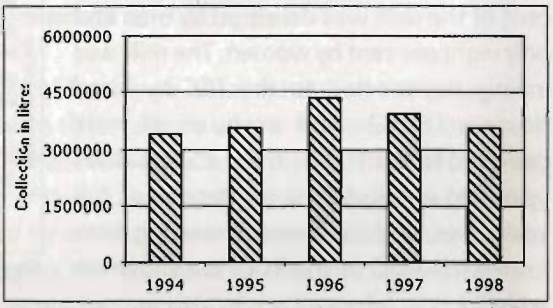

Figure 27: **Milk Collection at the Tamaghat Chilling Centre, 1994-98**

There was an increase of 26.5 per cent in milk collection from 1994 to 1996, followed by a decline of 18 per cent between 1996 and 1998. The decline at the TCC resulted partially when another chilling centre opened at Kunta, in Kabhrepalanchok District, and partly following the introduction in 1998 of 'milk holidays' (see below). Furthermore, many private dairies have been established in Kathmandu since 1996 and some farmers deliver to these directly. The decreasing trend is the result of competition from other dairy companies, not of a reduction in farm production of milk. Almost all of the farmers surveyed at the cooperatives indicated that their milk production during the last five years had increased substantially.

Table 21: **Milk Collection at the Tamaghat Chilling Centre from 1994 to 1998 (in lts)**

Month	1994	1995	1996	1997	1998	Total
January	267,324	369,851	411,448	485,913	337,000	1871,536
February	273,120	332,645	369,765	468,078	314,000	1,757,608
March	354,629	30,5711	359,059	444,277	285,000	1,748,676
April	344,652	26,4135	317,548	28,0,710	268,000	1,475,045
May	190,396	20,6613	244,478	309,961	224,000	1,175,448
June	167,257	178,696	227,653	261,947	219,000	1,054,553
July	174,628	203,900	228,497	303,074	294,245	1,204,344
August	312,329	232,413	303,628	177,000	263,462	1,288,832
September	285,019	303,952	41,1103	258,000	35,0191	1,608,265
October	379,547	359,769	479,429	277,000	26,7719	1,763,464
November	342,846	397,774	467,239	335,000	376,398	1,919,257
December	332,908	395,685	512,383	339,000	354,568	1,934,544
Total	3,424,655	3,551,144	4,332,229	3,939,960	3,553,583	18,801,572

Source: Chilling Centre, Tamaghat, 1998

More milk is delivered to the TCC between October and March (autumn-winter) than in April to September (spring-monsoon) although more milk is produced on-farm during the monsoon season than during the winter (Table 30). The lower deliveries in the monsoon result from problems of transport and spoilage during this season.

In 1998 the Nepal Dairy Corporation reduced the amount of milk they accepted at the TCC by 25 per cent because supply was exceeding the market capacity in Kathmandu—in other words there was surplus production. To accomplish this reduction, six to seven 'milk holidays' were introduced each month: on these days no milk was accepted at the TCC. After the boom years in the mid '90s, this reduction was a disappointment and created considerable hardship for the farmers.

The centre only accepts milk delivered from the cooperatives, not from individual farmers. The 39 cooperative representatives and porters interviewed at the TCC provided the following information. About 92 per cent of the milk was delivered by men and only eight per cent by women. The milk was mainly transported to the TCC by hired porters (60%). The amount of milk delivered to the TCC by these cooperatives (grouped within VDCs) on the day of the interviews, and the average walking time from each VDC to the TCC, are shown in Table 22.

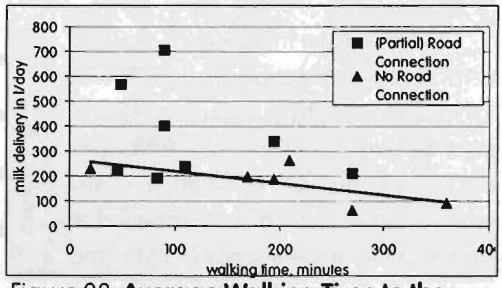

Figure 28: **Average Walking Time to the Chilling Centre versus Milk Delivered**

Table 22: Milk Delivery to the TCC, Travel Distance, and Total Value

S. No	VDC[1]	Milk Delivery Per Day (litres)	Walking Time (hours:mins)	Total End Sale Price of Milk (NRs)
1	Kanpur	60	4.30	1,242
2	Katunje	90	6.00	1,755
3	Kharelthok[2]	160	4.00	2,880
4	Koshi Dekha	184	3.15	3,312
5	Sathighar[2]	190	1.12	3,510
6	Sarsyukharka[2]	210	2.30	4,851
7	Sangachok[2]	240	1.50	5,040
8	Patalekhet5	400	1.30	7,800
9	Phoolbari	520	3.30	11,700
10	Hokse[2]	567	0.48	10,278
11	Maithinkot	580	2.50	11,286
12	Baluwa[2]	703	1.30	13,646
13	Anaikot[2]	1,130	0.45	21,387
14	Jyamdi[2]	1,355	3.15	26,333
15	Panchkhal	1,591	0.20	32,069
	Total /Average	7,980	2.34	157,088

Note: [1] Values refer to the sampled cooperatives from these VDCs (total 39) and are not necessarily the total values of VDC.
[2] Some VDCs are connected to the TCC by road (directly or partially) so that actual delivery time can be shorter.

The thirty-nine cooperatives (from fifteen VDCs) had delivered 7980 litres of milk to the TCC. Thus, among the sampled cooperatives, the average daily amount delivered in winter per cooperative on the days the TCC was open for collection was 205 litres. The average for all cooperatives over the whole year (including days when no milk was accepted) was 157 litres per day—estimated from the total milk processed by the TCC in 1998 (Table 21) and the total number of delivering cooperatives (63). There was a tendency for the villages from the VDCs closest to the TCC to deliver the most milk, and those furthest away the least (Figure 28).

The average walking time from the 39 cooperatives to the TCC was 2.3 hours/day, with a range from 12 minutes to six hours. The average walking time in different villages between the individual farms and the cooperative centres was 11 minutes, with a range of village averages from 5 to 21 minutes (Table 23). The road has also had a significant impact on milk transportation. Jyamdi VDC, the second largest milk producer, is about 3 hours 15 minutes walk from the TCC, but most of the milk is transported by truck along the highway.

Milk Production and Feed Requirements and Supplies

Data on milk production and supplies of feed were obtained during the survey of a sample of five village cooperative centres. In these villages all the farmers sold their milk through the village cooperatives. The sex of those delivering to the centres, the walking time, and the total number and average number of buffalo kept by those interviewed are shown in Table 23. Although women are responsible for most of the care-work related to the buffalo such as feeding, milking, grazing, and watering, the number of women milk farmers involved in actually selling the milk was very low. Ninety-five per cent of the deliveries to the village cooperative centres were made by men (Table 23). The average number of water buffaloes per household in the sample investigated was 1.44 (Table 23). The largest number of buffaloes per household was found in Deourali, which has direct road access, and the lowest number in Upretithok, located some five to six hours walking distance from the road. This indicates that market and road access play a significant role in milk production.

The total milk production per day in the sample of households interviewed at the village cooperatives, and the amount they sold through the cooperative to the TCC in the winter and

Table 23: **The Cooperative Survey – Gender Involvement, Walking Distance, Total and Average Numbers of Buffalo**

VDC	Village	People Interviewed Delivering Milk to the Cooperative			Average Walking Distance to Centre (min)	Total No. of Buffalo Kept by Those Interviewed	Average No. of Buffalo per Household Delivering Milk
		Men	Women	Total			
Baluwa	Ranipani	27	2	29	13	39	1.3
Hokse	Shreerampati	29	0	29	5	44	1.5
Koshidekha	Upretithok	11	4	15	21	15	1.0
Panchkhal	Kaphaledihi	26	0	26	5	36	1.4
Rabi-Opi	Deourali	20	0	20	13	40	2.0
Total/Average		113	6	119	11	174	1.44

Source: PARDYP milk survey, 1998

Table 24: **Daily Total Milk Production and Sales during Winter and Monsoon Seasons by the Sample of Milk Deliverers Interviewed at the Village Cooperatives**

Village	Milk Production l/day Winter		Milk Production l/day Monsoon		Milk Sales l/day Winter		Milk Sales l/day Monsoon		Average HH Consumption l/day	
	Total	Av per HH	Total	Av per HH	Total	Av per HH	Total	Av per HH	Winter	Mon-soon
Ranipani	188.5	6.5	235.0	8.1	139.5	4.8	181.0	6.2	1.7	1.9
Shreerampati	232.0	8.0	267.0	9.2	164.5	5.7	197.5	6.8	2.3	2.4
Upretithok	87.5	5.8	98.5	6.7	67.0	4.5	80.0	5.3	1.4	1.4
Kaphaledihi	161.0	6.2	186.5	7.2	110.8	4.3	130.0	5.0	1.9	2.2
Deourali	205.5	10.3	238.0	11.9	196.5	9.8	161.0	8.1	0.5	3.8
	874.5	7.4	1025.0	8.6	678.3	5.8	749.5	6.3	1.6	2.3

monsoon are shown in Table 24. The 119 households in the five cooperatives surveyed produced an average of 875 litres of milk per day in winter and 1025 litres per day in the monsoon, and sold 678 and 750 litres per day respectively. Milk production is about 15 per cent higher during the monsoon than in winter as a result of the availability of green grass during the summer, but the fat content is higher in winter. Although all cooperatives produced more milk during the monsoon one of the five, Deourali, actually sold less, and most kept slightly more for home use (including, for example, production of butter fat). This reflects seasonal problems with transport from areas located further from the TCCs as well as problems with spoilage during hot weather. In addition, farmers are not able to sell any of their supply on one day (or more) per week because of the recently introduced 25 per cent reduction 'milk holiday day' system.

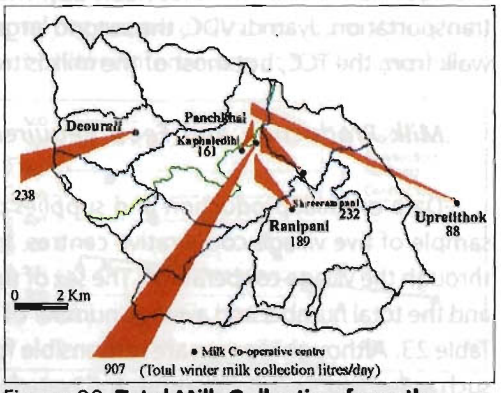

Figure 29: **Total Milk Collection from the Cooperative Centres**

Farmers were asked about the amount of feed given to the animals during the winter (November to February) and monsoon ('summer', mid June to September), and occurrences of feed shortage (Table 25). All the animals were stall-fed. Crop residues and grass were the two main sources of feed. The majority of winter feed (69%) derived from crop residues, the majority of summer feed from fresh grass. There was a shortage of crop residues from April to July in the spring and early monsoon, and of grass between October and May. Feed

Table 25: **Animal Feed Situation (winter/monsoon)**

Product	Winter (%)	Summer (%)	Total Shortages (months)
Crop residues	69	7	4
Concentrate feed	14	10	0
Grass	8	76	8
Forest products	6	6	10
Tree fodder	3	1	11
Total	100	100	

concentrate was the next most common source of feed but although available all the year round it is expensive and few farmers could afford it. Forest products comprised only six per cent of feed during both seasons, and were insufficient for most of the year. A similar study in the Bela-Bhimsensthan sub-watershed of Jhikhu Khola showed that between 1989 and 1994 it had become easier to obtain fodder from the forest (Shrestha and Brown 1995a).

Changes in milk production and the animal feed situation over the last five years were investigated during PRA surveys in thirteen selected villages. Grass collected from different sources played a very important part in the animal feed scenario. The data on grass collection for water buffaloes are summarised in Table 26. Women generally had sole responsibility for collecting grass from agricultural and forested land, although occasionally the whole family helped. Men more commonly collected fodder from fodder trees on private land, and were mainly responsible for the transportation of milk to the cooperative centres.

Although there were long periods of grass shortages and periods when very little feed of any type was available (Table 25), farmers have so far made no effort to store and preserve grass. The average time spent collecting grass and fodder is shown in Table 27. In winter little grass was available and the average household made only one trip per week to collect grass from rainfed agricultural areas. The average return trip took about seven hours. Tree fodder was collected from the farm once a week, taking another five hours. Most of the grass collected during the monsoon came from agricultural areas because forest access was restricted and the farmers had insufficient grazing land. During the monsoon an average household made 12 trips per week to collect grass from rainfed fields (equivalent to 22 hours/week) and 10 trips to collect grass from irrigated fields (30 hours/week). Further time was spent collecting grass from other sources.

Table 26: **Division of Labour for Feed Collection and Animal Care—Percentage Responsibility**

Product	Women Only	Men Only	Husband /Wife	All the Family	No Response	Total
Grass from irrigated land (*khet*)	77	0	0	8	15	100
Grass from rainfed land (*bari*)	85	0	0	15	0	100
Forest grass	69	8	8	8	7	100
Grass from grazing areas	15	8	8	0	69	100
Fodder from private fodder trees	0	47	15	0	38	100
Care of animals	38	8	54	0	0	100
Milk transport to cooperative collection centre	0	77	15	8	0	100

Table 27:.**Fodder Collection Frequency in the Winter and the Monsoon**

Product	Frequency (trips/week)		Time Spent (hrs/week)	
	Winter	Monsoon	Winter	Monsoon
Grass from irrigated land (*khet*)	NA	10	2	30
Grass from rainfed land (*bari*)	1	12	7	22
Forest grass	NA	NA	8	7
Grass from grazing areas	NA	NA	5	2
Fodder from private fodder trees	1	0	5	0
Total	>2	>22	27	61

The number of households in each village, the number involved in commercial milk production, and the main caste is shown in Table 28. In the thirteen villages in the study, 975 of the 693 households, or 71 per cent, sold milk. Brahmin families were the dominant force in commercial milk production. Tamang and Danuwar households kept less animals on average than did the Brahmins and far fewer participated in the milk trade. In Brahmin dominated villages almost all households were involved in commercial milk production. In contrast only 35 of the 120 households in Bakultar village in Baluwa VDC, which is dominated by Danuwar castes, sold milk and only six of the 105 households in Kalinjor village in Koshidekha VDC, which is dominated by Tamangs.

The Income from Milk, Women's Workload Dynamics, Feed Demand from the Forests, and the Use of Feed from Arable Lands

The price paid to the producers for milk is determined by the quantity and the fat content (Table 29). The average fat content of milk during winter was 6.5 per cent and in summer 5.8 per cent. The average price paid at the TCC over the year varied from Rs 2.50 to Rs 3.25 per one per cent fat content per litre. The fat content in water buffalo milk is much higher than that in cows' milk, which is one of the reasons why most of the milk in the study area comes from buffalo. Farmers normally keep cows' milk for home consumption.

Table 30 shows the estimated costs and benefits of milk production, assuming an average labour cost per day of Rs. 100 (the normal rate in the watershed for unskilled wage labour). The monthly value of milk and compost manure averaged Rs. 5364 of which Rs. 3348 was cash income. The total monthly expenditure averaged Rs. 5255 (including

Table 28: **Involvement in the Milk Trade**

VDC	Surveyed Village	Gender Group Interviewed	Number of HH Involved in PRA Sessions	Total No. of HH	Total No. of HH Selling Milk	Dominant Ethnic Caste
Hokse	Shreerampati a	Men	5	45	40	Brahmin
	Shreerampati b	Men	5	45	40	Brahmin
	Shreerampati c	Men	5	50	45	Brahmin
	Sub Total		*15*	*140*	*125*	
Pachkhal	Kaphaledihi	Men/ women	3	33	31	Brahmin
	Baniyadihi	Women	9	25	24	Brahmin
	Lamdihi	Men	1	100	100	Brahmin
	Sub Total		*13*	*158*	*155*	
Baluwa	Ranipani	Men/ women	4	75	50	Brahmin
	Bakultar	Men/ women	7	120	35	Danuwar
	Nayagaun	Men/ women	12	31	29	Brahmin
	Sub Total		*23*	*226*	*114*	
Rabi-Opi	Shikarkateri	Men/ women	8	30	30	Brahmin
	Deourali	Men	3	10	10	Brahmin
	Sub Total		*11*	*40*	*40*	
Koshidekha	Kalinjor	Men/ women	5	105	6	Tamang
	Salleni	Men/ women	4	11	8	Brahmin
	Sub Total		*9*	*115*	*14*	
	Total		71	975	693	

Table 29: **Average Fat Content in Milk from Different Villages in the Winter and Monsoon Seasons**

VDC	Village	Fat Content		Average price over the year per 1% fat content
		Winter %	Monsoon %	
Baluwa	Ranipani	6.6	6.6	3.00
Hokse	Shreerampati	6.2	5.8	3.00
Koshidekha	Upretithok	7.2	5.0	2.50
Panchkhal	Kaphaledihi	7.3	6.2	3.00
Rabi-Opi	Deourali	5.7	5.6	3.25
	Average	6.6	5.8	2.95

Table 30: **Monthly (Equivalent) Costs and Value of Benefits from Milk Production**

Animal Feed	Quantity	Total Value (Rs)
Dana (concentrate food)	50 kg	700
Dhuto (concentrate food)	60 kg	400
Maize flour	50 kg	500
Rice straw	8 bundles per day	480
Green grass (one *doko**/day)	30 doko* (900 kg)	150
Salt	15 mana*	25
Labour		3000
Total		5255
Mean monthly sales	180 litres/month	3348
Mean monthly home consumption	60 litres/month	1116
Compost manure (2 *doko** of compost/day)	60 *doko** (1800 kg)	900
Total		5364

Note: **doko*—standard basket; *mana*—volume measure, approximately 570 ml
The value of collected goods is based on the trade value if it were to be sold.

household labour). The average monthly net profit was thus about Rs. 109. If household labour costs are excluded, however, the net gain per month was about Rs. 3109, and if the potential trade value of collected fodder is also excluded then the actual benefit is even more. (These figures are only very rough estimates, however. They don't take into account the effect of milk holidays or other costs like the initial capital cost of a buffalo, the likelihood of death, costs of disease treatment, gain from selling calves, and downtime when no milk is produced.) This is a considerable amount of extra income for the average village resident.

The average time spent per day on activities related to milk production are shown in Table 31. Women were responsible for most of the activities, and spent more than twice as much time as men on buffalo management. Almost all farmers reported that their workload had increased substantially as a result of the new emphasis on the milk trade. According to the farmers, however, the income from one water buffalo was similar to that of a household member having a job in an office.

Table 31: **Average Time Spent on Activities for Milk Production by Men and Women**

Time	Men (hours/day)	Women (hours/day)
Morning	1.25	2.10
Day	0.40	1.30
Evening	0.35	1.10
Total	2.00	4.50

About 70 per cent of the farmers reported that the milk business had changed women's lives. Most of the money received was spent on household goods, and clothing and schooling of children. All farmers, male and female, wanted to increase milk production further.

The Farmers Perception of Problems in Milk Production, and Causes, Coping Strategies, and Possible Opportunities

The farmers purchased water buffaloes in order to make money by selling milk, but they felt they were not able to benefit sufficiently from this activity. They had great difficulty maintaining the buffaloes as they require special treatment and care throughout the day—the work required for one buffalo was considered equivalent to a full-time job in the city. Problems were identified at all levels—at the TCC, at the cooperative centres, and at the village level. These are summarised in the following sections.

At the Chilling Centre

- Problems

The major problems identified at the chilling centre are summarised in Table 32. The milk producers biggest concern was the 25 per cent reduction in the amount of milk accepted at the TCC, followed by transport problems, and the low prices paid for milk (Table 32).

Table 32: **Major Problems at the Chilling Centre**

Problem	Per cent
25% reduction in milk accepted at centre	36
Transportation	23
Low price of milk	15
Low pay for porters	13
Don't know	13
Total	100

At present the TCC accepts only 75 per cent of what the farmers are producing for sale. This new system is creating hardship for many farmers because the surplus exceeds home consumption needs and there are limited possibilities for processing the excess milk. On average the farmers produced eight litres of milk per day and consumed two litres at home (Table 33). The Nepal Dairy Development Company claims to have problems marketing the milk because of imports from India, and this has created this difficult spin-off situation for the farmers. These difficulties are the results of poor management and policies by central government (Thapa *et al.* 1997).

Table 33: **Daily Average Milk Production**

VDC	Village	Average Production/Day	Average Home Consumption/Day
Baluwa	Ranipani	6.5	1.69
Hokse	Shreerampati	8.0	2.33
Koshidekha	Upretithok	5.8	1.37
Panchkhal	Kaphaledihi	6.2	1.93
Rabi-Opi	Deourali	11.9	2.08
	Total Average	7.7	1.88

Source: PARDYP milk survey, 1998

The second biggest problem for the milk farmers was transportation. In most cases the milk had to be carried to the TCC. This could take several hours, and in the monsoon season when the temperatures are high spoilage of milk was also high. The physical effort of carrying the heavy cans was also significant. The third most important problem was the low price the farmers received for the milk (Rs18-22/l). Most farmers complained that the price of milk was lower than that of mineral water (Rs 19-20/l) or rakshi (local spirits, Rs.25-30/l).

- Causes

The farmers considered that the cause of their problems was the TCC policy of accepting 25 per cent less milk (86%), the policy of allowing milk imports into the country (7%), and the splitting of the cooperative centres (7%). Seventy five per cent of the farmers also commented that transportation was a major problem because of the lack of good tracks and roads to the TCC.

- Coping Strategies

As a result of the 25 per cent reduction in the amount of milk accepted by the TCC, 50 per cent of the farmers were forced to use more milk for home consumption than they could cope with. There were few other options for using the milk as there was a lack of fuelwood and water and the poor infrastructure is not conducive to taking the milk elsewhere for processing. Half of the farmers said that they didn't know how to cope with the milk surplus although some made *ghue* (butter fat).

- Opportunities

Fifty seven per cent of the farmers thought the surplus problem could be minimised if the management policy at the Dairy Company could be changed, seven per cent thought that better marketing might alleviate the milk surplus problem.

At the Cooperative Centres

- Problems

The major problems identified during the interviews at the village cooperative centres are shown in Table 34. Some were different to those identified at the TCC, although the problems were very similar for different groups and villages. Nearly one third of the farmers at the cooperative centres identified the shortage of fresh fodder during winter as the major problem.

Table 34: **Major Problems Identified by the Cooperatives Farmer Groups**

Major Problem	No. of Interviewees	%
Availability of grass	38	32
25% reduction in milk sales	29	24
Diseases	9	8
Availability of fodder	7	6
Lack of market	6	5
Water shortages	6	5
Concentrated feed	4	3
Roads	3	3
Other	7	6
Don't know	10	8
Total	119	100

Most of the farmers grew grass on their own agricultural land, since access to grass in the forest and on grazing land was restricted either by the state or by community user groups, but this grass was not sufficient to meet their needs. The second most important problem was the reduction in milk sales (24%), and the third diseases (8%).

- Causes

Twenty four per cent of the farmers said that the lack of grass was the result of water shortages. They were unable to grow grass because of the severe water shortage during the winter. About 16 per cent felt that it was more a case of a lack of land—which was sufficient for agriculture but not for grass production as well. Other causes identified for the shortage of fresh fodder were the limited access to grazing land (11%), population growth (11%), and forest closure (11%).

Forty one per cent of the farmers said that the reduction in the amount of milk accepted was the result of poor management and poor marketing by the Dairy Corporation.

- Coping strategies

Eighty seven per cent of the farmers said that they fed crop residues to the water buffalo during the winter to compensate for the lack of grass. The remainder said that they obtained some grass from the forest and rainfed areas, and grazed the animals on their own land.

- Opportunities

Fifty per cent of the farmers said that the existing shortage of grass could be solved by introducing improved grass seed, 19 per cent that it could be minimised by planting improved fodder trees, five per cent said that an improvement in the water supply would help, and 26 per cent offered no solution.

Conclusion

Milk production in the watershed expanded rapidly as a result of the establishment of the chilling centre. This resulted in the development of an extensive network of 63 collection centres from which milk is carried to the centre.

At present, the supply of milk in the watershed appears to be higher than the market capacity in Kathmandu, or at least the market capacity of the NDC. This has resulted in a 25 per cent reduction in the amount of milk accepted by the dairy corporation, which is causing confusion and hardship to the farmers. The increasing role of private dairies has still to be investigated. The real market potential and alternative possibilities for milk sales should be investigated, for example delivery to private dairy companies or production of alternative dairy products.

The farmers are eager to produce more milk, in spite of the fact that the majority said that milk production had added significantly to their workload. This is because of their need for cash income.

Milk production poses a particular problem for women, who reported that they spent an average of 4.5 hours per day over and above their previous workload on activities related to milk production. Men reported a two hours per day increase in their workload as a result of milk production.

Besides the market capacity in Kathmandu, the main constraints to milk production were the availability of green grass during winter, insufficient access to grazing lands and forests, and a significant shortage of water during winter. Feed concentrate was too expensive for most farmers, and the average land holdings were too small for additional production of grass.

Land use surveys of the Jhikhu Khola watershed have shown that between 1947 and 1996 there was a significant expansion of agricultural area at the expense of grazing land. At the same time forest degradation limited fodder supply, and access was reduced by the recent policy of turning national forests over to community management. Thus access to grazing areas has been reduced significantly, but the residues produced from the more intensive agriculture do not appear to be sufficient to compensate.

The milk marketing was mainly restricted to people of Brahmin caste and very few low caste people participated in the trade.

Since the excess milk can no longer be marketed and the farmers are apparently unable to consume all the excess, suggestions have been made that the milk be processed into other products. At present, this does not appear to be viable because of the lack of fuelwood, poor infrastructure, poor transportation network, and poor market access.

Notwithstanding the problems of overproduction, the heavy workload, and the modest returns in terms of cash income, almost all the farmers wanted to continue to keep water buffalo and even to produce more milk. Thus it is important to study fresh possibilities and opportunities, as well as methods to improve the quality of the grass and to introduce nitrogen-fixing grasses and fodder trees.

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