CHAPTER V

DISCUSSION

The main objectives of present study were to assess the feed resources availability, their nutritional value and comparative analysis of both feeding systems (FRG and MF) prevailing in the Bundelkhand region. Findings of the study are discussed on the following major points:

- Socio-economic status of livestock farmers in the region
- Livestock resources
- Feed resources availability and nutritional evaluation
- Comparative analysis of both feeding systems for major livestock
- Economics of both feeding system

5.1 Socio-Economic Status of Livestock Farmers in the Region

Data were obtained from ten representative villages of Bundelkhand region. Majority of the sample farmers (56%) were in middle age group (35-60 years), and 30% were young (below 35 years), and only 14% forms were old (above 60 years).

The reason of maximum number of old aged farmers (22%) in the large land holding category were undivided families under the leadership of senior most person. Results
on educational status of the farmers revealed that maximum farmers were educated up to primary standard (46.7%) or illiterate (36%), whereas 12.7 percent farmers passed high school and 4.67 percent (mainly from large land holding category) were Graduate. The literacy status of the farmers increased with increase in land holding in the region. The reasons for high literacy in large farmers were more availability of resources and awareness for education, on other hand maximum number of illiterate farmers were from small and medium landholders. Average land holding for small, medium and large farmers were 1.26, 2.86 and 6.19 ha/family. The irrigated land was more with large farmers, whereas resource poor small and medium farmers have limited irrigation facilities.

5.2 Livestock Resources of the Region

Data of livestock from 150 sample household revealed that buffaloes were the maximum reared livestock (32.06%) than cattle (29.98%), goat (2.5.58%) and sheep (12.88%) in the region. The livestock distribution in different categories of farmers showed that average number of buffaloes was higher with large (4.94/family) and medium farmers (3.84/family), mainly for milk production purpose whereas cattle were higher with small (3.74/family) and medium farmers (3.64/family), mainly for milk and draught purposes. Sajjan Sihag et al (2002) also reported that average number of cattle /family was higher in small farmers while buffalo/family was higher with large farmers in Haryana. Sheep and goats mainly reared by the small and medium landholders, due to low input and quick return. Large farmers were reluctant to rear sheep due to lack of family labor or some social reasons.
The maximum numbers of livestock ACU were reared by medium farmers (7.84 ACU/family) against large farmers (6.78 ACU/family) so that they compensate the income of crop production as well as draught power required for agricultural operations. The livestock ACU was found 4.83, 2.57 and 1.09/ha land for small, medium and large categories, respectively. Maximum pressure of ACU was noticed on the land of small farmers due to less land holding (1.16 ha/family). The pressure of ACU was decreased with increase in size of land holding (Tyagi, 1997).

The comparison of total livestock population in the year 1985 and year 2001 showed the negative growth (-4.10%) of livestock in the region. The major decline was observed in cattle population (-9.36%), especially male cattle decreased by 4.59 percent. This decline might be due to mechanization of agricultural operations. The farmers rearing animals mainly for milk production purpose, therefore population of buffaloes increased (3.15%) in the region. The population of goat and sheep were moderately increased from the year 1985 to 2001 in the region. Cattle were mostly reared by the small and medium categories and majority of the farmers in the Bundelkhand region are small and marginal landholders (IGFRI, 1992).

Tyagi (1997) recommended maximum animal density for the type of land found in the region is 0.78 ACU/ha, whereas huge number of animals existing with the farmers (3.08ACU/ha) in the selected villages. The govt. of UP (1991) reported that the dependence of people on livestock was reinforced due to poor agricultural productivity on account of large numbers of small and medium holdings. Poor
resource base and low cropping intensity of about 113 percent might be the factors for high animal pressure in the region.

5.3 Feed Resources

5.3.1 Feed resources availability in the region

The analysis of data related to feed resource availability and requirement showed that about 20 percent fodder was deficit in the sample villages. The major deficit was found from concentrate (-44.9%) whereas in the case of roughage it was only 7.19 percent on dry matter basis. Large farmers possessed surplus amount of fodder roughage (+40%) and concentrate (+9.3%), whereas small farmers faced acute deficit of fodder roughage (-37.6%) and concentrate (39.8%) for their livestock in the region.

Crop residues were the major source of roughage supply and lowest amount of roughage received from cultivated fodder in the region. The main reason behind less area under fodder cultivation were (i) lack of irrigation facility, (ii) prevailing system of free range grazing and (iii) lack of motivation and suitable fodder production technologies Saran et al (2000) also reported similar observation in Bundelkhand region.

The deficit of feed resources in semi arid regions was also reported earlier (Hampiah, 1981; Punj and Devendra, 1988; Mudgal et al 1988; Ravindran and Devendra, 1988; Tripathi, 1991; Roggero et al 1996).
Forage received from grazing on forest land/wasteland was the second largest roughage sources after crop residues in the region. Such finding also reported in Bundelkhand region by earlier workers (Singh et al, 1995; Singh et al, 2001).

5.3.2 Nutritional evaluation of feed resources

The nutritive value of locally available feed resources as crop residues, cultivated fodder, concentrate and naturally grown grasses were evaluated. The crop residues available with the farmers were mainly straws of cereal and pulse crops. The CP content in crop residues varied from 3.42 to 14.86 percent. The straws of cereal crops like wheat, paddy, barley and lentil contained the CP in the range of 3.42 to 4.37 percent. However the CP content was found higher in residues of leguminous crop viz., moongbean straw (12.8%), chickpea straw (10.2%) and soyabean straw (14.8%). The CP content and other chemical constituent of crop residues were almost similar as reported earlier (Sen and Ray, 1971; Desai et al 1988; NRC, 1988).

The anti-nutritional factor lignin content was ranged from 5.98 to 9.93 percent and IVDMD from 36.54 to 61.92 percent in different crop residues. The lowest IVDMD (36.54%) was found in lentil straw might be due to highest lignin content (9.93%). Lignin is negatively correlated with digestibility (Lapierre, 1993; Buxton and Fales, 1994; Dzowela et al, 1995). Highest digestibility (61.92%) of pigeon pea straw might be due to high proportion of leaves in that straw.

The main cultivated fodder crops were sorghum and maize in kharif and berseem and oat in Ravi season. The sorghum and maize fodder contained fair amount of CP 7.70 and 8.40 percent, respectively to maintain the livestock. Berseem is the
rich source of CP (16.75%) and grown as major fodder crop by the dairy farmers. The oil cakes and cereal grains were the main concentrate available with the farmers. The high CP content was observed in oil cakes ranges from 26.8 to 39.1 percent. Cell wall fraction was lower in all the concentrates. IVDMD of concentrate were very high and ranged from 78.56 to 84.38 percent on DM basis. Chemical composition and IVDMD of these concentrate and cultivated fodder crops were in agreement to other reports (Sen and Ray, 1971; NRC, 1988).

All the species of naturally grown grasses contained the CP in the range of 3.92 to 7.60 percent, minimum in Chrysopogon fulvus and maximum in Cynodon dactylon, respectively. The lignin content was in the range of 5.92 to 7.6 percent and IVDMD varied from 48 to 60 percent. The CP content of these grasses were found comparable with earlier reports ((Sen and Ray, 1971; NRC, 1988).

5.3.3 Nutritional evaluation of shrubs and tree leaves

All the shrubs and tree leaves possessed high CP throughout the year (9.65 to 18.75%). Chemical compositions of these leaves are comparable with the results of Negi et al, (2003). Season wise analyses showed that CP content was higher in monsoon and summer season and moderately decline in winter season in all the shrubs and tree species. The similar trend of CP content of tree leaves was observed by Majumdar et al, (1988).

The cell wall fraction (NDF and ADF) increased with the maturity of leaf and varied with the season. All the shrub species invariably exhibited lower content of NDF and ADF in summer or monsoon, at the time of emergence of new leaves. The
cell wall fraction remain lower during summer and maximum in winter when leaves mature (Negi et al, 2003).

The lignin (ADL) content in the leaves of all the shrubs species ranged from 4.8 to 14.5 percent, which was comparatively lower in monsoon and increased in the winter season with the maturity of leaves. Similarly, IVDMD values of tree leaves were higher in monsoon than summer and lowest in winter season. Lignin is the component most negatively correlated with degradability (Lapierre, 1993; Buxton and Fales, 1994; Dzowela et al, 1995).

Lower dry matter digestibility of *Madhuca indica, Ficus religiosa, Flacourtia indica* leaves might be due to presence of higher lignin content in these species. The mean IVDMD of shrubs and tree leaves was varied from 43.68 to 71.90 percent. These values are in agreement with earlier reported degradability (38 to 78) percent of shrubs and tree leaves (Skarpe and Bergstrom 1986).

Higher cell wall fraction and lower IVDMD was observed in winter season, when leaves matured. Digestibility may be negatively related to ADF content of forage (Albrecht and Broderich, 1990). The results of shrubs and tree leaves evaluation are also in the confirmation of the earlier reports on shrubs and tree leaves (Singh, et al, 1988; Singh et al, 1999; Ramana et al, 2000).

The results of present evaluation of shrubs and tree leaves showed that these species are potential source of nutrient supply to supplement in the diet of ruminants especially during lean period.
5.4 Comparative Analyses of Free Range Grazing and Managed Feeding Systems

The lactating cattle and buffaloes were reared under both the feeding systems in the region. However most of the growing cattle and buffaloes were reared under FRG system during summer and part of the monsoon season. Sheep and goat were also reared in FRG system from April to September. The major parameters taken for the comparison of both the systems were feed intake, nutrient availability (surplus/deficit), milk production and economics of production.

5.4.1 Feed intake of lactating cows

Data about the quantity of feed and fodder offered were obtained with a fair degree of precision, with the cooperation of farmers. Three types of feeds i.e. green fodder, dry fodder and concentrates were being fed to the milk cows (Table 8).

The annual average of dry matter intake (DMI) of milk cows was higher in MF system (6.81 kg/h/d) as compared to FRG system (5.70 kg/h/d), in the region. The feed intake was similar among animals of different landholders in FRG system, however in MF system large farmers fed their animals with higher amount of feed compared to small and medium landholders.

The average body weight of milk cows of MF and FRG was 343 and 329 kg, respectively. The DMI was less than requirement of 6 to 8 kg (ICAR, 1985) in FRG system. The major decrease of DMI in summer season might be due to poor availability of feed resource in summer season. This indicates that feeding care was better in MF system especially by the large farmers owing to more feed resource
available with large holding. Increase in feed intake of animals with the increase in size of land holdings of farmers was also reported by Patange et al (2002).

The green fodder included locally available green grasses, edible weeds from cropped land and cultivated fodder as green maize, oat and beerseem. The maximum intake of green fodder by milch cows was observed in monsoon season as average of both the feeding system (6.6 kg/h/d) followed by winter (5.7 kg/h/d), and lowest in summer season. However cows under FRG system could not received green fodder during summer season.

Contrary to our results, maximum green fodder intake was reported in winter season (Patel et al, 1982; Patange et al, 2002) for other climatic zones. The less area under cultivated fodder and limited irrigation facilities adversely affect the green fodder availability in winter season. The average green fodder intake of animals was adjusted according to seasonal availability (Badal and Dhaka, 1998).

The feed intake of milch cows in FRG and MF system was differed significantly in summer and monsoon season. But, in winter season DMI of milch cows was similar in FRG and MF system (6.98 and 7.07 kg/h/d) respectively. Free rage grazing of cows did not exist in winter season (Gomez et al, 1998).

The amount of concentrate feeding increased upward with increase in land holdings of the farmers, in MF system. The amount of concentrate, fed throughout the year by the dairy farmers in the area, was 1.48 and 1.07 kg/h/d in MF and FRG system respectively. The ratio of roughage and concentrate was found uneven in the both feeding systems which might be due to high cost of concentrate.
5.4.2 Feed intake of lactating buffaloes

The year wise study of dry matter intake by milch buffaloes was significantly higher (8.75 kg/h/d) in MF system as compared to FRG system (7.75 kg/h/d). The mean DMI of MF buffaloes in monsoon, winter and summer seasons were 8.80, 9.06 and 8.39 kg/h/d which were sufficient to meet the DM requirement of 8-10 kg/h/d (ICAR, 1985). But in FRG system, buffaloes get DM below the requirement in monsoon (7.73 kg/h/d) and summer season (6.52 kg/h/d) due to less availability of feed resources in free range grazing. The DMI buffaloes were similar in all the farmers categories in FRG system but in MF system, large and medium farmers offered higher quantity of feed to their milch buffaloes compared to small farmers, because of more feed resource available to them due to large cropping land.

The DMI of MF buffaloes are comparable to report of Udeybir et al, (2000). The farmers categories wise, DMI of buffaloes are comparable with milch Marathwadi buffaloes of Maharashtra region (Patange et al, 2002). In winter season, FRG buffaloes were not allowed for free range grazing and fed as managed feeding system, therefore DMI of buffaloes were similar in FRG and MF system (9.012 and 9.41 kg/h/d respectively) in winter season.

The maximum green fodder intake of buffaloes was recorded in monsoon season because of availability of monsoon grasses and edible weeds from cropped area and wasteland. However large and medium farmers fed higher quantity of green fodder in winter season, mainly berseem to their milch buffaloes due to availability of irrigation. The average green fodder intake was adjusted according to its seasonal
availability (Badal land Dhaka, 1998). The average quantity of green fodder intake of buffaloes is lower than reported in Haryana (Sihag et al, 2002), which might be due to regional variation more particularly soil fertility, better irrigation facility and awareness.

The dry fodder consisted of mainly crop residues, like wheat straw, sorghum kadbi and straws of leguminous crop as moong, urd, gram soyabean etc. Crop residues were the major source of dry matter (66.9%) in total ration of buffaloes during summer season. Ranjhan, (1999) has also reported that about 50-60 percent of DMI in large ruminant comes through crop residues only and Pantage et al, (2002) reported 64.4 percent of crop residues in total ration of buffaloes.

The concentrate feeding to milch buffaloes was higher in summer season due to remunerative price of milk. Handa and Gill (1989) also reported maximum feeding of concentrate during March-May. Buffaloes under MF system were fed higher amount of concentrate (2.18 kg/h/d) than FRG system (1.81 kg/h/d). The large and medium farmers fed 2.55 and 2.30 kg/h/d concentrate to their milch buffaloes against 1.70 kg/h/d by small landholders might be due to higher cost of concentrate. The quantity of concentrate feeding to milch buffaloes in Bundelkhand region are comparable with the findings of Patange et al (2002), who reported concentrate feeding of 2.16 kg/h/d in Marathwari buffaloes. But, lower than Murrah buffaloes (3.46 kg/h/d) of Haryana (Sihag et al 2002) which might be due to financial constraints of the farmers. Overall data revealed that buffaloes under MF system were
fed comparatively better than FRG system and feed supply to the milch buffaloes raised with increased land holding of the owners.

5.4.3 Nutrient availability to milch cows in different feeding systems

The plane of nutrition of milch cows was assessed in terms of digestible crude protein (DCP) and total digestible nutrients (TDN). The supply of DCP and TDN to the milch buffaloes was compared with standard requirements (ICAR, 1985) for both the feeding system.

Milch cows under MF system were fed round the year with higher DCP and TDN (0.354 and 4.116 kg/h/d) as compared to cows under FRG system (0.315 and 3.959) kg/h/d), due to higher dry matter intake and concentrate supply in MF system. The average supply of DCP and TDN to milch cows in MF system was almost equal to standard requirement (ICAR, 1985). However, cows under FRG system were faced deficit of 20.7% DCP and 14.7% TDN, due to feeding of less quantity of green fodder and concentrate to FRG cows.

Acute nutrient deficit (- 46% DCP and -36% TDN) in FRG cows during summer season was due to non-availability of green fodder limited quantity of concentrate feeding and major supply of poor quality crop residues during summer season. Thus, farmers maintaining low to medium yielding cows in FRG system need to augment the nutrient supply by providing more of greens, concentrate of dry roughage to support the production potential of cows.
5.4.4 Nutrient availability of milch buffaloes in different feeding systems

Daily DCP and TDN supplied to milch buffaloes in different feeding systems (Table 10) were compared with standard feeding recommendations (ICAR, 1985). The buffaloes under FRG system received recommended level (ICAR, 1985) of DCP and TDN, even surplus amount of DCP (+5.90%) and TDN (+2.74%) in case of large farmers. But the buffaloes under FRG system received deficit amount of DCP (-16.50%) and TDN (-11.99%) due to lower feed intake specially green fodder and concentrate.

Patange et al, (2002) also surveyed ration of buffaloes and reported deficit of DCP and TDN 10.8 and 5.8 percent in Marathwada region. Lowest amount of nutrient received by the FRG buffaloes during summer season due to feeding of crop residues as a major part of feed, especially by the small landholders in Bundelkhand region. Such feeding of animals under village conditions has also been reported for Hisar region (Lal et al, 1995) and rural areas of Azamgarh district in Uttar Pradesh (Singh et al, 1998).

Among season, maximum level of DCP was supplied during summer in MF system, and medium farmers fed surplus amount of DCP (13.4%) through concentrate, might be due to remunerative price of milk during summer season. Handa and Gill (1989) also observed highest supply of DCP in summer season than rest of the year.

On the basis of above observations there is a need to increase the nutrient supply to FRG buffaloes by providing more of green fodder and concentrate to support the production potential and get the optimum production.
5.4.5 Milk production

Milk production of cows and buffaloes in 24 hours recorded thrice in a season, with the cooperation of the farmers. The average milk yield of cows fed under MF system was 3.42 litre/day against 2.39 litre/day in FRG system. The milk yield of FRG cows in winter season was similar to cows in MF system (3.41 and 3.72 litre/day), whereas FRG cows were low producer for rest of the seasons. These results might be due to the free grazing cows received the nutrient supply less than the recommended level (ICAR 1985) throughout the year, except in winter season. The cows of large farmers in MF system produced highest quantity of milk (3.87 litre/day) throughout the year, due to constant supply of DCP and TDN.

The average milk yield of buffaloes was also higher in MF system (4.66 litre/day). The average milk production of cattle and buffaloes of Bundelkhand region found lower than milk yield of cattle and buffaloes in Haryana as 5.61 and 5.81 kg/day, respectively (Sajjan Sihag et al, 2002).

The highest milk yielded by the buffaloes of large farmers (5.94 litre/day) in MF system during winter and lowest in FRG buffaloes of small farmers (1.5 litre/day) during summer. The categories of farmers also made significant difference in milk production. The average milk yield of cattle and buffaloes was higher in the animals of large farmers than small farmers. Such findings also reported by Sajjan Sihag et al, (2002). Season wise, milk yield of cows and buffaloes was increased or decreased as per the feed supplied by the owners. Green fodder and concentrate contribute
possibility and significantly to the milk yield of both for cows and buffaloes (Shalander et al, 1994, Deepak shah et al, 1995).

Data of milk production clearly indicated that buffaloes yielded higher milk than cows in the region. Buffaloes were better maintained in MF system by large as well as medium farmers, while cows by large farmers only. Cows with small and medium landholders produced lower quantity of milk, especially in summer season. Low producing cows and buffaloes in FRG system need supplementation of nutrient through green fodder and concentrate to support their production potential.

5.4.6 Feed intake of growing heifers

The cattle and buffalo heifers were maintained in managed feeding system during winter season and in free range grazing during summer and part of monsoon season by all categories of the farmers.

The mean dry matter intake of cattle heifers was 4.05 kg/h/d throughout the year. The DMI was highest in winter (4.57 kg) than monsoon (4.22 kg) and lowest in summer season (3.36 kg/h/d) as per the seasonal availability of feed resources. Large farmers fed their cattle and buffaloes heifers with higher amount of dry matter might be due to more availability of feed resources.

In monsoon and summer season, the DMI of cattle and buffalo heifers was lower than the standard feeding (ICAR,1988; Pathak 1988) due to free range grazing by all the animals. Animals with small landholders received lowest DMI due to limited supplementary feeding by their owners. High roughage and low concentrate in the diet may also limit the feed intake. Positive correlation were observed between
dietary concentrate content and the percent DMI in straw based diet in both growing cattle and buffaloes (Udeybir, et al, 2000).

Dry roughage or crop residues were the major sources of feed for growing animals throughout the year due to less availability of green fodder in the region. Average amount of concentrate feeding was higher for buffaloes (0.56 kg/h/d) than cattle heifers (0.33 kg/h/d), might be due to higher market value of buffalo heifers. The feeding of concentrate increased with increase in landholding of owners might be due to high cost of concentrate.

5.4.7 DCP and TDN supply of growing animals

The supply of DCP and TDN to growing cattle and buffaloes heifers was compared to standard requirements (ICAR, 1985) on the basis of their body weight. The average DCP and TDN supply to growing cattle were 0.190 and 2.259 kg/h/day in the region, which was deficit by 35.5 and 13.3 percent respectively. However acute deficit of DCP (-58.3%) was observed in summer season. Buffaloes were fed better than cow heifers in the region. The average DCP and TDN supply of growing buffaloes were deficit only 16.8 and 3.4 percent as compared to standard requirements.

The maximum deficit of DCP and TDN was observed in summer season with all the categories of the farmers because most of the green fodder and concentrate available with the farmers were usually fed to lactating animals.

The deficit of DCP and TDN observed when animals were fed on poor quality roughage based diet (Pradhan, 1994). The average TDN supply was comparatively better than DCP in growing cattle and buffaloes. The nutrient supply to cattle and
buffaloes heifers at village level were found lower than pooled data of different trials at different experimental stations in India (Udeybir et al, 2000).

Nutrient supply to buffaloes were comparatively better than cattle heifers in the villages might be due higher sale value of buffalo heifers in the region.

5.4.8 Growth rate of heifers

The initial body weight (mean) of cattle and buffalo heifers was 136±6.2 kg and 142±5.7 kg, respectively. The growth rate of cattle heifers was highest in winter season (231 g/day) than in monsoon (219 g/day) but in summer reason average growth was negative (-11 g/day). Cattle lost their body weight in small (-25 g/day) and medium categories of the farmers (-17 g/day), during summer season. The feed intake and nutrient supply to the cattle heifers in different season was deficit which, might be the season for such growth. Live weight gain of cattle heifers with large farmers was significantly higher as compared to the animals of small and medium categories, due to higher amount of nutrient supply by the large farmers to their growing cattle.

The average growth of buffaloes heifers was similar in monsoon and winter season (314 g/day) whereas, lower growth rate of buffaloes was observed in summer season (53 g/day). The growth rate of buffaloes for large and medium categories was 250 and 241 g/day, which was higher than buffaloes of small farmers (189 g/day). The normal growth rate of heifers assumed 300 to 500 g/day for cattle and 400 g/day for buffalo heifers and nutrient intake through feed highly correlated with growth performance (ICAR, 1985; NRC, 1988; Pathak, 1988; Udeybir, 2000).
The growth rate of buffalo heifers was better than cows in the region but lower than standard growth. Cattle heifers of small and medium farmers lost their body weight during summer season might be due to deficit nutrient supply during free range grazing in summer season.

5.4.9 Feeding pattern of sheep and goat in the region

Feed intake of sheep and goat was recorded in different seasons for the animals of all categories of the farmers. The large farmers were not rearing sheep in the region might be due to some social reasons. Feeding practices, adopted by the farmers for sheep and goat, were grazing on wasteland or forestland and supplemental feeding at home. The grazing hours for sheep and goat were similar as 6 to 8 hours for small, medium and large categories.

The average supplementary feeding to sheep was similar in small (0.50 kg DM/h/d) and medium (0.52 kg DM/h/d) landholders. However medium categories of farmers supplemented moderately higher amount of concentrate to their sheep might be due to availability of more resources. The average dry matter supplemented to goat by small, medium and large farmers was 0.55, 0.54 and 0.60 kg/h/d, respectively. The concentrate was maximum supplemented to goat in summer season by large farmers (0.27 kg/h/d) and higher amount of crop residues was also supplemented in summer (0.41 kg/h/d) by all the categories of the farmers.

The mean body weight of adult sheep and goat were found 31.95±3.21 kg and 30.20±5.74 kg, respectively. The feed intake of sheep and goat in the region was sufficient to meet their requirement (ICAR, 1985). However moderate deficit of DM
in the goat of small farmers needs to be supplemented with concentrate. Goats potential is not often exploited fully due to lack of appropriate feeding (Pachauri et al, 1999).

Highest amount of dry matter was supplemented to sheep and goat during summer season might be due to less availability of grazing resources in summer season and availability of shrubs and three leaves to supplement in the ration. Similar supplementary feeding to goat was also recommended (Mahanta et al, 2002) to the goats grazing on range lands in Jhansi district. Our findings are in agreement that goat farming is predominant in semi-arid regions of the country including Bundelkhand (Ranjhan, 1997).

5.5 Economics of Milk Production

Economics of the milk production was worked out for cattle land buffaloes on the basis of present rates of input and output prevailing in the region.

The total input cost of rearing a milch cow was lower in FRG system (Rs. 6560/year) as compared to MF system (Rs. 10591/year). Similarly, the total income from sale of products was also lower in FRG system (Rs. 10125 /cow/year) than MF system (Rs. 14550/cow /year). But a narrow gap observed in net income from a cow under FRG (Rs. 3565/year) and MF system (3959/year) might be due to more labor requirement and limited investment on feed resources in MF system. However milk productivity of cows was higher in MF system (1252 litre/day) than FRF system (872 litre/day) might be due to better nutrient supply to cows in MF system. This indicates that FRG cows require feed supplementation to support their production potential.
The cost of rearing a buffalo was lower in FRG system (Rs. 10750/year) than MF system (Rs. 14739/year) in the region. The total income was also lower in FRG system (Rs. 17842/buffalo/year) than MF system (23159/buffalo/year) and net income from FRG and MF system was Rs. 8420 and 7092/buffaloes/year. Similar to the cows, milk productivity of buffaloes was higher in MF system (1717 litre/buffalo/year) than FRG system (1335 litre/year) due to feeding of required amount of nutrients (ICAR, 1985) in MF system.

The cost of milk production in FRG and MF system was Rs. 7.52 and 8.46/litre for cows and Rs. 8.05 and 8.58/litre milk for buffaloes in the region. The lower productivity and less cost of milk production in FRG system were due to limited supply of concentrate and major part of feed supply through grazing resources. Paul et al (2001) also observed that grazing with limited supplementation was more economical than stall feeding.

Concentrate was the resource which had highest marginal value productivity in dairy animals and income could be increased by expenditure on feeding (Tripathi et al, 1986; Shalander et al, 1994; Deepak shah et al, 1995). Increase in investment also increases the annual return from dairy farms (Lee keejong et al, 1996).

The average expenditure on feed resources by the farmers was 57.9 and 56.7 percent of total rearing cost of cattle and buffaloes, respectively. The expenditure on feed may be 60-70 percent of total rearing cost of dairy animals. There is scope to increase the investment for feed cost especially on concentrates. Jansen et al (1997) suggested pasture improvement for livestock production and economic profitability.
Cost of rearing as well as total income from cows and buffaloes increased upwards with the size of land holding of owners in the region, might be due to feed resources availability and more investment capability. The net income from cows as well as buffaloes was higher in MF system. However, highest net income from lactating cow was in case of large farmers, while highest net income from buffaloes received by medium and large farmers might be due more investment on feed resources.