MANPOWER UTILIZATION PATTERN IN MANAGEMENT OF LIVESTOCK FARM OPERATIONS

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MASTER OF VETERINARY SCIENCES

In

LIVESTOCK PRODUCTION MANAGEMENT

By

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(VM0038/2018-19)

BIHAR VETERINARY COLLEGE, PATNA-800014

2021

DEPARTMENT OF LIVESTOCK PRODUCTION MANAGEMENT

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CERTIFICATE- I

This is to certify that the thesis entitled, "**MANPOWER UTILIZATION PATTERN IN MANAGEMENT OF LIVESTOCK FARM OPERATIONS"** submitted in partial fulfilment of the requirements for the award of the degree of Master of Veterinary Science in the discipline of **Livestock Production Management** of the faculty of Post-Graduate Studies, Bihar Animal Sciences University, Patna, Bihar is the bonafide research work carried out by **Dr. BRAJESH KUMAR, Registration No-VM0038/2018-19,** son of Shri. **AMARNATH SINGH** under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been fully acknowledged.

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CERTIFICATE- II

This is to certify that the thesis entitled, "**MANPOWER UTILIZATION PATTERN IN MANAGEMENT OF LIVESTOCK FARM OPERATIONS** "submitted by **Dr. BRAJESH KUMAR, Registration No-VM0038/2018-19,** son of **Shri. AMARNATH SINGH** to the Bihar Animal Sciences University, Patna, Bihar in partial fulfilment of the requirements for the degree of Master of Veterinary Science in the discipline of **Livestock Production Management** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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Place _____

Date _____ **(*Brajesh Kumar)***

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LIST OF ABBREVIATIONS AND SYMBOLS

ABBREVIATIONS	FULL FORM
%	: Percentage
@	: At the rate
a.m.	: Ante-meridian
p.m.	: Post meridian
a.u.	: Adult unit
ANOVA	: Analysis of variance
et. al.	: Et alli and others
Fig.	: Figure
Hr.	: Hour
Min.	: Minute
Sec.	: Second
i.e.	: That is
Kg	:Kilogram
S.E.	: Standard Error
S.No.	: Serial Number
Viz.	: Namely
Vs.	: In opposition
Wt.	: Weight
<	: Less than
>	: More than
ha.	: Hectare
A.I.	: Artificial Insemination

±	: Plus or Minus
&	: And
Etc.	: Et cetera

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DEPARTMENT OF LIVESTOCK PRODUCTION MANAGEMENT
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Title of thesis**: Manpower Utilization Pattern in Management of Livestock Farm Operations**

Name of student: **Dr. Brajesh Kumar** Adm. No.:VM0038/2018-19

Major discipline: Livestock Production Management Minor discipline: Animal Nutrition

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Major Advisor: **Dr. Ravikant Nirala**

ABSTRACT

The present study on '*Manpower Utilization Pattern in Management of Livestock Farm Operations*' was done at the Dairy Unit of Livestock Complex, BASU (Patna). For study purposes, 176 dairy animals divided into different categories *viz.* milch cows, milch buffaloes, heifers, calves, dry animals and bulls were taken. The observations of various dairy farm activities were carried out for 120 days while milking activities were reported for 60 days. The total time utilized per day in actual milking of Sahiwal cows, crossbred cows and Murrah buffaloes were 591.45±21.41, 642.30±18.06 and 671.70±21.42 seconds, respectively. The lower time was observed in cows compared to buffaloes because the teats of cows are softer than buffaloes' teats. The average milk yield per day of Sahiwal cows, crossbred cows and Murrah buffaloes were 2.40±0.09, 2.98±0.18 and 4.31±0.09 kg, respectively. Average milk yield per day was observed higher in the morning than evening session.

The total time spent in feeding operations of milch animals, Sahiwal heifers and calves were 161.37±10.39, 91.36±8.02 and 53.19±3.70 minutes, respectively and cleaning operations took 212.85±17.16, 142.80±13 and 126.36±8.92 minutes, respectively in milch animals, Sahiwal heifers and calves. The average time spent in the management of calves including feeding of colostrum, changing the bedding, watering of calves and washing the utensils were 3.25±0.22, 4.80±0.10, 1.59±0.09 and 2.69±0.09 man-minutes per calf, respectively. The time spent in miscellaneous operations *viz.* veterinary aid, rectal palpation, artificial insemination and weighing of calves were 12.63±0.73, 1.37±0.04, 7.50±0.16 and 4.97±0.19 man-minute per animal, respectively.

Brajesh Kumar **Ravikant Nirala**
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P G FORM – VI

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CERTIFICATE OF THESIS AND ORAL EXAMINATION FOR POST GRADUATE

This is to certify that the thesis entitled **MANPOWER UTILIZATION PATTERN IN MANAGEMENT OF LIVESTOCK FARM OPERATIONS** (Submitted by **Dr. Brajesh Kumar**, Admission No. **VM0038/2018-19**) S/O / D/O of **Shri**. **Amarnath Singh** to the Bihar Animal Sciences University, Bihar Veterinary College, Patna in partial fulfilment of the requirement of M.V.Sc. Degree in the discipline of **Livestock Production Management** has been examined by us. The candidate was examined by us on **25-02-2021**. We recommend the acceptance of the thesis. His performance in the oral examination has been found satisfactory.

(N. B. In case of Master's degree, Oral Examination will also include comprehension of the student in the discipline).

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Forwarded (in duplicate) to the Director, Resident Instruction-cum-Dean, Post-Graduate Studies.

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Forwarded to the Registrar, Bihar Animal Sciences University, Patna for necessary action.

Director of Resident Instruction-cum-Dean, Post-Graduate Studies

1 Introduction

The livestock sector plays an important role in the Indian economy, serving as a key player in the socio-economic development of rural households and provides supplementary income to a large number of families. This sector on average provides 35 million human employments per year (http://www.agriinfo.in). India has the largest milch animal population and emerges as the leading producer and consumer of milk and dairy products worldwide since 1998. Our country ranks first in milk production with estimated milk production of 187.70 million tonnes during 2018-19 (GOI). This consistent increasing trend in milk production is due to better management practices and a parallel increase in livestock population over the years. At present, the total livestock population in India is 535.78 million and the bovine population is 302.79 million, showing an increase of 4.6% and 1%, respectively over the previous livestock census of 2012 (20th Livestock Census). The cattle and buffaloes accounted 36% and 20.5% of the total livestock. The livestock sector has been increased faster than the crop sector in the past decades because of the rising demand for livestock products and shrinking cultivation areas because of population growth and urbanization. In this regard, dairy farming has played a prominent role and proved instrumental in the context of the Indian economy. The dairy sector contributes significantly to poverty reduction and income generation (Dayanandan, 2011) in rural areas as income from milk comprises as high as 75-80 % of the total income as the underprivileged are heavily dependent on dairy subsistence. From these dairying enterprise small, marginal and landless workers, which accounts for nearly 70% of the total labour mass in rural India, derives potential income source for their livelihood.

Dairy sector falls in primary sector, which are very manpower-intensive enterprise as compared to crop production and other allied enterprises. Success in dairy farming requires judicious management of resources i.e. land, labour, and capital. The availability of labour is critical to carrying out day-to-day dairy farm operations. The associated housing, feeding, disease, and breeding management in the different age groups of animals require a large number of skilled workers. The milking cows need proper care and routine management of cleaning, washing, sanitization and optimum nutrition for efficient milk production. This care and management is an absolute manpower-intensive process and makes up around 15-20% of

the total farm expenses. Therefore, manpower in the form of labour, supervisor, and management, personnel needs to be properly selected (unskilled, semi-skilled, and fully skilled) and deployed. Proper hiring techniques of labour and their management can greatly impact the productive and financial success of any dairy farm.

Labour management practices in the agriculture and allied sector are less addressed subject in agriculture economics (Mugera and Bitsch, 2005). The easy availability of workers is the most common pre-expansion manpower management challenges for a dairy farm supervisor. Problems after expansion include the deployment of suitable workers for a particular work achieving performance goals for workers, finding qualified workers training and evaluating the skills of workers. The irrelevant elimination of workers is too much constricting concept but improving the skills and efficiency of manpower are effective tools for increasing the output in the farm. Division of labour is also an important aspect, less skillful job involving physical labour is done by unskilled workers, whereas jobs with more technicalities require semi-skilled or skilled personnel like technicians, operators, supervisors, typists, marketing staffs, accountants and managers. Thus, after expansion, managing employees and analyzing their efficiency is perceived as a key challenge for dairy farmers. The efficiency of the workforce decides the production and profit of a dairy farm. Moreover, because of its qualitative aspect, the output measure is a difficult task in the case of a livestock-based enterprise. Experience, skillful knowledge, willingness, responsibilities, and attitude for completion of the assigned work are valuable points for labour efficiency consideration. Apart from these attributes, regularity and punctuality is also an indirect yardstick for labour efficiency, which plays a pivotal role in assigning the same or similar pieces of work to a different person.

Labour incurs the 2nd highest expenditure in a dairy establishment after the cost of feeding. Since the cost of infrastructure and production potential of animals is fixed that cannot compromise on the feed quality. Hence, it is the proper labour utilization that determines the profit maximization of the farm. Thus, the proper estimation of skill and physical fitness of workers for different operations in the dairy farm reduces the wastage of workforces' potential. Training of scientific knowledge must be given to the dairy worker to improve the skill and knowledge and can surely nullify the mismanagement of different farm activities responsible for economic losses. At the same time, suitable policies and strategies should be practiced to establish belongingness among personnel and ensures self-motivation for work, and upkeep a high level of enthusiasm towards the dairy plant operations. Scientific

norms for requirements of workers for different activities in dairy farms are available, but its application as per the conditions is vital. Previous analysis of Rawat *et al.* (1973), Singh and Dave (1985) and Devarajulu and Naidu (1989) on dairy farm activities may not fit into the context of nowadays because of hike of labour wages, amendments the laws of the workers and also due to variability in their availability. At the same time, information on worker requirement for carrying out daily routine farm activities *viz.* feeding, milking operations, feeding activities, cleaning of different sheds, management of calves, harvesting of green fodder, *etc.* and their impact on dairy farm profitability is scanty (Grewal and Rangi, 1980). Considering the above line of discussion, it is conclusive that management of manpower is the highly important managerial factor in determining the level of efficiency of a dairy farm and overall profitability of the dairy farm enterprises. Therefore, it is important to know the working efficiency of manpower, their efficient utilization, and constraints faced during their positioning in various activities at the dairy farm. Keeping in view, the present investigation was carried out done at the dairy unit, farm B.A.S.U., Patna with the following objectives.

Objectives: -

1. To study the efficient use of manpower for managing different categories of animals.
2. To study the utilization of manpower in different activities of the dairy farm.
3. To study the constraint faced during manpower deployment in different activities.

2 Review of Literature

In dairy farming for proper utilization of capital and investment, manpower plays an inseparable role. Also to avoid wastage of human resources and complete exploitation of manpower skills there is a need for judicious estimation of labour estimation. The requirement of skilled manpower is a must for performing different farm activities *viz*. milking, feeding, cleaning, miscellaneous activities and calf management. Milking activities are the most important in dairy animals. Milch cows and buffaloes are usually milked twice daily. Teats should be cleaned properly by the use of a good disinfection solution before every milking. Enough and good quality of feed should be provided to all animals. Feeding activities include transportation of fodder, chaffing of fodder, distribution and loading of fodder in the manger. A proper supply of clean water should be available to all animals on the dairy farm for better productivity. Cleaning is very important to maintain the well-being of dairy animals and improves productivity. Manures should be kept away from animals. Floors, walls, feeder and drinkers should be kept clean. Insects and flies should be kept away by using flypaper. Animal dung and other animal wastes should be cleaned before milking. Cleaning operations include removing the dung by shovel, cleaning the dirt and residual feed by use of broom and basket. Miscellaneous operations are also time taking tasks and need the skilled worker to perform different activities like rectal palpation, artificial insemination and treatment of dairy animals.

Keeping in view of farm operations like milking, feeding, cleaning, and miscellaneous and calf management present investigation was conducted at LFC. Regarding the present study, some of the needful literature are reviewed and presented as follow

2.1 Manpower/time utilized in operations of the dairy farm

Valasek *et al.* (1967) conducted a study on the efficiency of manpower and noted that the total time was 28 minutes 52 seconds in the management of each cow.

Wysong and Omar (1970) collected the data from 25 different farms in Turkish and observed that 3 men were involved in 20 cows on the dairy farm.

Anonymous (1976) reported that the time taken in caring for calving cows was 3.5 hours and 1.5 hours, 1.8 hours for inspection of heifer and calves, respectively.

Topikha and Kobzeva (1982) investigated research on the dairy farm at Lvovsky and reported that the 2.3 man-hours were utilized for each 100 kg production.

Rani *et al.* (1993) concluded that approximately 24% manpower was used in feeding operations, 23% workers used in the cleaning tasks, Milking and watering accounted for 18% and 17% of the total worker, respectively.

2.2 MILKING OPERATIONS

Puftz and Thomas (1940) studied the efficiency of a person who is involved in a milking operation and he calculated that a skilled milker obtained 7.1 kg milk in 6.68 minutes while an unskilled milker obtained 3.6 kg of milk in 9.1 minutes. He observed that milking time varied from person to person.

Grazzani (1965) observed that time taken in milking activities was approximately 42 to 50% of the total time which were spent in various activities of the dairy farm.

Hubenov and Daikov (1965) studied the time-motion study of milking of cows and buffaloes. They found that less time was taken in the milking of cows compared to buffaloes because teats of buffaloes are hard.

Repka *et al*. (1976) conducted a research on a dairy farm that had 600 cows including 150 in the calving shed. The total strength of manpower was 32 in which 18 workers were engaged in milking operation. He noted time spent in different milking and auxiliary activities. Total time taken in the cowshed per cow was 9.05 min, of which milking activities took 4.75 minutes and 12.99 minutes spent in the calving shed.

Baidikov (1977) investigated that men required in milk production under the loose housing system and conventional housing was 17.8 and 28.1 minutes daily per cow,

respectively. Actual milking time spent under conventional housing and cubical loose housing system was 12.7 and 7.4 minutes, respectively. Time spent in milking operation was more in conventional housing compared to the loose housing system.

Repka (1978) studied the requirement of manpower in milk production in 12 large dairy farms and each dairy farm had capacity of 240-800 cows. In 6 farms, cows were kept in a conventional housing system and another 6 farms were designed as a loose housing system. On average 7.24 minutes were taken in loose housing per cow per milking parlour while in the conventional housing system, it took 18.91 minutes. About 4.05 minutes to 14.12 min per cow was required in daily milking operation.

Genejigen (1980) studied the manpower utilization pattern in a different dairy farm at Waiboerhoeve farm (Netherland). Milking operations took 52.3, 37.4, 37.0 and 33.9 minutes, respectively in different four farms.

Whipp (1981) concluded that the milking operation took about 38% of the total time on the dairy farm.

Nayak and Mishra (1984) studied on relation to milking ability and composition of Red Sindhi, crossbred cows and murrah buffaloes. The dairy animals were milked twice a day by hand and kept under same types of management. Murrah buffaloes took maximum time for letdown of milk than Red Sindhi and crossbred cows. It was observed that red Sindhi and crossbred cows had similar letting down duration irrespective of temperament but the duration increased when the animals were aggressive. Likewise, Murrah buffaloes, irrespective of temperament, had significantly higher milking duration than the crossbred and Red Singhi cows.

Devarajulu (1986) in his study reported that on average 50% of the time was utilized by labour on a dairy farm in handling the milch animals.

Devarajulu and Naidu (1989) studied the time spent on milking activities in dairy farms. They found that 30% of the total time was utilized in milking activities under the stall feeding and management system. They found that one worker is required for maintaining 11 milch animals, or 27 heifers or dry animals. Total manpower needed per animal was 152 man-hour yearly. About 43.63 man-minutes time spent daily per cow which also included 13 minutes spent in milking of 9.5 kg milk. Heifers and dry animals required a total of 18.00 men-minutes including 13.00 minutes spent in milking of 9.5 kg milk.

Robes and Angaricia (1991) studied the manpower costs on Cuban dairy farms and accounted for approximately 20% of the total costs of milk production.

Chang *et al.* (1992) studied the manpower input in US dairy farms and found that the manpower involved in milking operations was over 50% of the total manpower inputs on US dairy farms.

Joshi *et al.* (1992) observed that time spent in hand milking was considerably higher compared to machine milking (per cow). In the morning, hand milking took 14.37±0.602 minutes while machine milking took 7.06±0.03 minutes.

Sonck (1993) conducted a research on manpower in the dairy farm in the Netherlands. He noted the proportion of 0.30 of labour input required by milking on dairy farms in the Netherlands.

Bhagat and Sastry (1994) in their study found that one man handled 12 buffaloes per day during milking activities and completed the task in 3 hours when twice time milking program was done daily.

Rai *et al.* (1997) reported that the utilization of manpower and time in milking activities was highest and idle time was lowest after comparing all different activities of a dairy farm. He found that time spent in morning milking was higher compared to afternoon or evening milking.

Aulakh and Gupta (1998) studied manpower requirements in cow milking by hand. They observed 26 milkers performing 1018 milking in one year. They observed that milking of 4.14±0.04 liter milk took around 408.75±3.81 seconds. Total milking time was affected by skills of milker, breeds of animals, and time of milking and different season.

Chaudhary *et al*. (2001) studied the requirement of manpower in milking and the cost of milking in machine and hand milking systems in a dairy farm at Punjab Agricultural University, Ludhiana. One skilled milkman can milk 16 buffaloes or 18 cows by hand milking per day under two times milking program while he can milk 26 buffaloes or 38 cows in machine milking.

O' Callaghan *et al.* (2001) conducting a study on Irish dairy farms and analyzed the utilization of manpower and milking facilities. He reported that the ratio of the Milking unit was 6:1.

Dogra *et al.* (2002) conducting a research on milch buffaloes, reported that time was taken by the worker on an average 13.15 seconds in bringing the milking equipment in the milking parlour, 46.84 seconds in restraining the dairy animals, 17.14 seconds in distributing concentrates to the dairy animals, washing the udder it took 24.71 seconds, 94.5 seconds let-down of milk, 23.83 seconds in weighing the milk in the bucket and 13.77 seconds for cleaning the teats by the disinfectant solution. Then the total time spent in milking activities were 8.27 minutes per buffalo.

Juned *et al*. (2002) conducted a study on the manpower utilization pattern in the management of rural husbandry and observed that time spent in milking operation was 0.5-1-man-hour per day.

Schick *et al.* (2005) conducted a time-motion study on 40 to 1000 dairy cows and in milk milk-production systems; the total time spent was 50 man-hours per cow.

Sreedhar (2007) conducted a research on manpower utilization patterns in the management of the dairy farm and he reported that the female worker was taken 0.7 hours during milking activities in a small dairy farm.

O'Brien *et al*. (2006) conducting a study on Irish dairy farms and analyzed the utilization of manpower and milking facilities. He reported that the ratio of Milking unit was 7.6 and also illustrated that the milking unit numbers were not linearly increasing with expanded herd-sizes of cows.

Rahmanovic *et al*. (2006) noted that workers took 12-15 minutes in manual milking while good breed milch cows were milked 2 to 3 times daily and manual milking was completed within 6-8 minutes.

Ohnstd and Jago (2007) conducted a study in New Zealand dairy farms and found that fetching of cows in milking shed and preparing the shed for milking took approximately 17% of the total time. On average milking task took 62% of the total time and 21% on cleaning operations and releasing the cows from the milking parlour.

Singh *et al*. (2008) conducted a study on manpower utilization on milking operation total time utilized by men in milking activities was 0.20 hours per day.

Gonulol and Toruk (2009) conducted a research in Turkey and evaluating the milking performance of milch cows and found that the average actual milking was taken 6.84 minutes per cow.

Sreedhar and Ranganadham (2009) had done a study on labour utilization patterns in the management of different categories of dairy animals at Dairy Experimental Station, Rajendranagar, and Hyderabad. They reported that the total time for milking activities were taken 14.26±0.56 man-minutes per day in milch animals.

Dekoning (2010) observed that the milking operations in small (strength below than 50 cows), medium (50 to 80 cows) and large farms (more than 80 cows) were 34.8, 27.8 and 17.8 hours respectively annually input per cow. Worker input per cow annually (hour) for all operations decreased with increasing herd size.

Gupta *et al.* (2011) reported that more time spent in morning milking than evening milking. High yielder animals had taken higher time compared to low yielder animals during milking. The time spent in hand milking ranged from 75 to 88 % in the morning session and 79 to 84 % during the evening session and in machine milking, it required 73-78 % for morning 67-70 % for the afternoon and 69 to 71 % for the evening session.

Bara and Shah (2012) observed manpower utilization in milking activities in dairy farms. The milking time differs based on breed and milk yield. Milking time observed in Gir was 247.11±1.18 seconds and Crossbred was 263.84±1.24 seconds. Morning evening sessions differ significantly from evening sessions.

Oudshoorn *et al.* (2012) conducted a study on dairy farms and stated that time taken by worker per day 5.3 min. in each cow during hand milking, while milked by machine, consumed 3 minutes.

Prasad and Laxmi (2014) conducted an experiment on the milk yield, method of milking and milk flow rates in Murrah buffaloes. They noted that the total duration in hand milking was 5.60 minutes. The stripping time in the case of hand milking was 1.30 minutes more than that of machine milking (0.88 minutes).

Sathiybarathi *et al.* (2015) studied that the requirements of manpower in milking operation was more than 50% which was the maximum compared to all activities, the requirement of manpower was also dependent upon the method of milking. 25% manpower was utilized during feeding operation and time taken was higher next to milking operation. A

loose housing system also reduces the manpower requirement compared to a conventional housing system.

Bhinda *et al.* (2017) conducted a study on manpower utilization patterns in the management of different categories of animals. They divided the animals into 6 groups viz. (1) Milch, (2) Pregnant, (3) Dry animal, (4) Calves, (5) Heifers and (6) Bull and Bullock. The average time utilized in milking operation was 16.51±0.076 minutes/dairy animal/day. The labour input was 41.07% of the total labour in the milking activities.

2.2 FEEDING AND WATERING OPERATIONS:

Whipp (1976) conducted a research to observe the time required in feeding operations in milch animals. He found that 16% of total maintenance time was spent in feeding operations in dairy farms.

Coicovi (1978) observed Romanian dairy animals for manpower requirements. He observed in tied-up system farm, producing 3000 litres milk, total man time required was 15 min 44 sec per cow which include 4 min per cow of feeding operations.

Prabhakaran and Raut (1979) observed that the total time spent was 10.8 to 39.6 minutes in the feeding of a cow by a man under field conditions.

Grewal and Rangi (1980) studied the available details to see the manpower utilization in feeding activities in dairy farms in Punjab. He observed that 19% of total manpower was utilized for feeding activities in farms.

Nirman *et al*. (1981) studied different time taken by dairymen and general men in feeding activities. He found that the time taken by general men and dairymen were 8.4 min and 6.6 min per cow respectively.

Skiaker (1982) conducted a research on 15 Norwegian farms, each farm having 12 dairy animals to study low-cost modification. He observed that total working time decreases from 339 to 250 man-minute which was approximately 105 man-minute decreases in feeding time.

Agarwal and Sharma (1983) studied 61 villages in Karnal (Haryana) having 1807 houses. They found that 75% of the total time of workers was spent in feeding operations.

Soliman and Abd -EI Monem (1988) studied the available details of 213 traditional farms in Egypt. They found that 35% of labour was utilized in feeding operations and 17% in milking operations in dairy farms.

Deverajulu and Naidu (1989) studied manpower utilization in feeding activities in dairy farms. He observed that for dry animals 21.6% of total manpower was devoted to feeding activities. For milch animals, this value was 19.3% and for heifers 21.7%.

Singh (1989) observed 52 workers in milk farms to study the time spent in feeding operations. He observed that 10% of total workers were used in feeding operations for 453 milch animals by a tractor-trolley.

Jat *et al.* (2002) studied manpower utilization in four groups T1, T2, T3 and T4 under different housing systems. He found that total man-time spent were 19.00±0.000, 18.00±0.577, 17.67±0.667, and 23.00±1.155 minute daily per animal.

Prasanna (2002) observed the manpower utilization in the dairy farm having cross-bred female calves at IVRI Izatnagar. He observed that 51.54 man-minute was spent in milk feeding to calves in the morning time and 46.58 man-min during evening time. 24.85 man-minutes were spent on concentrate and greens feeding. Overall 41% of total manpower time was utilized in feeding operations.

Sharma *et al.* (2006) studied manpower utilization in different housing systems in different seasons. He observed three groups, each group having 10 cross-bred cows. Manpower needed in feeding operations loose housing system was much lower than closed housing in the summer season. The feeding time in the loose housing system, loose housing with central shed and closed housing system was 25.50, 37.50, and 61.25 minutes, respectively in the rainy season. In winters, the feeding time in a loose housing system (30.50minutes) was significantly lower than closed housing (90.25 minutes).

Speroni and Federici (2006) studied that milk production was affected by time taken in rumination, rest and standing by a cow. The time budget was according to the pattern of these activities in 24 hours duration.

Sreedhar (2007) observed manpower utilization in milch animal farming. He observed that 23.3% of the total time of female workers was spent on cleaning purposes.

Sreedhar and Ranganatham (2009) reported that the feeding time of milch, pregnant, dry, calves, heifers, bulls, and bullocks were 8.31, 4.02, 3.74, 2.86, 1.31, 3.88 and 6.33 minutes/day, respectively. Time taken per day watering of milch, pregnant, dry animals, calves, heifers, bulls and bullocks were 1.92, 1.87, 1.84, 3.80, 1.89, 2.50 and 2.22 minutes, respectively.

Grothman *et al.* (2010) studied manpower utilization in dairy farms with automatic feeding technology in European countries. A farm with 60 animals using an automatic feeding system took 50.6 man-minutes daily and the same type of farm with 120 animals took about 65.2 man-minutes daily. On the same farm, when a feed mixer wagon was used, a total of 71.3 man-minutes spent daily for 60 animals and 202.8 man-minutes for 120 animals. Thus, in AFS using the farm, approximately 112.15 man-minutes saved daily in 120 animals.

Bara and Shah (2012) had done a time-motion study for different feeding activities. Feeding operation time consumption was noted in two sessions, morning and evening daily. Approximately 10.74 man minute spent daily per animal.

Bisaglia *et al*. (2013) conducted a study in Netherland in farms with automatic feeding systems and farms with conventional feeding systems. He found that feed was given once daily in 80% of CFS and 3.5±1.6 times feed pushups daily. In a conventional system, the feed pushup was about 7.8±2.0 times daily with a time gap of 3.1±0.9 hours between feeding. The feeding time reduces about 16.4 seconds daily per cow in AFS and 33.2 seconds daily per cow in CFS.

Sathiyabarathi *et al.* (2015) studied that 25% manpower is required for feeding operations. Manpower requirement in feeding is next to the milking.

Rameswar Panda and Rajashree Samanta (2018) observed that 232.3 man minutes per 120 cows were required under the Conventional feeding system, whereas under the Automatic feeding system 65.2 minutes required.

2.3 CLEANING AND WASHING OPERATIONS:

Bangi and Dave (1969) observed daily routine activities to study the approximate time spent on various activities. A hand cart can be used for manure and dung removal to reduce the effective manpower time required.

Whipp (1976) studied that 11% of the total time used for dung cleaning 6% of total time spent on cleaning cubicle littering, that is 4.6 minutes per cow.

Grewal and Rangi (1980) studied the available data of dairy farms in Punjab. He found that 14-16% of total manpower was spent in cleaning animals and animal sheds which accounts approximately 14.28-16.32 minutes daily per animal.

Phillips (1981) conducted a time-motion study on a 150 cow dairy farm and observed the handling of manure of animals and compared between the use of the boxer spreader and loader, liquid manure conveyer with 7.5 m^3 liquid tanker that is replaced from a 3500 m^3 open concrete storage tank 2.2-meter-deep for unloading manure and reported that reduce the time and workload of manpower which was engaged in the handling of farmyard manure from 26 to 21 man-days after using the conveyer/tanker by them.

Nemerzhitskii (1984) conducted a time-motion study in dairy farms, Ukraine (1000 cows) and collected the data on utilization of manpower and time spent by them in changing the bedding and cleaning of sheds (removal of dung and dirt mechanically). He revealed that the time spent in these activities was ranged from 1.75 to 4.11 minutes/cow.

Nanda *et al*. (1988) observed 42 high and low yield cross-bred jersey cows to study the manpower requirements. He found that 34.98% of total man time spent in cleaning cows and byre which is the highest part of the time spent on any operation. Next, the highest percentage of time spent on feeding and watering.

Soliman and Abd-EI Monen (1988) conducted a time-motion study in Egypt analyzed the data related to workers used in different operations and observed that and 21% of total worker requirement for cleaning activities in a dairy farm and 28 % manpower were accounted for watering operations.

Singh (1989) analysed the data of 453 lactating cows and buffaloes at NDRI, Kamal and found that 18% manpower was engaged in the cleaning of the milking shed of milch animals.

Devarajulu and Naidu (1989) conducted a research in a tie-up shed having 27 dry animals, 24 pregnant heifer and 100 lactating crossbred cows with the tail to the tail arrangement. Dry animals require 41.3% of total time in cleaning operation, heifers require 40.2% and milk animals need 24.1% of total time in cleaning activities daily.

Joshi *et al.* (1992) observed labor requirements in cleaning activities using the shovel and bullock-operated refuse cleaner in IVRI cattle farm with 800 cows under observation. He found that 35.84±4.661 man-hrs.'/ha area spent in dung collection using the shovel. When the same work done by bullock operated dung removal, it took 5.27±0.71 bullock-h/ha. Thus, there was a huge difference in labor requirements in the two systems. Labor needed in wet dung removal is 0.896±0.082 man-h/cu meter and removal of semi-dry dung took 0.532±0.033 man-hr. /cubic meter. 0.756±0.059 men-h/cu meter spent in manual removal of wet dung. 4.96±0.219 man minute per cow daily spent in the washing of lactating cows.

Dalli and Gill (1995) observed three groups of buffaloes Group 1, Group 2 and Group 3 to study the time taken in different farm activities. They found that groups Group 1 and Group 2 took significantly more time in cleaning activities than Group 3.

Hansen (2000) collected data on the requirement of the worker in conventional and loose housing systems. He reported that the efficiency of the worker in different housing systems would be determined by the size of the herd. On average 27-31% labour was required for herd sizes more than 100 cows in loose housing systems. However, reduce the work of feeding and cleaning in loose housing systems while the herd size was reduced to less than 70 cows but counterbalanced on milking operations because of higher worker required during milking activities.

Jat *et al.* (2002) studied manpower utilization in cleaning activities of farms in four groups 1, 2, 3 and 4 under different types of housing systems. The time required in cleaning activities in groups 1, 2, 3 and 4 were 22.33±0.333, 20.00±0.577, and 19.00±0.577 and 24.00±0.577 minutes per calf daily respectively.

Juned *et al*. (2002) collected the data in rural husbandry and analyzed that on an average 0.12-1.40 man-hours per day were required in caring for dairy animals and cleaning cattle sheds.

Babu *et al.* (2003) studied time taken in various calf rearing operations. He found that the total time taken was 14.54 to 15.72 man min per calf daily.

Sharma *et al*. (2006) studied manpower utilization in different housing systems in different seasons. He studied three groups, each group having 10 cross-bred cows. Manpower utilization was the same in the summer season under all types of the housing system. Manpower utilization for cleaning (62 to 119 man-minutes daily for a group of 10 animals)

and other purposes (10.75 to 13.25 man-minutes daily) are non-significantly different in the rainy season. Manpower for cleaning differed non-significantly in the winter seasons. Activities that were included underfeeding activities are fodder chaffing, distribution and loading in the manger.

Sikka *et al.* (2007) conducted a time-motion study in Haryana and reported that women workers also engaged in different operations of the dairy farm and she spent 27% of the total time in the removal of dung, disposal of dirt, and cleaning the sheds of animal in buffalo farming.

Sreedhar (2007) observed labour utilization in dairy farms. He found that female workers gave 1.2 to 1.75 hours daily in feeding practices.

Sreedhar and Rangandham (2009) observed time spent on several dairy farm activities for several categories of animals. Cleaning of animals and their shed took a significant amount of time. The time spent in the cleaning of shy of milch, dry animals and pregnant animals were 3.70±0.55, 3.95±0.72 and 3.88±0.47 man-minutes daily per animal respectively. Bulls get extra attention from farmers and due to their aggressive behavior, bulls needed more time for cleaning.

Bara and Shah (2012) observed time spent on various cleaning activities during morning and evening sessions. The approximate time spent in cleaning the manger and alley was 1.5 man-minute/a.u. daily. The time spent in shed cleaning was 10.75 man-minute/a.u. daily.

Rameswar Panda and Rajashree Samanta (2018) stated that time taken in cleaning milch animals shed, pregnant animals shed, dry animals shed, calf shed, heifers shed and bulls shed were 3.70±0.55, 3.95±0.72, 3.88±0.47, 2.95±0.33, 3.99±0.35 and 4.25±0.92 man minutes per animal per day.

2.4 CALF MANAGEMENT

Kung *et al.* (1997) study on labour input (America) and calf performance using different milk feeding and management methods in a dairy herd found an average daily time requirement for group-housed calves of slightly less than 1 min/calf.

Prasanna (2002) conducted a study on crossbred female calves in cattle and buffalo farm at IVRI Izatnagar (U.P) and noted that labour took 5% of total time (average of 16.5

man minutes) in changing of bedding material (removed the straw bedding and disposed them at 50 meters away from the shed of the calves. Cleaning the calf pen by water jet spray required 0.91 man minutes per calf and on an average 0.92-man minute per calf were taken brooming the dirt of calf pen by using a broomstick.

Junqueira *et al.* (2005) carried out a study in Brazil to investigate the effect of stimulation of teat of the udder on milking of F1 Holstein Gir cows and reported that the bucket feeding of calf required 3.63 minutes per day.

Dalgaard *et al*. (2007) observed that the labour used in quarantine areas for newly introduced calves on 12 farms averaged between 30-60 minutes per day for daily tasks including milk feeding.

Gleeson *et al*. (2008) found in the study that the average daily labour input of 2.1, 1.7 and 1.8 min/calf within small, medium and large size dairy herds with different calf rearing methods.

Sreedhar and Ranganadham (2009) studied that time spent for feeding the calves, watering the calves, cleaning the shed of calves and washing the calves was 2.86±0.42, 1.31±0.41, 2.95±0.33 and 3.83±0.48 man-minutes/calf/day respectively. Total time taken during miscellaneous activities in calves was 0.29±0.30 man-minutes per calf per day.

Taurus (2009) estimated a thumb rule in the management of calves. Approximately 1man min. /calf /day were taken in rearing work.

2.5 MISCELLANEOUS OPERATIONS:

Nanda *et al.* (1988) studied that milking took 47.3% and herd management activities took 52.7% of total time. In different milking activities, milking took at least 7.98% of total time and pre-milking and post-milking events took 18.13% and 21.19%, respectively. In herd management operations, in 8 working hours, veterinary treatment and AI services took 7.3%, feeding took 10.4% and cleaning of cows and byre took 35% of the time.

Jat *et al.* (2002) studied manpower utilization in four different groups T1, T2, T3 and T4 under different housing systems. The total man time taken in miscellaneous activities by different groups was 3.33±0.333, 3.00±0.000, 2.67±0.3330 and 3.67±0.333 minutes daily per animal, respectively.

Sreedhar and Ranganadham (2009) observed that more time was being spent in miscellaneous works of pregnant animals than lactating animals because pregnant cows need more care. They found that in dry animals 1.48±0.32, in milch animals 0.49±0.36, and in pregnant animals, 11.82±0.97 man-minutes per animal were spent daily for miscellaneous activities. The total time required for several activities for different categories of animals were different. Milch animals required 38.64±0.73, dry animals' need 17.9±0.44, and pregnant animals need 27.00±1.04 man-minutes daily per animal for miscellaneous operations.

Bara and Shah (2012) conducted a study on labour utilization pattern on a dairy farm at Anand and observed that approximately 2.59 man-minute spent daily on miscellaneous works.

Wadhawani *et al*. (2015) found that the time utilized in veterinary aid and A.I. service was 8.9±0.1 man minutes/cow but in the case of the dry cow it was only 6.8±0.1 man minutes/cow.

Bhinda *et al.* (2017) investigated manpower utilization of management in different six dairy farms. The average time spent in miscellaneous tasks in G_1, G_2, G_3, G_4, G_5 and G_6 was 1.68±0.28, 9.63±0.09, 3.80±0.07, 1.06±0.21, 1.80±0.32, and 9.84±012 minutes, respectively each animal per day. There were 11.52% workforces involved in miscellaneous activities.

3 Materials and Methods

3.1 Locale of research

The present study on manpower utilization pattern in management of livestock farm was carried out at Dairy Unit of Livestock Farm Complex, Bihar Animal Science University, in Patna district of Bihar State. The BASU, Patna is situated coordinates of 25’36’00” N 85’05’06” E.

3.2 Plan of work

During the study, no managemental change or direction was given to farmworkers. The time was regularly recorded for different activities of Livestock Farm Complex, BASU (Patna).

3.3 Period of study

The observation of various dairy farm activities was carried out for 120 days while milking activities were reported for 60 days.

3.4 Dairy animals on the farm

All six categories of dairy animals were selected from LFC farms for comparison of manpower utilization patterns among the different categories and breeds. Animals are divided into six categories viz. (1) Milch cows, (2) Milch buffaloes, (3) Dry animals, (4) Calves, (5) Heifers, and (6) Bulls. The time utilized in pre-milking, milking, post milking, cleaning, feeding, calf management, and miscellaneous activities were recorded. The average strength of dairy animals of Livestock Farm Complex, Bihar Animal Science University (Patna) are presented in table 3.2.

Table 3.1 No. of the animals at the Livestock Farm Complex (LFC)

SI. No.	Category of animal	No. of animals
1	Milch cows	31
2	Milch buffaloes	10
3	Dry animals	32
4	Calves	44
5	Heifers	53
6	Bulls	6
	Total	176

3.5 Housing of the animals

The livestock farm adopted a loose housing system while individual paddock had either brick paving or cement concrete floor.

A loose housing system is a flexible arrangement of building and open lots developed for efficient milking and management of dairy animals. In this system, the cows are kept in an open building, lot, or pasture, but are not confined in stalls except while being milked.

3.6 Manpower Involved

Manpower is required for the smooth running of dairy farms. The involvement of worker in the dairy farm is classified based on the skill which is classified as -

1. Unskilled: Unskilled workers don't have knowledge about the farm, they engaged in simple duties in different operations or activities. e.g., Farmworker for distributing feed and fodder, cleaning, and watering etc.
2. Semiskilled: Workers who know specific to take important decisions e.g., drivers, milkmen, fodder cutting operator, and data recorder.
3. Skilled: A skilled worker is one who is capable of working efficiently and taking responsibility for the farm. He has good and comprehensive knowledge of the farms. e.g., Technical Officer/ Assistant.

4. Highly Skilled: A highly skilled person who has scientific knowledge about the farm and supervises worker and their work. They also give guidance to skilled workers to efficiently handle the farm activities. e.g., Administrative officer, Farm Manager.

3.7 Recording the time for different operations

The time was noted for regular activities of the dairy farm by using a stopwatch. The different activities were pre milking operations, milking, post milking, feeding, cleaning and miscellaneous operations. Miscellaneous operations included weighing of calves, rectal palpation, Artificial Insemination and treatment of dairy animals.

3.8 Daily operation schedule

The different activities were carried out on the Dairy Unit of Livestock Farm Complex, Bihar Animal Science University routinely, observed regarding timing concerning economic use of worker efficiently for different farm operations. . The daily schedules for different activities at LFC are presented in table 3.2.

Table 3.2 Daily Schedule of different activities at LFC

Time (hours)	Farm operations
3.00-4.00	1.Cleaning the milking parlour
	2. Tying the animal in the milking parlour
	3. Distribution of straw and concentrate
4.00-5.30	1. Milking operations in parlour
	2. Recording the data
5.30-13.00	1. Unfastening the animals
	2. Cleaning operations in different sheds
	3. Cleaning of milk bucket and cans
	4. Cleaning and washing the animals
	5. Treatment of sick animals
	6. Caring for the calf
	7. Grazing the animals in pasture land
	8. Distribution of green fodder
14.00-15.15	1. Distribution of wheat/ paddy straw
	2. Preparation and distribution of concentrate
	3. Cleaning of milk palour
15.15-19.00	1. Milking operations
	2. Recording the data
	3. Milk distribution
	4. Unfastening the animals
	5. Cleaning the milk bucket and cans

3.9 Milking Byres

Milking was performed in milking byres following tail to the tail system. In the center of the inner road of the paddocks, there were two milking byres attached with holding areas.

3.10 Milking in Dairy cows

In dairy cattle, milking was done by hand milking. Dairy cattle were milked in two milking byres (Shed No.1and 2).

3.11 Milking in Buffaloes

Buffaloes were milked by hand milking. They were milked twice daily at 5:00 AM and 4:00 PM. All the buffaloes were milked in Byre No. 1. The full hand method of milking was adapted because it is the best method as it causes minimum injuries to the teats. After milking, milk was weighed and recorded at the weighing cum record room situated outside the milking byre. Two workers were engaged in the supply of concentrate to the milch animals. After completion of the milking process, all dairy animals were released for grazing.

3.12 Milking Operations

Cows and buffaloes were milked by milkmen in two sessions:

1) Morning
2) Evening

3.12.1 Animal tying

The time (seconds) spent for tying of milch animals in the parlour.

3.12.2 Concentrate feeding

The time (seconds) spent on giving the concentrate mixture to milch cows and buffaloes just before milking.

3.12.3 Carrying the empty bucket from the recording room to milch animals

The time (seconds) was spent carrying an empty bucket from the recording room to milch cows and buffaloes.

3.12.4 Bringing calf from calf shed to dam

The time (seconds) spent for bringing calf from calf shed to the dam by milker.

3.12.5 Suckling the milk by calf

The time (seconds) spent in suckling the milk by the calf.

3.12.6 Tying the legs

The time (seconds) spent on tying the legs of milch animals was recorded.

3.12.7 Washing of hands

The time (seconds) spent on washing of hands was recorded.

3.12.8 Washing of udder

The time (seconds) spent on washing of udder of milch animals was recorded.

3.12.9 Stimulating the udder

The time (seconds) spent on stimulating the udder just before milking of milch animals.

3.12.10 Actual milking

The time (seconds) spent in milking by milkmen was noted.

3.12.11 Untying the legs

The time (seconds) spent on untying the legs of milch cows and buffaloes.

3.12.12 Carrying milk to the recording room

The time (seconds) spent in carrying milk from milch animals to the recording room of milch animals were noted.

3.12.13 Weighing and unloading the milk

The time (seconds) spent in weighing and unloading the milk in milk cane.

3.12.14 Recording room to the distribution centre

The time (minutes) spent in the recording room to the distribution centre was recorded.

3.13 Feeding Operations

The time spent for the distribution of straw, concentrate, and green fodder to dairy animals.

3.13.1 Straw feeding

Two workers were engaged in the distribution of straw to dairy animals. Paddy/wheat straw which was in gunny bags directly distributed to the feeding manger.

3.13.2 Concentrate feeding

Concentrate feeding is very important in milch animals because it helps in the let-down of milk as well as to fulfil the nutrient requirement for production & maintenance. Concentrate feeding to calves was done in calves sheds. Two workers were engaged with the preparation and distribution of concentrate to cows and buffaloes. Concentrate feed which was in gunny bags was directly unloaded into the tub and mixed with water and distributed directly from the water tub to the feeding manger. Concentrate feeding was done twice a day. Green fodder was fed ad-libtum and concentrate was given at calculated.

3.13.3 Green fodder feeding

The green fodder was harvested from the nearby fields and carried through tractor. The chaffing of green fodder in the farm was carried out through a chaff cutter. Generally in the chaffing operations, 5 workers were engaged. The chaffing of fodders was started early in the morning at about 6:00 AM. The tractors were used for the transportation of green fodder to different animal sheds. Three workers were engaged in the unloading of fodder in the tractor.

3.14 Cleaning and washing of sheds

Cleaning is one of the important and time taking operations of the dairy farm. The dung of dairy animals was collected and loaded in the tractor by the use of a shovel. The dirt and feed residue were cleaned by broom and water. The dung and feed residues were utilized as fertilizer in the fodder field. The alley, manger, and floor were cleaned by use of jet spray water and broom.

3.15 Calf Management

The first hour after calving is the most critical period in the entire life of the new-born calf. Good feeding and management are essential for better nursing of calves. Colostrum was fed to new born calf within one hour after birth. It contains a large amount of globulin which provides passive immunity to the calf. Soft bedding material and clean water were also made available to the calf in a calf pen.

3.16 Miscellaneous Activities

The time (minutes) spent on the miscellaneous work *viz.* weighing of calves, rectal palpation, A.I., and treatment of sick animals was noted.

Miscellaneous activities on the farm included some of the following practices:

Weighing of calves: Calves were weighed fortnightly on a mechanical weighbridge. Four workers and one supervisor were involved in weighing of calves.

Rectal palpation and Artificial Insemination: At B.A.S.U., Patna, the dairy animals were artificially inseminated by using high-quality semen. After the proper detection of estrous, artificial insemination was done in cows and buffaloes. Two workers were engaged in restraining the animals and A.I. was done by expert.

Treatment of sick animal: The animals showing any abnormal health conditions were treated by the veterinary doctors. One compounder was also involved in this activity.

Record keeping: Record keeping is the most important routine tasks in dairy farms. Two persons were engaged in the recording of data.

3.17 Total working time

The total time taken by the worker in different activities was calculated. The different activities included pre milking, milking, post milking, feeding, cleaning operations, miscellaneous works, and management of calves.

3.18 Statistical Analysis

The recorded data during the study were analysed as per the procedure laid down by Snedecor and Cochran (1994). The different statistical tools *viz.* average, standard error and percentage were used to compare the data among breeds.

Fig. 3.1. Recording the data of cleaning the shed.

Fig. 3.2. Recording the data of cleaning the milk pail.

Fig. 3.3. Recording the data of feeding of animals.

Fig. 3.4. Recording the data during milking activities.

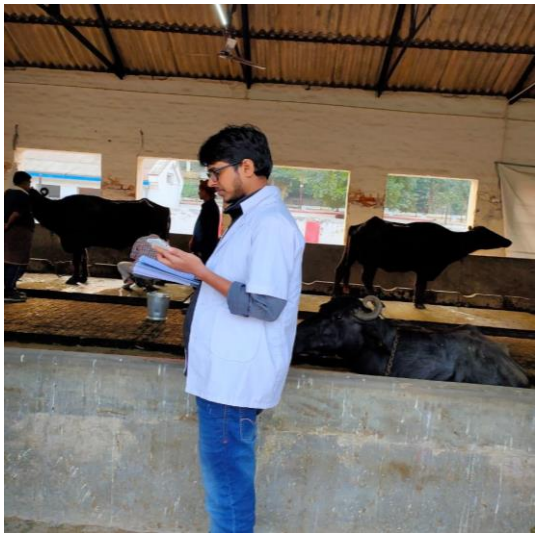

Fig. 3.5. Recording the data during pre-milking activities.

Fig. 3.5. Recording the data during post-milking activities.

Fig. 3.7. Recording the data during treatment of cow.

Fig. 3.8. Recording the data during milk feeding of calves.

4 Results and Discussion

Manpower is an important tool for running the dairy farm smoothly. Efficient workers are the key factor affecting the profitability of the dairy farm. Worker cost is the second most important factor after the cost of feed for a dairy farm operation; that accounts 25-30% of the total cost (Burte, 1995). Proper management of human resources increases the profitability of the dairy farm. Training must be organized in the established dairy farm to increase the skill and knowledge and solve the unwanted problems of the dairy farm. The manpower involved in the different operations viz. pre milking, milking, post milking, feeding, cleaning, management of newborn calf and miscellaneous farm operations. Feeding operations include the distribution of roughages, concentrates and green fodders. Cleaning operations include removing the dung and feed residual. The study was conducted for 120 days at the Dairy Unit of Livestock Farm Complex, BASU, Patna. During the study, dairy animals were divided into six groups *viz.* Milch cows, Milch buffaloes, Dry animals, Calves, Heifers and Bulls.

To fetch more profit, studies regarding the assessment of human resource management are an essential factor. Human resource management in dairy farming is extremely challenging to calculate the economics of dairy farms. Although in Bihar there is a vast population of workers, but skillful workers are not easily available on low wages for running the dairy farm economically. Keeping in view of the aforesaid fact there is an indispensable role of manpower management in dairy farms. To evaluate the performed study, it is convenient to divide the result into the following fractions:

4.1 Manpower deployed in different activities of dairy farm
4.2 Time spent in pre milking operation of dairy animals
4.3 Time spent in actual milking of cows and buffaloes
4.4 Time spent in post milking of cows and buffaloes
4.5 Time spent in feeding operations of cows and buffaloes
4.6 Time spent in feeding operations of heifers
4.7 Time spent in feeding operations of calves
4.8 Time spent in cleaning operations of cows and buffaloes sheds
4.9 Time spent in cleaning operations of heifers sheds

4.10 Time spent in cleaning operations of calves sheds

4.11 Time spent in other activities of the dairy farm

4.12 Time spent in miscellaneous activities of the dairy farm

4.13 Time spent in the management of calves

Table 4.1 Manpower distribution pattern in the dairy farm

S. No.	Activity	No. of Person	Percentage (%)
1	Farm manager	1	3
2	Scientist	3	8
3	Supervisor	1	3
4	Technical Assistant	3	8
5	Compounder	1	3
6	Workers involved in milking	5	13
7	Workers involved in cleaning activities	7	19
8	Workers involved in chaffing of fodder and distribution of feed and fodder	8	22
9	Workers involved in grazing of buffaloes	1	3
10	Tractor driver	2	5
11	Workers involved in miscellaneous activities	5	13

4.1 Manpower deployed in different activities

Distribution of manpower in the dairy farm is shown in Table 4.1 and graphically depicted in Fig. 4.1.

Milking operations were accounted for 13% of the total workers. The maximum workers were engaged in chaffing of green fodder and distribution in feed and fodder that accounted 22 % of the total manpower engaged. In total activities, 19 % workers were involved in cleaning activities of different sheds of the dairy farms, whereas 13 % workforce was engaged in the miscellaneous activities.

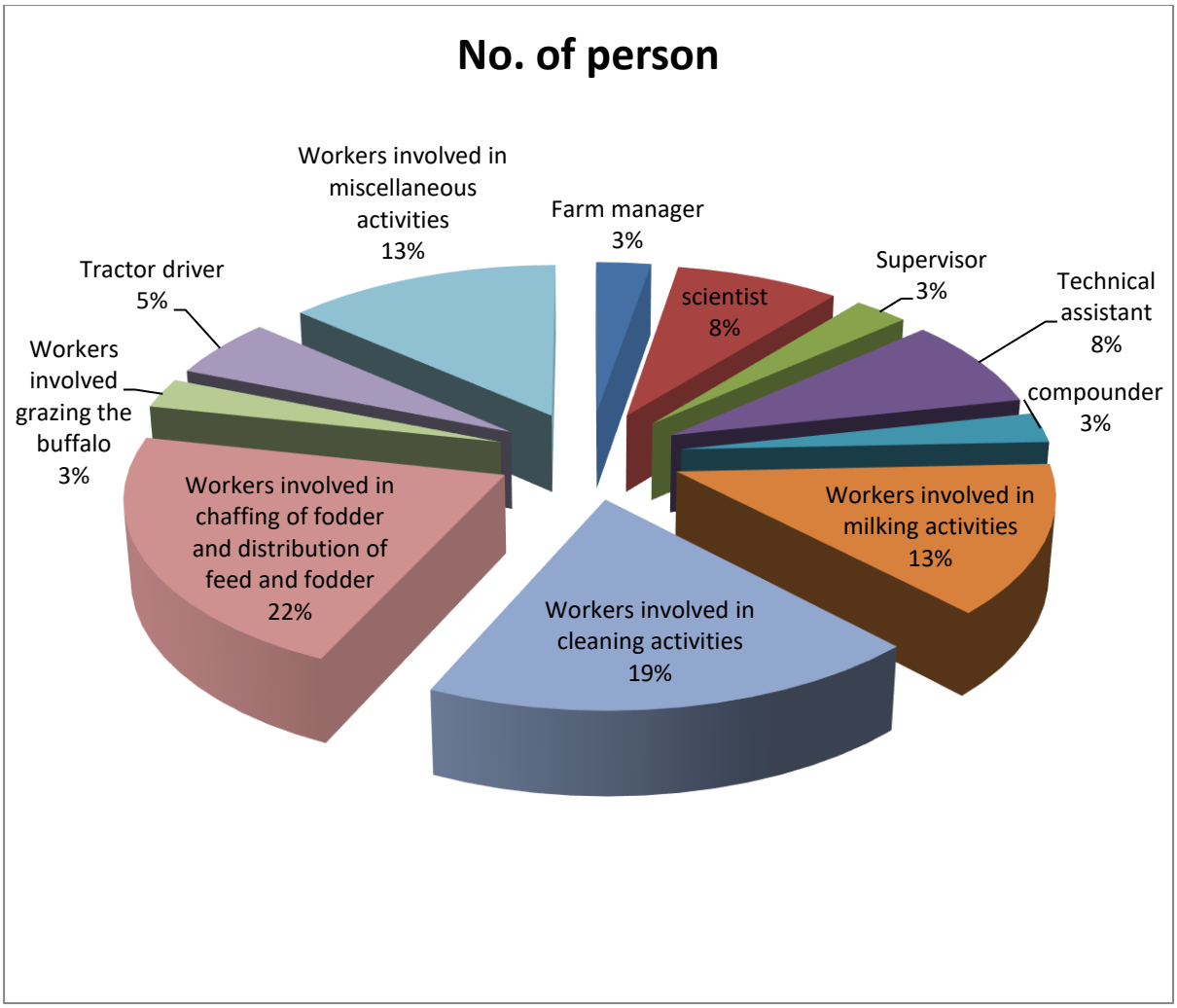

Fig. 4.1. Percentage of manpower deployed in a dairy farm

O'Donovan *et al.* (2008) investigated that 34% workers were engaged in the milking operations in the dairy farm. O'Brien *et al.* (2006) also stated that 34% of labours were

involved in milking activities. Manpower deployed in milking activities mainly depends upon the number of milch animals available on the farm.

The manpower involved in feeding activities viz. chaffing of green fodder and distribution of feed and fodder is similar to the study of Devarajulu and Naidu (1989), who observed that 21.20% labours were involved in daily feeding activity among the milch animals.

Soliman and Abd-EI Monen (1988) reported that 28% workers were involved in the cleaning process of dairy farms. These types of variation may be due to the size, construction and type of housing for the animals. Bhinda *et al.* (2017) reported that the total workers required in miscellaneous activities were 11.52% in the dairy operations.

4.2 Pre milking operations of milch cows and buffaloes

The time (seconds) taken to different activities of pre milking operations in Sahiwal, crossbred cows and buffaloes during morning and evening sessions are presented in Table 4.2.1, 4.2.2 and 4.2.3 and graphically depicted in Fig. 4.2, 4.3, 4.4, 4.5, 4.6, 4.7.

Time spent by manpower in pre milking activities *viz.* tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, tying of legs, washing of the hands and washing the udder by potassium permanganate solution before milking in Sahiwal, crossbred cows and buffaloes during evening session higher than the morning session. Higher time was taken for suckling the milk by calves in Sahiwal, crossbred cows and buffaloes during the morning session over that of the evening session.

Table 4.2.1: Time spent by manpower (in seconds) pre milking operations of Sahiwal cows

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Animal tying time	13.10±0.28	13.30±0.25	13.20±0.19	-0.5305
2	Concentrate feeding time	18.40±0.34	18.70±0.37	18.55±0.25	-0.5878
3	Carrying empty bucket	51.20±1.70	51.55±1.67	51.37±1.17	-0.1467
4	Bringing the calf to the dam	42.35±2.11	43.50±2.07	42.92±1.46	-0.3880
5	Calf suckling time	24.15±0.65	23.40±0.53	23.77±0.42	0.8875
6	Tying of legs	14.85±0.38	15.35±0.31	15.10±0.25	0.9995
7	Washing of hands	6.25±0.25	6.35±0.26	6.30±0.18	0.2749
8	Washing of udder	12.70±0.18	12.85±0.37	12.77±0.20	-0.3634

Table 4.2.2: Time spent by manpower (in seconds) pre milking operations of crossbred cows

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Animal tying time	14.90±0 .29	15.25±0.32	15.07±0.21	-0.8066
2	Concentrate feeding time	17.50±0.59	17.65±0.51	17.57±0.39	-0.1897
3	Carrying empty bucket	49.40± 1.71	49.50±1.94	49.45±1.28	0.0386
4	Bringing the calf to the dam	42.55±2.05	43.90±2.07	43.22±1.45	-0.4620
5	Calf suckling time	25.25±0.41	24.25±0.36	24.75±0.28	1.8138**
6	Tying of legs	15.85±0.37	16.25±0.40	16.05±0.27	-0.7293
7	Washing of hands	6.15±0.18	6.40±0.25	6.27±0.16	-0.7974
8	Washing of udder	13.70±0.44	14.30±0.38	14.17±0.29	-1.0572

Note: ** is significant at 5%

Table 4.2.3: Time spent by manpower (in seconds) pre milking operations in Murrah buffaloes

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Animal tying time	15.30±0.32	15.95±0.27	15.62±0.21	1.5237*
2	Concentrate feeding time	19.15±0.59	19.25±0.57	19.20±0.40	-0.1218
3	Carrying empty bucket	53.05±1.40	53.20± 1.37	53.12±0.96	-0.0765
4	Bringing the calf to the dam	42.55±2.05	43.90±2.07	43.22±1.44	-0.4620
5	Calf suckling time	26.10±0.52	24.40±0.35	25.25±0.34	2.6826***
6	Tying of legs	15.85±0.37	16.25±0 .40	16.05±0.27	-0.7293
7	Washing of hands	6.05±0.19	6.55±0.29	6.30±0.17	-1.4083*
8	Washing of udder	13.85±0.38	14.50±0.44	14.17±0.29	-1.1047

Note: *** is significant at 1% and * is significant at 10%

The average time taken per animal per day for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, milk suckling by calves, tying of legs, washing of the hands and washing the udder in Sahiwal cows were 13.20±0.19, 18.55±0.25, 51.37±1.17, 42.92±1.46, 23.77±0.42, 15.10±0.25, 6.30±0.18 and 12.77±0.20 seconds, respectively.

In crossbred cows, the average time taken per animal per day for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, milk suckling by calves, tying of legs, washing of the hands and washing the udder were 15.07±0.21, 17.57±0.39, 49.45±1.28, 43.22±1.45, 24.75±0.28 16.05±0.27, 6.27±0.16 and 14.17±0.29 seconds, respectively.

The average time taken per animal per day for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, milk suckling by calves, tying of legs, washing of the hands and washing the udder with potassium permanganate solution before milking in Murrah buffaloes were 15.62±0.21, 19.20±0.40, 53.12±0.96, 43.22±1.44, 25.25±0.34, 16.05±0.27, 6.30±0.17 and14.17±0.29, respectively.

Bara and Shah (2012) reported that the average time taken for animal tying ranged from 10.14±0.09 to 12.90±0.14 seconds. Sachan *et al.* (2018) found that the average time spent in the tying of animals ranged from 8.72±0.60 to 10.86±0.60 seconds.

The data observed in the present finding was slightly higher compared to other scientists; it also depends upon the skill of workers, the behaviour of animals and the construction of the shed.

Bara and Shah (2012) reported that the total time utilized in concentrate feeding during morning and evening to Kankrej, Gir and crossbred cows were 33.10±0.16, 32.84±0.13 and 35.08±0.21 seconds, respectively.

Bara and Shah (2012) also stated that the total time spent in carrying empty pail from the recording room to the milking parlour for Gir, Kankrej and Crossbred cows was 27.62±0.15, 26.65±0.26 and 27.74±0.30 seconds, respectively. Sreedhar (1999) stated that the time spent on this task was 6.17±1.34 to 12.67±0.75 seconds. The present finding has differed because the time taken in this activity was dependent upon the distance between the recording room and animals.

The recorded data time taken by calf to suck milk of dam in this study was approximately similar to Bara and Shah (2012). They observed that the time taken in sucking the milk was ranged from 24.61±0.18 to 26.35±0.13 seconds. Sreedhar (1999) reported that the average time spent in suckling the milk of dam by calf was 40.33±2.98 to 50.83±7.01 seconds.

The present observation in tying of legs before milking is closer to Sachan *et al.* (2018), who reported that the average time spent in the tying of legs ranged from 12.65±0.59 to 14.40±1.2 seconds. Rawat *et al.* (1973) stated that on average 25.17±1.78 seconds were spent in the tying of milch animal before milking.

Singh and Dave (1985) found that 0.38 ±0.04 minutes were taken to washing the udder of cows. Sreedhar (1999) observed that the time taken in the cleaning of udder and drying with cloth ranged from 53.50±5.50 to 78.00±5.23 seconds.

Sachan *et al.* (2018) reported that the time taken in the washing of the udder ranged from 4.77±0.18 to 5.80±0.41 seconds. In the present study, after washing the udder cloth was not used. This could be a reason for the relatively lower time noted comparatively.

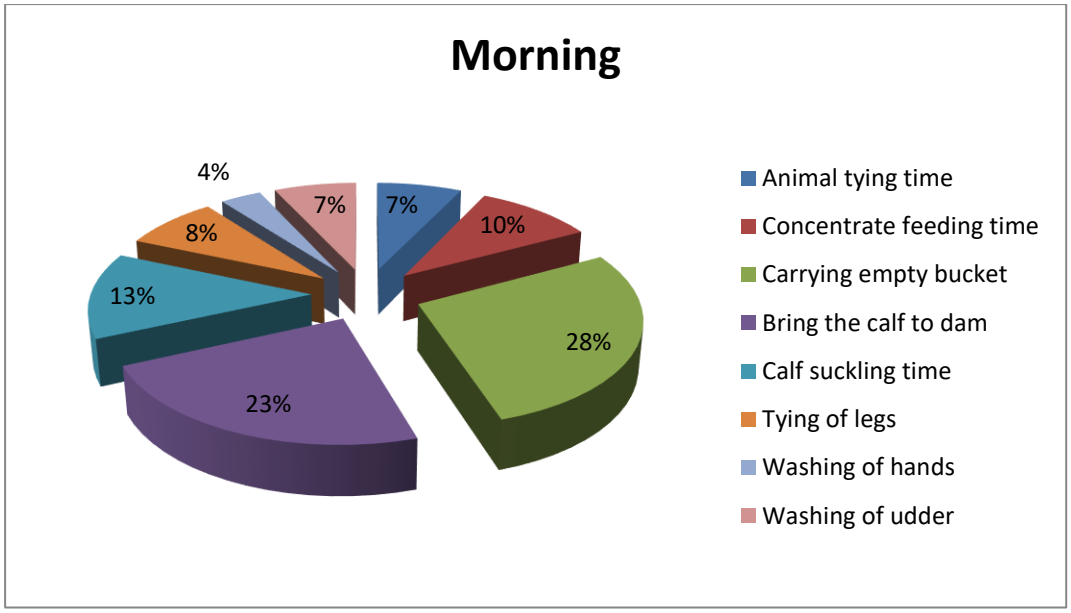

Fig. 4.2. Percentage of time spent in pre-milking operations of Sahiwal cows during morning

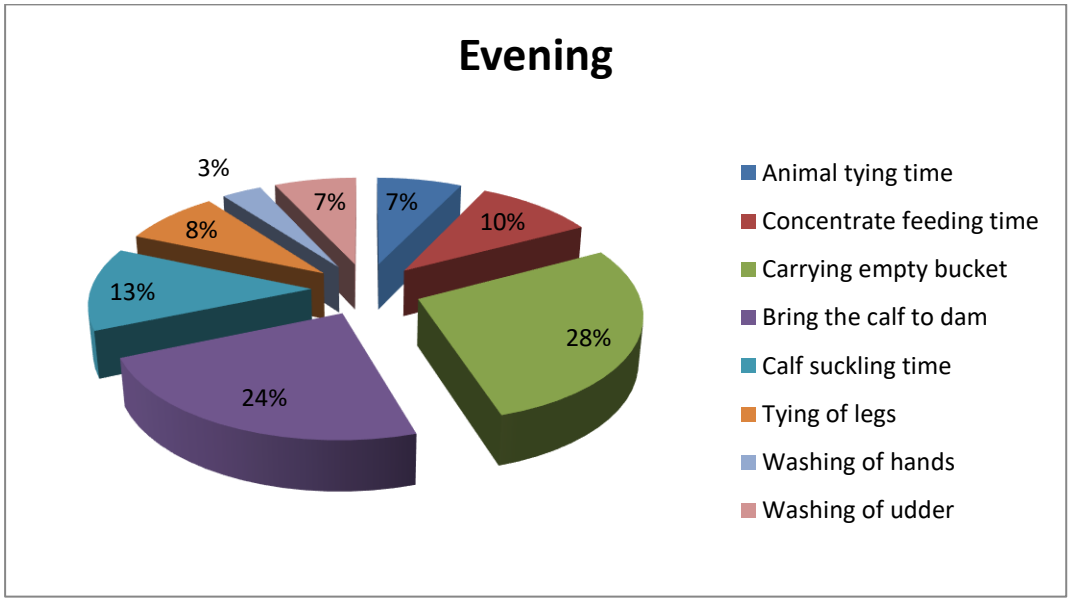

Fig. 4.3. Percentage of time spent in pre-milking operations of Sahiwal cows during evening

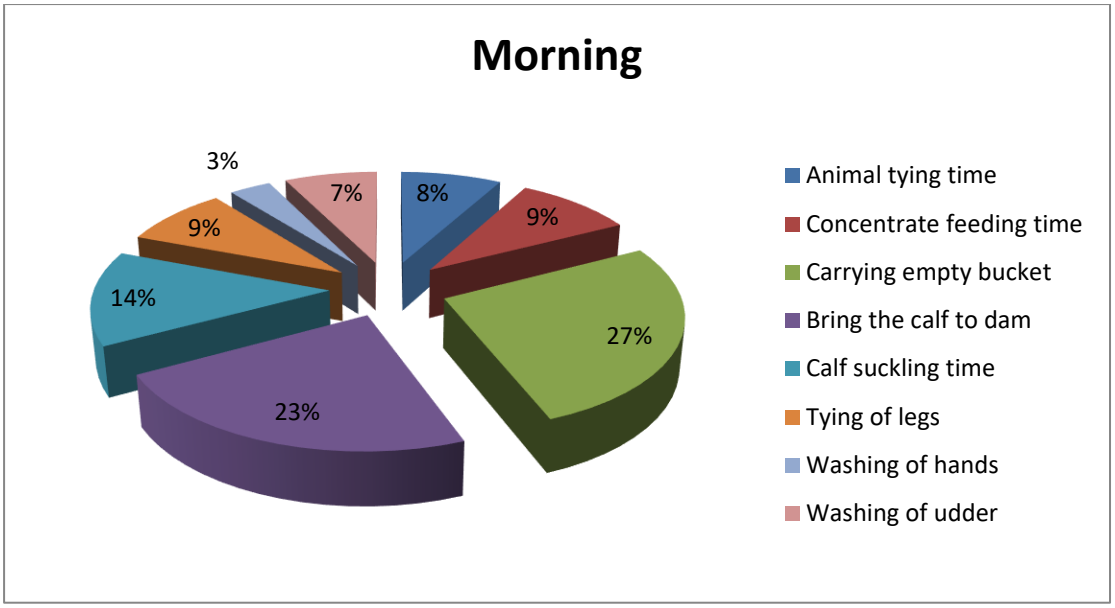

Fig. 4.4. Percentage of time spent in pre-milking operations of crossbred cows during morning

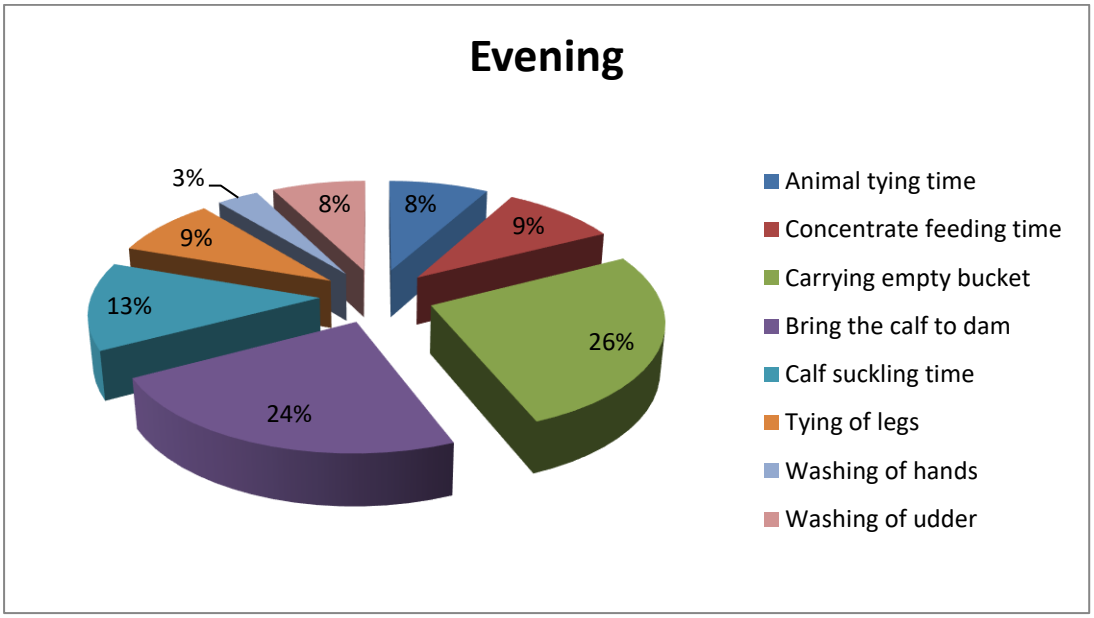

Fig. 4.5. Percentage of time spent in pre-milking operations of crossbred cows during evening

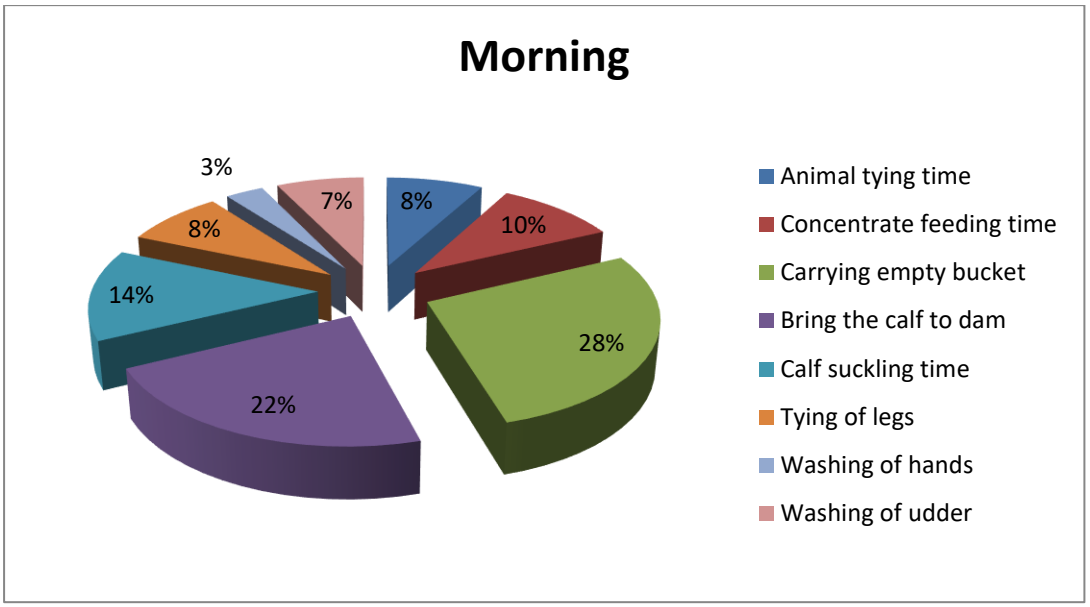

Fig. 4.6. Percentage of time spent in pre-milking operations of Murrah buffaloes during morning

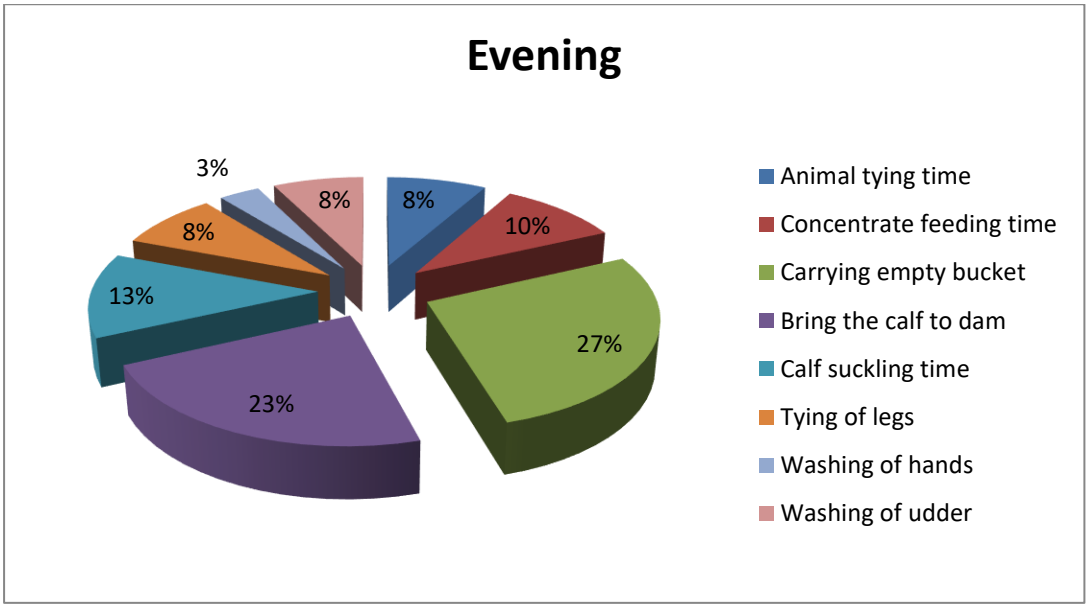

Fig. 4.7. Percentage of time spent in pre-milking operations of Murrah buffaloes during evening

4.3 Actual milking time

Actual time in milking depends on the breeds, milk yield of milch animal, size of teats, sessions and skills of the workers.

The time spent for actual milking in Sahiwal, crossbred cows and Murrah buffaloes during morning and evening sessions are presented in Table 4.3 and graphically depicted in Fig. 4.8.

Table 4.3: Time spent (in seconds) in actual milking of the cows and buffaloes

S. No.	Breeds	Morning session	Evening session	Average time	t value
1	Sahiwal	330.95±19.34	318.10±20.36	324.52±13.90	0.4576
2	Crossbred	332.85±11.80	322.90±12.96	327.87±8.69	0.5675
3	Murrah	335.30±11.43	324.25±12.82	329.77±8.52	0.6432

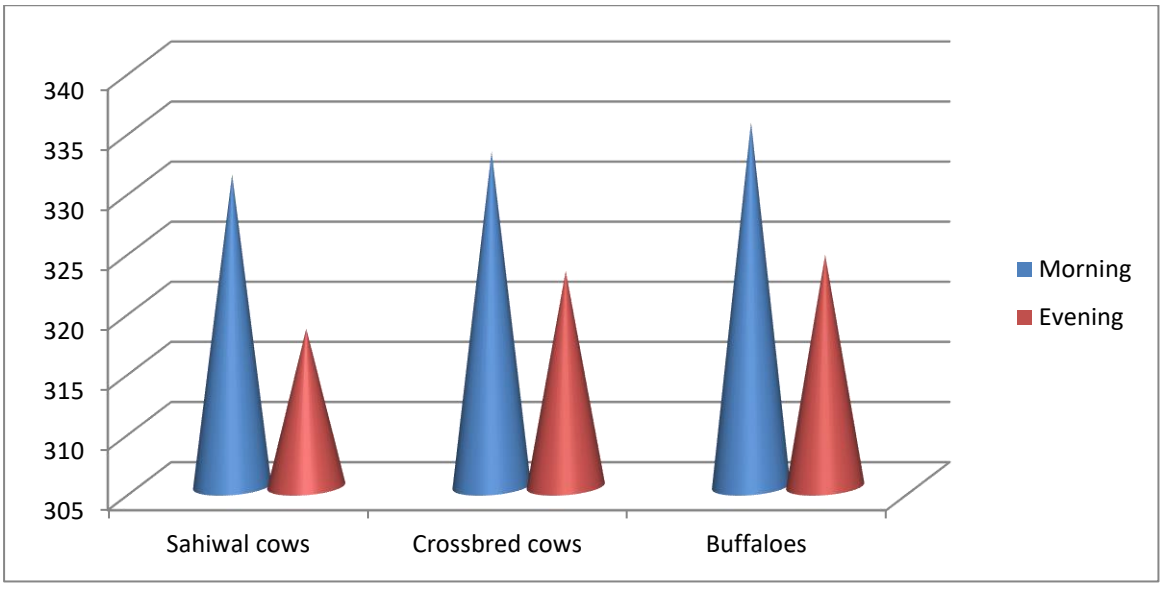

Fig. 4.8. Average time spent in actual milking of different breeds

The actual milking time for the Sahiwal cows was 330.95±19.34 seconds (morning) which was higher than 318.10±20.36 seconds (evening). The average time was found to be 324.52±13.90 seconds. In crossbred cows, the time taken in milking during morning and evening sessions was 332.85±11.80 and 322.90±12.96 seconds respectively. In the morning, milking time was more compared to the evening. The average time of milking was observed to be 327.87±8.69 seconds.

In Murrah buffaloes, the time (seconds) noted of actual milking in the evening session (324.25±12.82) was lower than that noted in the morning session (335.30±11.43). The average time of milking was observed to be 329.77±8.52 seconds.

The present study agreed with those reported by Rawat *et al.* (1973) who found that the time taken in hand milking in Red Sindhi, Sahiwal and Tharparkar cows were 321.20±25.55, 319.88±15.39 and 276.68±16.04 seconds, respectively.

Sachan *et al.* (2018) observed the time taken in milking ranged from 182.16±10.95 to 295.60±11.03 seconds. Puftz and Thomas (1940) noted that the skilled milker took 6.68 minutes for letting down 7.1 kg in milking, while 9.1 minutes for 3.6 kg was taken by the unskilled milker.

Devarajulu and Naidu (1989) calculated that on an average 13.04 minutes spent in the milking of cows. Singh and Dave (1985) reported that the time required in hand milking per crossbred cows were 6.06 minutes.

4.4 Milk yield of cows and buffaloes

The milk yield in Sahiwal, crossbred cows and Murrah buffaloes during morning and evening sessions are presented in Table 4.4 and graphically depicted in Fig. 4.9.

The milk yield (in kg) in Sahiwal cows per milking in the morning was (2.52±0.08), which was higher than evening (2.28±0.10) with an average milk yield of 2.40±0.09 kg. In crossbred cows, the milk yield (in kg) per milking in the morning was (3.14±0.19) which was higher than evening (2.82±0.18) with an average milk yield of 2.98±0.18 kg.

Table 4.4: Milk yield (in kg) of milch cows and buffaloes

S. No.	Breeds	Morning session	Evening session	Average milk yield	Total milk yield
1	Sahiwal	2.52±0.08	2.28±0.10	2.40±0.09	4.81±0.17
2	Crossbred	3.14±0.19	2.82±0.18	2.98±0.18	5.96±0.37
3	Murrah	4.59±0.11	4.03±0.12	4.31±0.09	8.62±0.18

The milk yield (in kg) in Murrah buffaloes per milking in the evening was (4.03±0.12) which was lower than morning (4.59±0.11) with an average milk yield of 4.31±0.09 kg. Total milk yield per day in Sahiwal, crossbred cows and Murrah buffaloes was 4.81±0.17, 5.96±0.37 and 8.62±0.18 kg, respectively.

The finding in this study shows similarity with the data reported by Rawat *et al.* (1973) which found that the milk yield of the Sahiwal breed was 2.287±0.13 kg per milking.

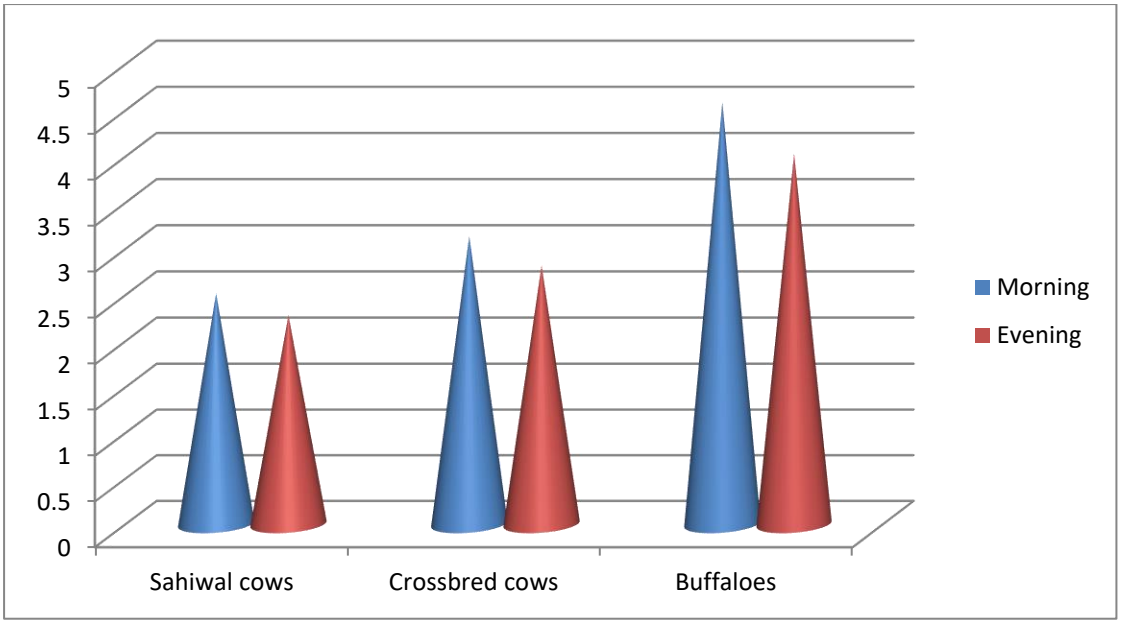

Fig. 4.9. Average milk yield of different breeds

4.5 Post milking operations of milch animals

The time (seconds) taken to different activities of post milking operations in milch cows and buffaloes during morning and evening sessions are presented in Table 4.5 and graphically depicted in Fig. 4.10 and 4.11.

Time spent in different post milking operations *viz.* washing the udder after milking, untying of legs, carrying milk from the animal to recording room and delivering the milk into the weighing balance during the morning were 4.60±0.15, 4.60±0.18, 56.45±1.98 and16.20±0.35 seconds, respectively which were slightly lowered compared than the evening session viz. 4.70±0.14, 4.75±0.25, 56.85±1.98 and16.35±0.31 seconds, respectively.

Table 4.5: Time spent by manpower (in seconds) for post milking operations of milch animals

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Washing of udder	4.60±0.15	4.70± 0.14	4.65±0.10	-0.4728
2	Untying of legs	4.60±0.18	4.75±0.25	4.67±0.15	-0.4837
3	Carrying empty bucket to the recording room	56.45± 1.98	56.85± 1.98	56.65±1.38	-0.1427
4	Unloading the milk pail and weighing time per bucket	16.20±0.35	16.35±0.31	16.27±0.23	0.3195
5	Recording room to distribution centre per cane	67.05±0.60	67.65±0.49	67.35±0.39	-0.7687

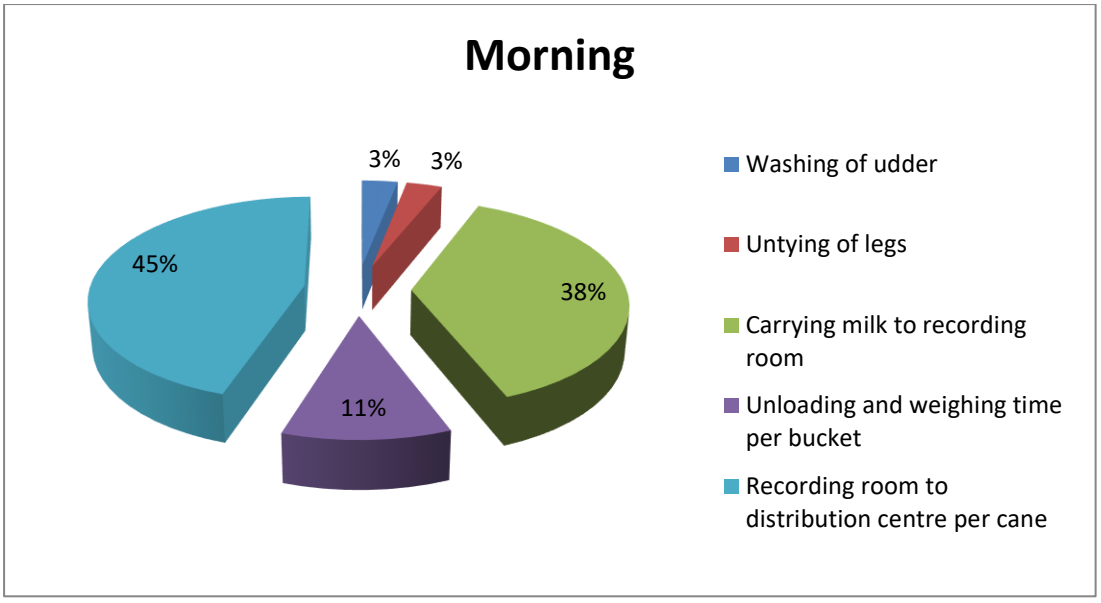

Fig. 4.10. Percentage of time spent in post milking operations of milch animals during morning

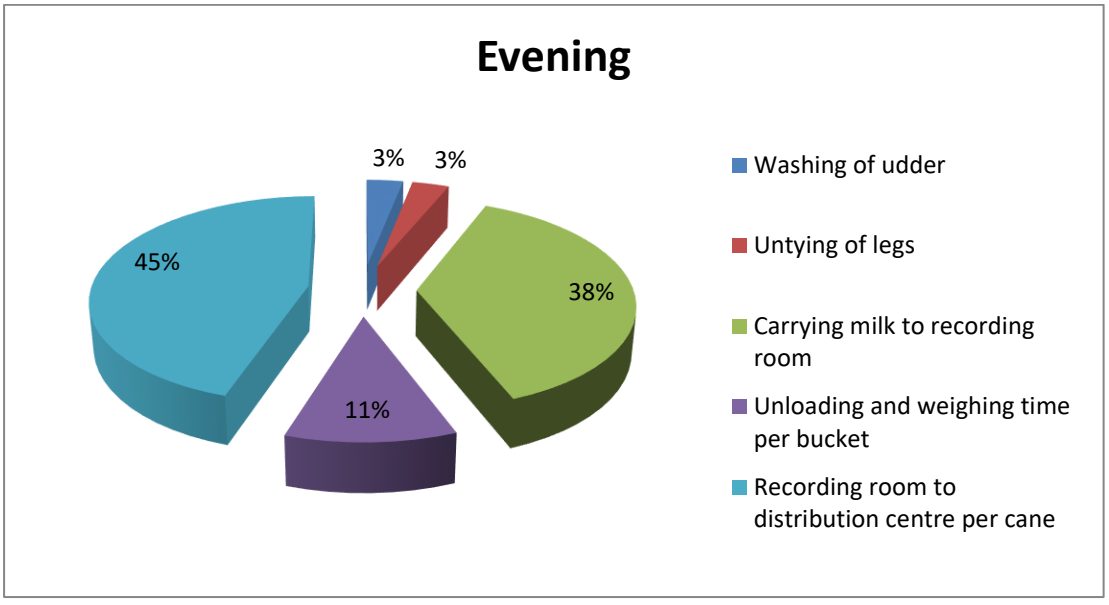

Fig. 4.11. Percentage of time spent in post milking operations of milch animals during evening

The time (seconds) noted for carrying milk cane from recording room to distributing center in the morning session (67.65±0.49) was more than the evening session (67.05±0.60) with average time of 67.35±0.39.

The average time spent per day in washing the udder after milking, untying of legs, carrying milk from the animal to the recording room and delivering the milk into the weighing balance were 4.65±0.10, 4.67±0.15, 56.65±1.38 and16.28±0.23 seconds, respectively.

Sachan *et al.* (2018) reported that untying of legs took on an average 5.43±0.47 seconds which is slightly higher than the present study. It depends upon the skills of workers.

Bara and Shah (2012) observed that time spent in carrying the milk from milch animal to the recording room and delivering the milk into the weighing machine ranged from 27.34±0.23 to 35.86±0.14 seconds. Devarajulu and Naidu (1989) noted that the time taken in carrying the milk to weighing balance and delivering it into the can was 12.70±0.4 seconds.

Sreedhar (1999) studied that the time took in the carrying milk from animal to balance and delivering the milk into the weighing balance was 9.67±0.47 to 13.67±0.94 seconds. Sachan *et al.* (2018) calculated that the time ranged from 38.63±0.99 to 48.10±1.03 seconds in carrying and weighing the milk. This time mainly depends upon the distance between the animal and the recording room.

Bara and Shah (2012) noted that the average time for weighing and recording of milk yield ranged from 10.77±0.07 to 11.96±0.10 seconds. The present study took slightly more time because it included weighing, recording the milk yield and unloading the milk into cans.

4.6 Feeding operations of milch cows and buffaloes

The time (minutes) taken in the feeding of milch cows and buffaloes during morning and evening sessions are presented in Table 4.6 and graphically depicted in Fig. 4.12.

The different feeding activities include carrying the gunny bag and distributing wheat/paddy straw from the storeroom to milch cows & buffaloes, concentrate feed directly poured with water in the water tub and distributing to the manger and unloading and distributing of green fodder to milch cows & buffaloes.

Table 4.6: Time spent by manpower (in minutes) in feeding operations of milch cows and buffaloes

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Distribution of wheat straw	19.75±0.25	19.16±0 .21	19.45±0.17	1.7812**
2	Preparation and distribution of concentrate	37.09±0.21	36.75±0.23	36.92±0.16	1.0794
3	Distribution of green fodder	29.51±0.57	19.37±0.56	24.44±0.90	12.7651***

Note: *** is significant at 1% and ** is significant at 5%

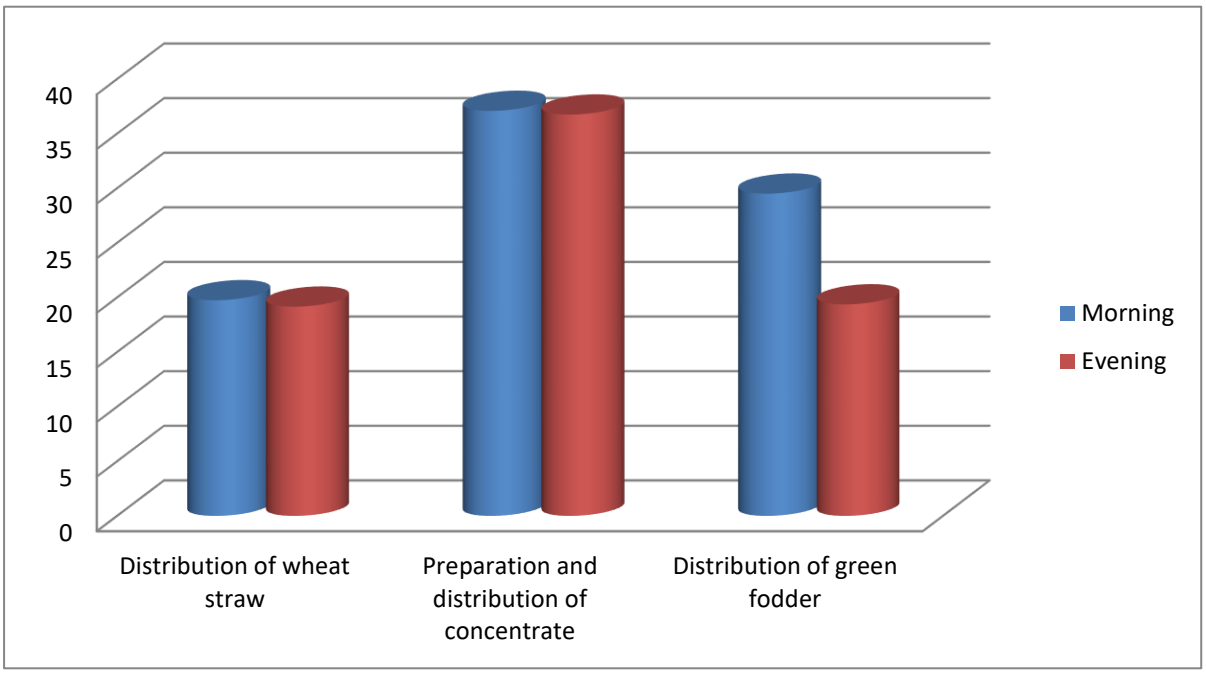

Fig. 4.12. Average time spent in feeding of milch cows and buffaloes

The time taken per day to distributing straw and preparation and distribution of straw during morning session recorded to 19.75±0.25 and 37.09±0.21 minutes, respectively and during evening sessions were 19.16±0.21 and 36.75±0.23 minutes, respectively. Slightly difference was observed between morning and evening sessions.

Higher time (minutes) was recorded for unloading and distributing of green fodder to milch cows & buffaloes during the morning session (29.51±0.57) over that of the evening session (19.37±0.56). In the morning session, distribution of green fodder to each manger of cows and buffaloes in the tied-up system but distributing of green fodder in the common manger during an evening session in losing housing condition.

Average time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in the milch animals shed were 19.45±0.17, 36.92±0.16 and 24.44±0.90 minutes, respectively.

Devarajulu and Naidu (1989) reported that the average time spent in feeding 100 milch animals were 842.16±11.51 minutes. Dosangh and gill (1994) conducted a time-motion study of different sizes of a dairy farm at Ludhiana (Punjab). They found that total time utilized in feeding activities in small, medium and large sizes of the dairy farm were 16.19 minutes, 12.48 minutes and 10.92 minutes, respectively.

Rai *et al.* (1997) conducted a 90 days experiment at Krishi Vigyan Kendra of NDRI, Karnal. They observed that the time spent in feeding operation per day at 4 dairy units 3 cows, 3 buffaloes, 8 cows andc8 buffaloes were 10.46, 11.28, 43.91 and47.0 minutes, respectively.

Bara and Shah (2012) observed that the average time is taken in Gir shed (43.69 A.U.); Kankrej shed (34.44A.U.) and crossbred shed (55.00 A.U.) was 39.30±0.28, 32.97±0.27 and 38.08±0.28 minutes, respectively.

4.7 Feeding operations of Sahiwal heifers

The time (minutes) observed in feeding activities of Sahiwal heifers during morning and evening sessions are presented in Table 4.7 and graphically depicted in Fig. 4.13.

The different feeding activities include carrying the gunny bag and distributing wheat/paddy straw to Sahiwal heifers, concentrate feed directly poured with water in the

water tub and distributing it to the manger and unloading and distributing green fodder to Sahiwal heifers.

Table 4.7: Time spent by manpower (in minutes) in feeding operations of Sahiwal heifers

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Distribution of the wheat straw	17.82±0.10	18.04±0.11	17.93±0.07	-1.4846*
2	Preparation and distribution of concentrate	20.96±0.27	19.87±0.26	20.41±0.20	2.8881***
3	Distribution of green fodder	7.12±0.22	7.55±0.17	7.33±0.14	-1.5365*

Note: *** is significant at 1% and * is significant at 10%

Higher time (minutes) was taken for distributing green fodder to Sahiwal heifers during the evening session (7.55±0.17) over that of the morning session (7.12±0.22).

Average time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in heifers shed were 17.93±0.07, 20.41±0.20 and7.33±0.14 minutes.

Devarajulu and Naidu (1989) reported that the average time spent in feeding 30 heifers was 116.60±5.00 minutes.

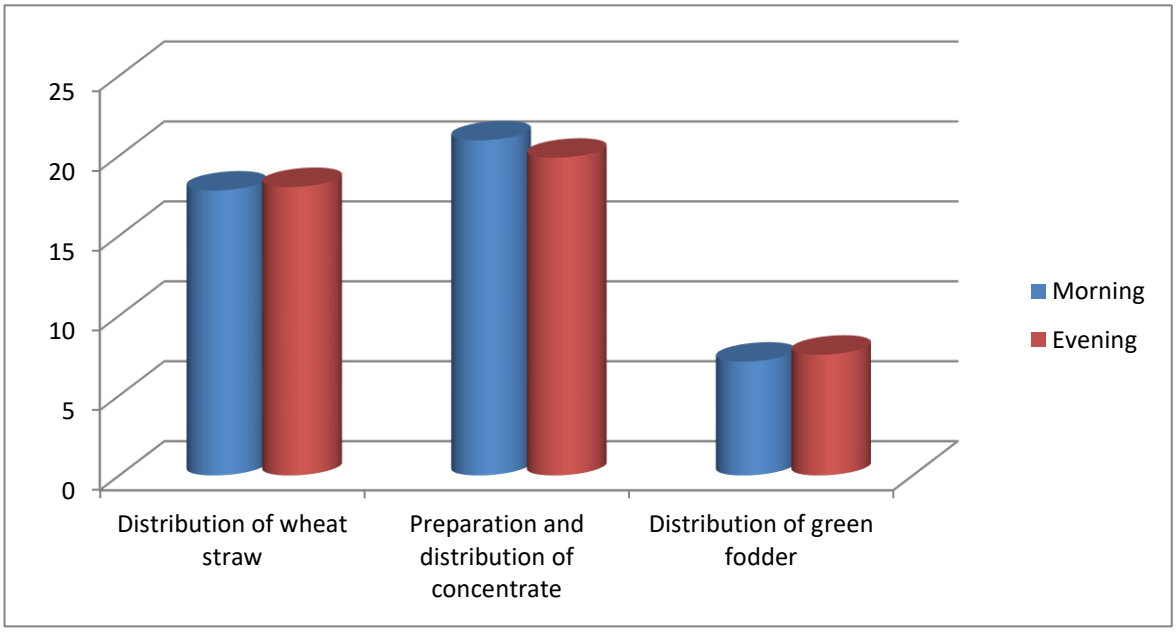

Fig. 4.13 Average time spent in feeding of Sahiwal heifers

4.8 Feeding operations of calves

The time (minutes) observed in feeding activities of calves during morning and evening sessions are presented in Table 4.8 and graphically depicted in Fig. 4.14.

Table 4.8: Time spent by manpower (in minutes) in feeding operations of calves

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Distribution of the wheat straw	7.58±0.12	6.88±0 .22	7.23±0.14	2.7599***
2	Preparation and distribution of concentrate	13.19±0.25	11.93±0.22	12.56±0.19	3.7226***
3	Distribution of green fodder	6.40±0.10	7.21±0 .11	6.80±0.09	-5.4148***

Note: *** is significant at 1%

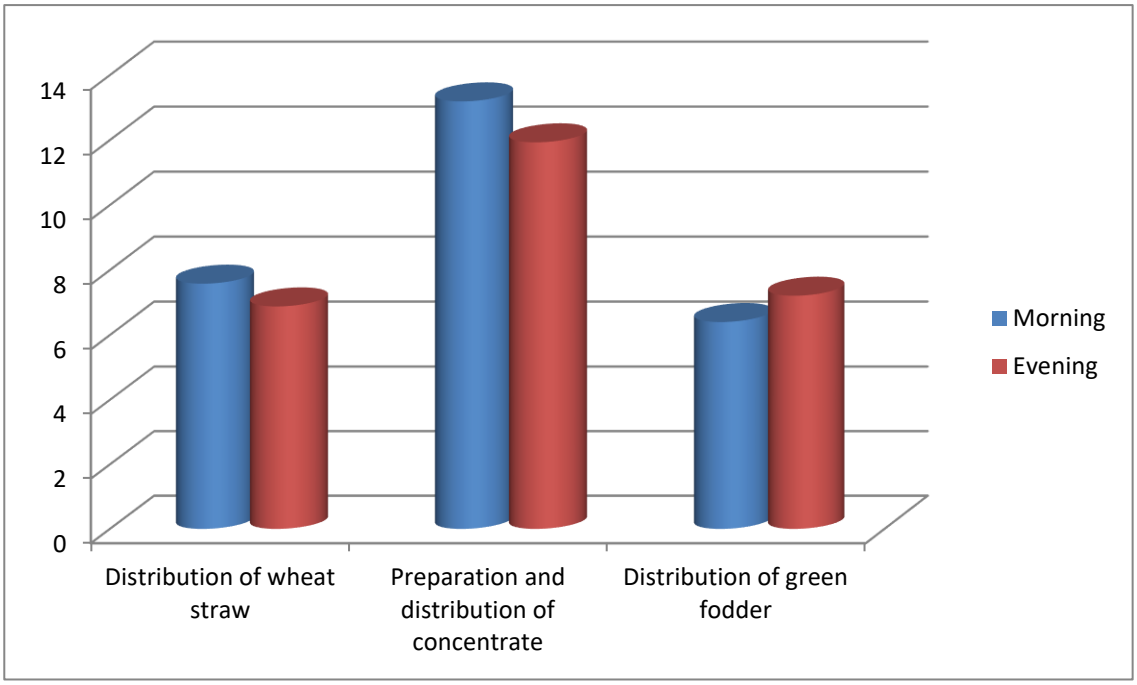

Fig. 4.14. Average time spent in feeding of calves

The different feeding activities include carrying the gunny bag and distributing wheat/paddy straw to calves, concentrate feed directly poured with water in the water tub and distributing it to the manger and unloading and distributing green fodder to calves.

The time taken per day to distributing straw and preparation and distribution of straw to calves during the morning session (7.58±0.12 minutes) was higher than evening sessions (6.88±0.22 minutes) respectively while the preparation and distribution of concentrate in the morning session (13.19±0.25 minutes) was more compare than evening session (11.93±0.22 minutes).

The time observed for distributing of green fodder in the evening session 7.21±0.11 minutes was higher than the morning session 6.40±0.10 minutes. The average time found to be 6.80±0.98 minutes. The average time per day in the distribution of wheat straw and preparation and distribution of concentrate was 7.23±0.14 and12.56±0.19 and minutes.

Sreedhar and Ranganathan (2009) reported that the each calf took 1.31 minutes per day in feeding activities.

4.9 Distribution of wheat/paddy straw in different sheds

Wheat/paddy straw (roughage) was supplied from the storeroom and distributed to different feeding managers. Two workers were engaged in distributing from the storeroom to

feeding managers. Time motion study of manpower in the carrying and distributing of straw to the feeding mangers in different sheds are presented in Table 4.9 and graphically depicted in Fig. 4.15.

Table 4.9: Time spent (in minutes) in the distribution of straw in different sheds

S. No.	Shed	Morning session	Evening session	Average time	t value
1	Cattle shed	19.74±0.25	19.16±0.21	19.45±0.16	1.7812**
2	Buffaloes shed	15.97±0.55	16.78±0.56	16.37±0.39	-1.0141
3	Heifers shed	16.16±0.50	16.88±0.54	16.52±0.37	-0.9684

Note: *** is significant at 1% and ** is significant at 5%

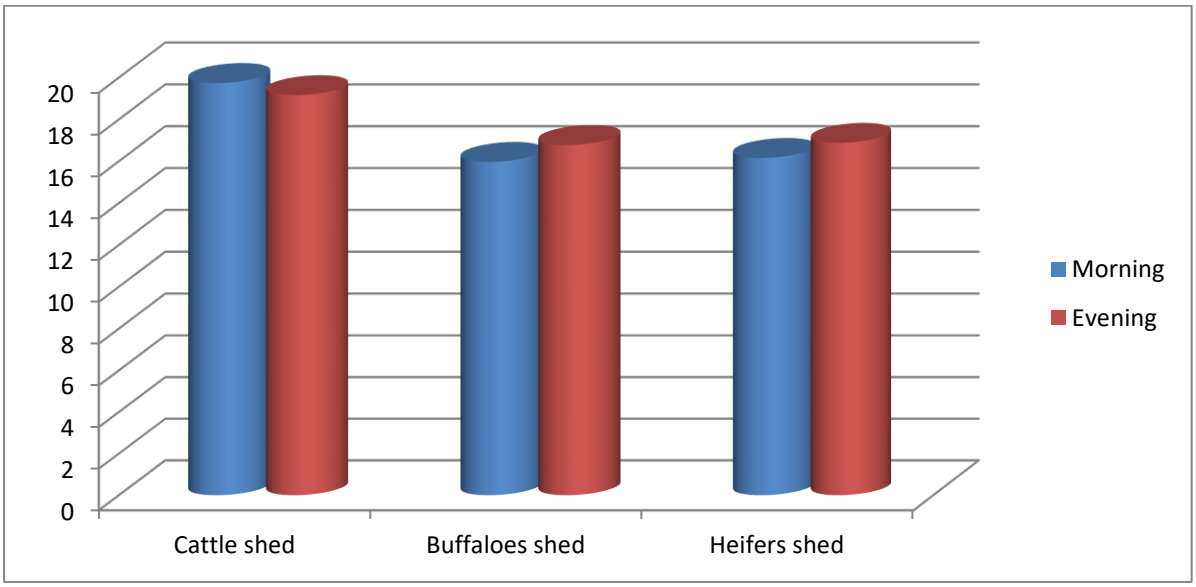

Fig. 4.15. Average time spent in distribution of wheat straw in different sheds

The time (minutes) noted for distributing wheat/paddy straw in the cattle shed during the morning session (19.74±0.25) slightly more than the evening session (19.16±0.21). The average time was observed to be 19.45±0.16.

The time taken per day to distributing straw and preparation in buffaloes and heifers shed during evening session recorded to 16.78±0.56 and 16.88±0.54 minutes, respectively and during morning sessions were 15.97±0.55 and 16.16±0.50 minutes, respectively. The time recorded in the evening session was higher than in the morning session. The average time was 16.37±0.39 and 16.52±0.37 minutes.

Sreedhar and Ranganathan (2009) reported that each dry animal and pregnant animal took 3.74 minutes and 4.02 minutes, respectively per day in feeding activities.

4.10 Distribution of green fodder in different sheds

Green fodder was never chaffed and it was directly supplied from the field and given as such to animals. Four workers were involved in unloading from the tractor and distributing to different feeding mangers. Time motion study of manpower in the unloading from the tractor and distributing to different feeding mangers in the different sheds are presented in Table 4.10 and graphically depicted in Fig. 4.16.

The time (minutes) spent by workers in unloading and distributing green fodder in the cattle shed during the evening session (11.34±0.18) slightly more than the morning session (11.02±0.20). The average time was observed to be 11.18±0.14 minutes.

Table 4.10: Time spent by manpower (in minutes) in the distribution of green fodder in different sheds

S. No.	Shed	Morning session	Evening session	Average time	t value
1	Cattle shed	11.02±0.20	11.34±0.18	11.18±0.14	-1.1247
2	Buffaloes shed	9.65±0.29	10.28±0.20	9.96±0.19	-1.7620**
3	Heifers shed	6.09±0.19	6.30±0.16	6.19±0.13	-0.8615

Note: ** is significant at 5%

The time taken per day to unloading distributing of green fodder in buffaloes and heifers shed during the evening session recorded to be 10.28±0.20 and 6.30±0.16 minutes, respectively and during the morning session were 9.65±0.29 and 6.09±0.19 minutes, respectively. The time recorded in the evening session was also higher than the morning session. The average time spent in buffaloes and heifers sheds were 9.96±0.19 and 6.19±0.13 minutes, respectively.

Naik and Lathwal (2016) reported that time taken in unloading of berseem took on an average 11.80±0.50 minutes. The tractor time required in transportation was 16.00±0.61 minutes.

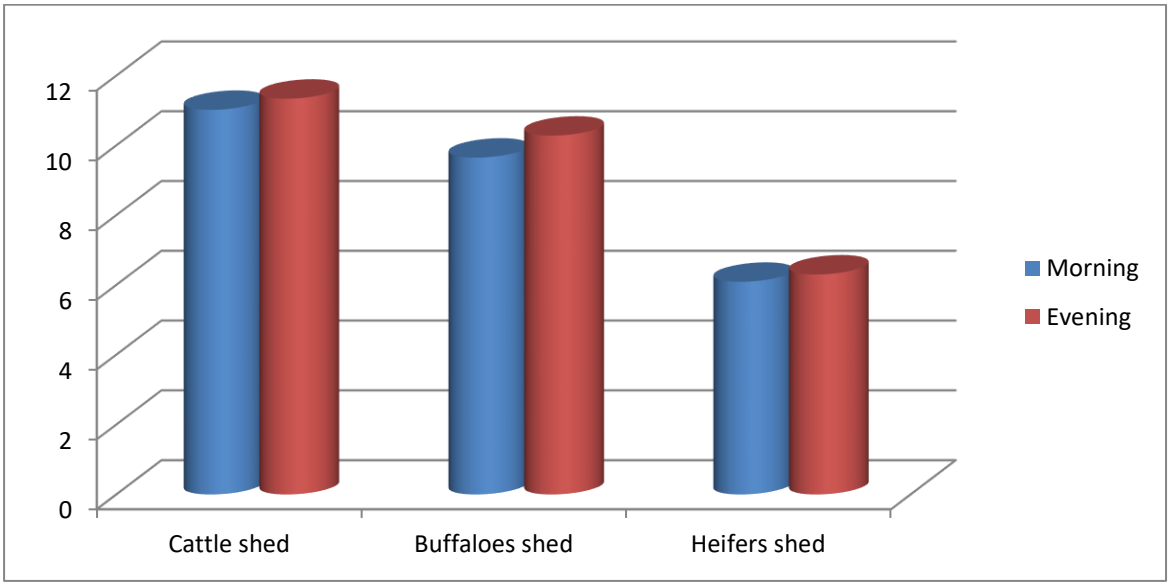

Fig. 4.16. Average time spent distribution of green fodder in different sheds

4.11 Manpower utilization in cleaning operations

Cleaning is one of the important and time taking operations of the dairy farm. It is an essential activity to keep dairy animals disease-free. The production of milk is increased if the milch animals are healthy. The dung of dairy animals was collected and loaded in the tractor by the use of a shovel. The dirt and feed residue were cleaned by broom and water. Two workers engaged in cleaning activities in the different sheds and one person would move the tractor near the different sheds. When the tractor was filled with dung and residues, then it would dispose and converted into manure and utilized as fertilizer in the field. The alley, manger and floor have been cleaned by use of jet spray water and broom.

4.11.1 Cleaning operations of milch cows and buffaloes sheds

The time utilized for removing the dung and feed residual from the manger and floor and cleaning the dirt by broom & water of milch cows and buffaloes shed during the morning and evening sessions are presented in Table 4.11.1 and graphically depicted in Fig. 4.17.

Table 4.11.1: Time spent by manpower (in minutes) in cleaning operations of milch cows and buffaloes sheds

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Removing the dung	19.45±0.19	20.81±0.31	20.13±0.21	-3.7289***
2	Cleaning the dirt	55.06± 1.81	44.52±0.71	49.79±1.28	5.4017***
3	Cleaning by the water	37.28±0.91	35.73±0.93	36.50±0.66	1.1831

Note: *** is significant at 1%

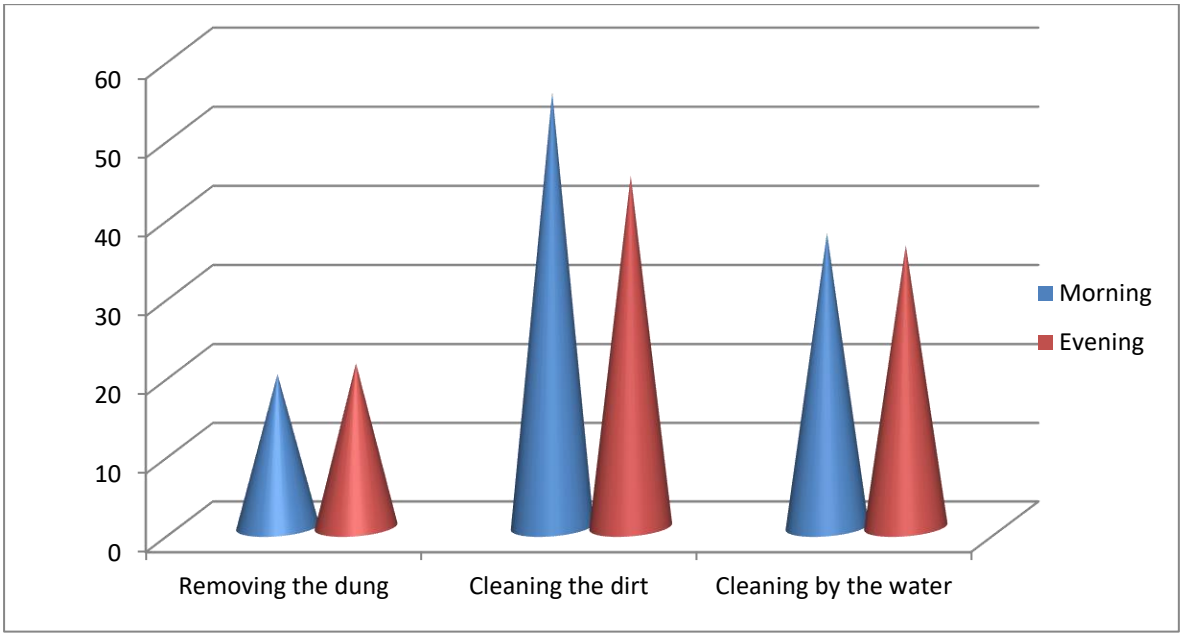

Fig. 4.17. Average time spent in cleaning of milch cows and buffaloes sheds

The average time spent in the removal of the dung, cleaning the dirt by broom and water were 20.13±0.21, 49.79±1.28 and36.50±0.66 minutes, respectively. In the morning session, more time was spent in the cleaning of the shed because of dung accumulated during the whole night.

Bara and Shah (2009) observed that the average time taken in Gir shed (43.69 A.U.), Kankrej shed (34.44A.U.) and crossbred shed (55.00 A.U.) were 119.62±0.60, 178.12±0.73 and 205.81±0.47 minutes, respectively. Sreedhar and Rangandham (2009) observed that the time spent in the cleaning of the shed was 2.95 ±0.33 minutes (man minutes/animal/day).

4.11.2 Cleaning operations of Sahiwal heifers shed

The time utilized for removing the dung and feed residual from the manger & floor and cleaning the dirt by broom & water of Sahiwal heifers shed during morning and evening sessions are depicted in Table 4.11.2 and graphically depicted in Fig. 4.18.

In the morning session, time spent in removing the dung, cleaning the dirt and cleaning the floor by the water in the shed of Sahiwal heifers were 12.23±0 .20, 35.10±0.79 and 26.88±0.47 minutes, respectively while 10.66±0.12, 33.27±0 .86 and25.77±0.36 minutes, respectively took in the evening

The average time spent in the removal of the dung, cleaning the dirt by broom and water were 11.45±0.17, 34.18±0.59 and 25.77±0.36 minutes, respectively.

Rameswar Panda and Rajashree Samanta (2018) stated that the time taken in cleaning of heifer shed took 3.99±0.35 minutes each heifer per day.

Table 4.11.2: Time spent by manpower (in minutes) in cleaning operations of Sahiwal heifers shed

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Removing the dung	12.23±0 .20	10.66±0.12	11.45±0.17	6.6597***
2	Cleaning the dirt	35.10±0.79	33.27±0 .86	34.18±0.59	1.5677*
3	Cleaning by the water	26.88±0.47	24.66±0.43	25.77±0.36	3.4900***

Note: *** is significant at 1% and * is significant at 10%

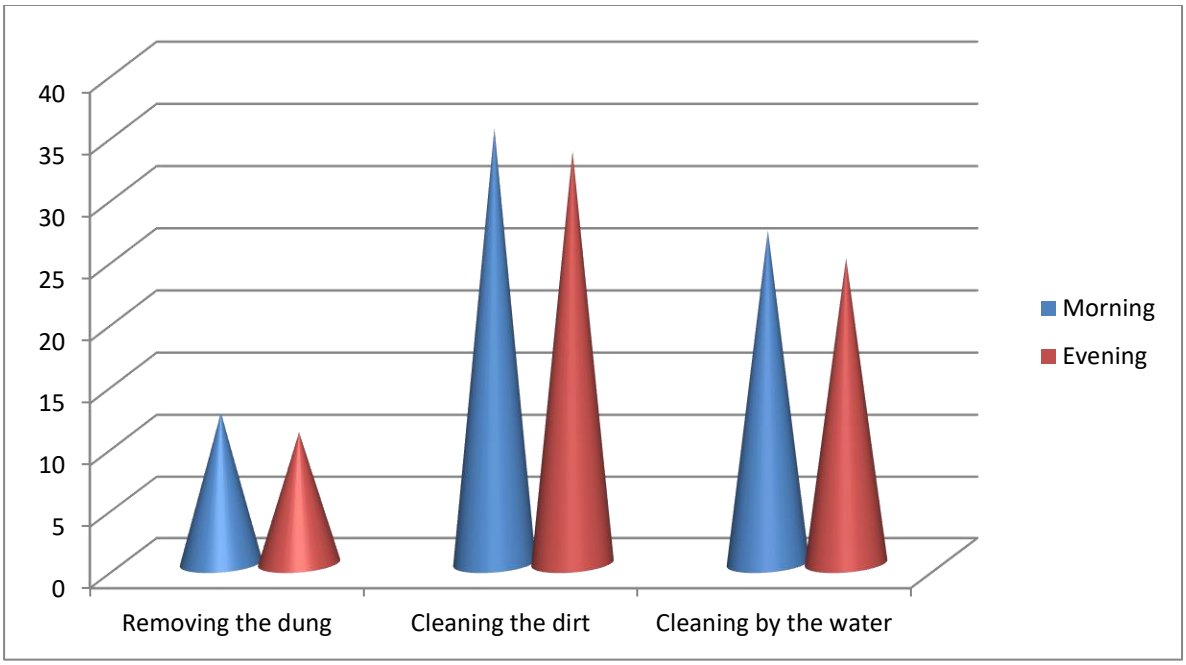

Fig. 4.18. Average time spent in cleaning of Sahiwal heifers shed

4.11.3 Cleaning operations of calves shed

The time utilized for removing the dung and feed residual from the manger and floor and cleaning the dirt by broom & water of calves shed during morning and evening sessions are presented in Table 4.11.3 and graphically depicted in Fig. 4.19.

In the morning session, time spent in removing the dung, cleaning the dirt and cleaning by the water was 12.68±0.15, 25.13±0.46 and 25.94±0.45 minutes, respectively while 11.63±0.32, 26.77±0.62 and24.21±0.39 minutes were taken in the evening, respectively.The average time spent in the removal of the dung, cleaning the dirt by broom and water were 12.16±0.19, 25.95±0.40 and 25.07±0.32 minutes, respectively.

Rameswar Panda and Rajashree Samanta (2018) stated that the time taken in cleaning of calves shed took 2.95±0.33 minutes each calf per day.

Table 4.11.3: Time spent by manpower (in minutes) in cleaning operations of calves shed

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Removing the dung	12.68±0.15	11.63±0 .32	12.16±0.19	2.8878***
2	Cleaning the dirt	25.13±0.46	26.77±0.62	25.95±0.40	-2.1299**
3	Cleaning by the water	25.94±0.45	24.21±0.39	25.07±0.32	2.9098***

Note: *** is significant at 1% and ** is significant at 5%

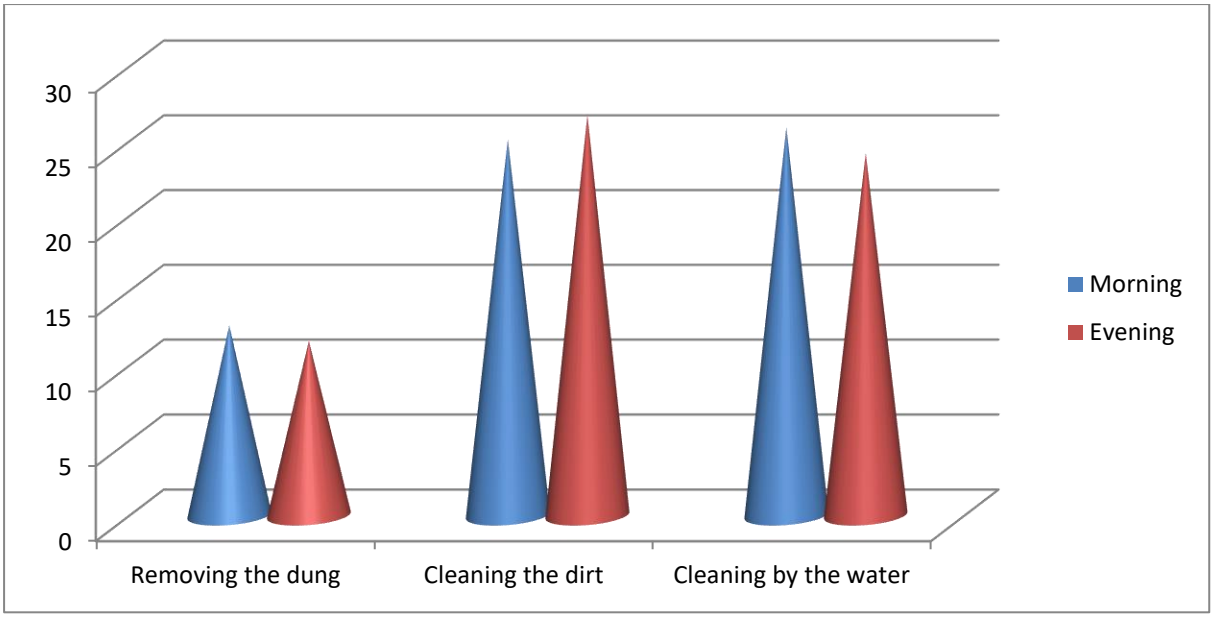

Fig. 4.19. Average time spent in cleaning of calves shed

4.11.3 Cleaning operations in different sheds

The cleaning operations in cattle shed, buffaloes shed and heifer sheds are presented in Table 4.11.4 and Fig 4.20.

In the cattle shed the time utilized for removal of dung from the floor and cleaning the dirt from the floor and manger were 41.96±0.49 and 61.08±0.39 minutes. The time for cleaning the dirt from the floor and manger were 51.80±0.29 and 35.27±0.41minutes in the removal of dung from buffaloes shed. The time (minutes) observed in the heifers shed for removal of dung were 30.96±0.27 and cleaning of dirt from the manger & floor were 51.70±0.60 minutes.

Rai *et al.* (1997) conducted a 90 days experiment at Krishi Vigyan Kendra of NDRI, Karnal. They observed that the time spent in cleaning operation of the shed per day at 4 dairy units 3 cows, 3 buffaloes, 8 cows and 8 buffaloes were 110.27, 79.38, 93.10 and 85.08 minutes, respectively.

Table 4.11.4: Time spent (in minutes) in cleaning operations in different sheds

S. No.	Shed	Removing the dung	Cleaning the dirt	Total time
1	Cattle shed	41.96±0.49	61.08±0.39	103.04±0.57
2	Buffaloes shed	35.27±0.41	51.80±0.29	87.08±0.48
3	Heifers shed	30.96±0.27	51.71±0.60	82.67±0.64

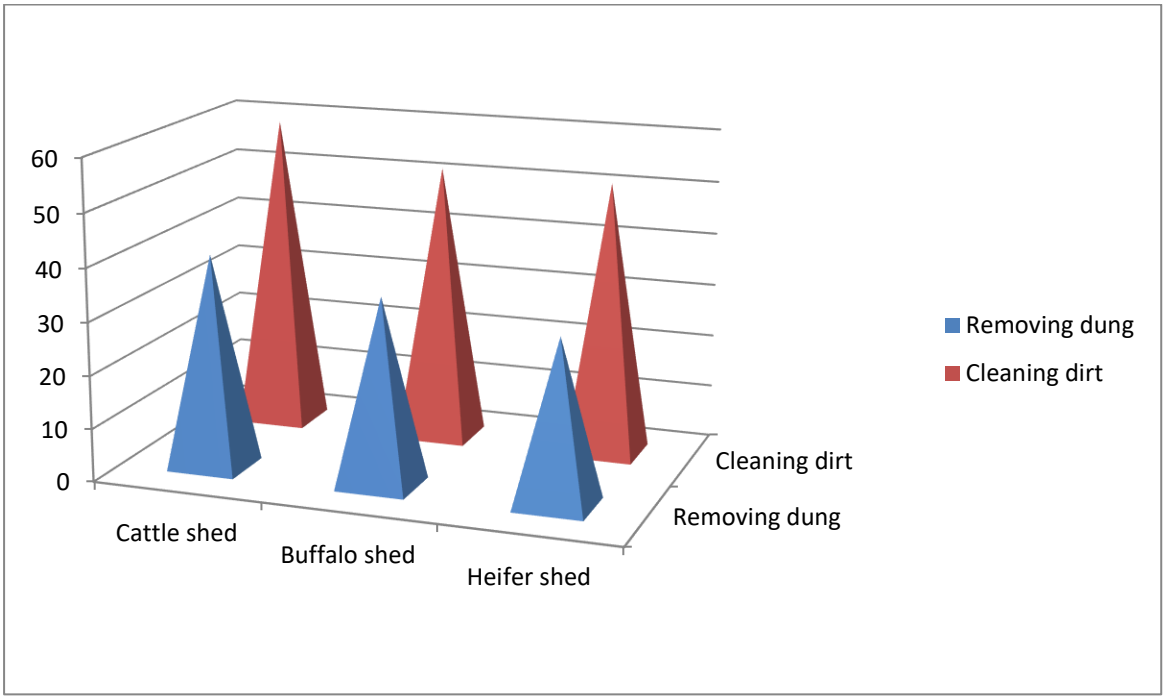

Fig. 4.20. Average time spent in cleaning of different sheds

4.12 Manpower utilization in the management of calves from 0 to 6 days of age

Good calf husbandry is essential to keep the dairy calf alive and fit enough to perform well later on. Many systems have been developed for the good management of calves. A calving pen is providing to the calves for better protection and to avoid unnecessary

disturbance from other animals. Time taken in different activities that are related to the management of newborn calf is presented in Table 4.12 and graphically depicted in Fig. 4.21.

Colostrum is the first milk secreted from the dam after parturition and it contains a large number of gamma globulins which provide passive immunity and protect the calf from many infectious diseases. It is important to feed the colostrum in the first 15-30 minutes.

Table 4.12: Time spent (in minutes) in the management of calves from 0 to 6 days of age.

S. No.	Activity	Morning session	Evening session	Average time	t value
1	Feeding of colostrum (man-minutes/calf)	3.62±0.18	2.87±0.36	3.25±0.22	t= 0.1073**
2	Change the bedding (man-minutes/calf)	4.81±0 .16	4.79±0.15	4.80±0.10	t=0.1073
3	Watering of the calf (man minutes/calf)	1.62±0.14	1.57±0.12	1.59±0.09	t= 0.2877
4	Washing the utensils(man-minutes/calf)	2.78±0.13	2.61±0.14	2.69±0.09	t= 0.8949

Note: ** is significant at 5%

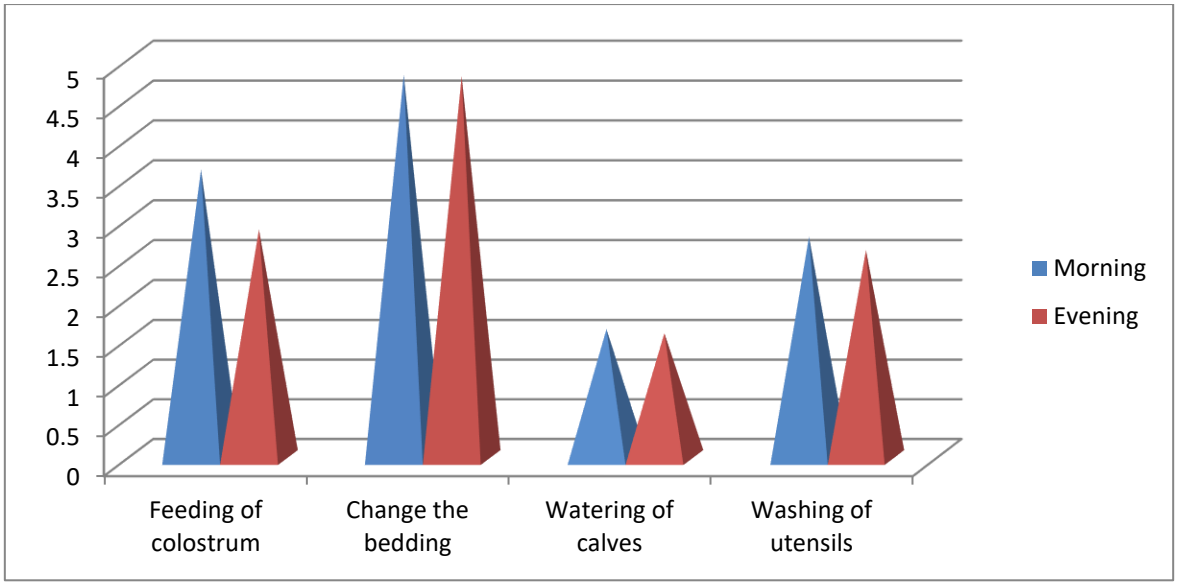

Fig. 4.21. Average time spent in management of calves (0-6 days of age)

The average time taken for feeding of colostrum to the calf, change the bedding, watering of the calf and washing the utensil were 3.25±0.22, 4.80±0.10, 1.59±0.09 and 2.69±0.09 minutes, respectively.

Naik and Lathwal (2016) reported that the average time taken for management of each calf (0-5 days of age) took 14.78±0.31 minutes. He also observed that feeding of colostrum by calf consumed maximum time (more than 50% of the total time).

4.13 Other daily activities of the dairy farm

The time utilized in other daily activities of the dairy farm is presented in Table 4.13 and graphically depicted in Fig. 4.22.

Time taken per day in the cleaning of the recording room during the morning session was 14.12±0.22 (man-minutes/day) and cleaning of the weighing room took 10.44±0.20 (man-minutes/day). The time utilized for cleaning of cans and buckets were 17.11±0.22 and 10.03±0.11 (man-minutes/day), respectively. Washing the bull took 5.78±0.11 minutes per animal per day.

Bara and Shah (2012) observed that the average time taken in cleaning & washing milking parlour and recording room was 205.64±2.16 minutes per day. Bara and Shah (2012) also stated that the average time taken in cleaning of cans was 15.92±0.65 minutes per day.

Table 4.13: Time spent (in minutes) in other daily activities of dairy farm

S. No.	Activity	Average time
1	Cleaning of recording room (man-minutes/day)	14.12±0.22
2	Cleaning of weighing room (man-minutes/day)	10.44±0.20
3	Cleaning of cans (man-minutes/day)	17.11±0.22
4	Cleaning of buckets (man-minutes/day)	10.03±0.11
5	Washing of bulls (man-minutes/animal)	5.78±0.11

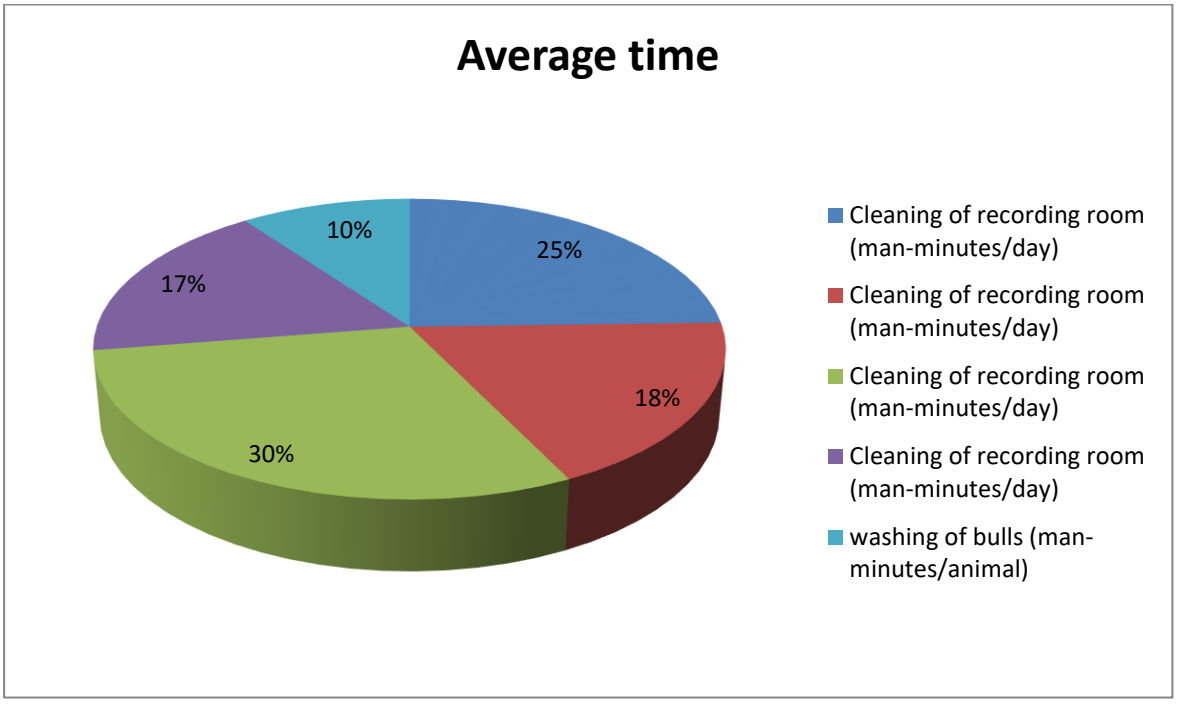

Fig. 4.22. Percentage of time spent in other daily activities of the farm

4.14 Miscellaneous operations of the dairy farm

It included manpower required on the dairy farm treatment of animals, rectal palpation, artificial insemination of milch cows & buffaloes and weighing of calves. Time taken in miscellaneous works in the dairy farm is presented in Table 4.14 and graphically depicted in Fig. 4.23.

Weighing of the calves was done on the mechanical bridge fortnightly. Time taken in weighing of each calf was 4.97±0.19 minutes. Rectal palpation was done to examine the follicular growth & development and also diagnose any disorders of the reproductive tract. Time taken in rectal palpation per animal was observed to be 1.37±0.04 minutes.

Artificial insemination in the dairy animals was done during the early morning or evening session. Artificial insemination was done in those animals which were in heat. Time spent in artificial insemination per animal was noted to be 7.50±0.16 minutes. Veterinary doctor and compounder engaged in the treatment of unhealthy animals. On an average 12.63±0.73 minutes were utilized in veterinary care and treatment of each animal.

Rameswar Panda and Rajashree Samanta (2018) reported that the time spent in miscellaneous operations of calves and heifers was 0.29±0.30 and 1.22±0.34 minutes, respectively each animal per day. Naik and Lathwal (2016) observed that man-minutes per animal in A.I. & veterinary care were 3.62±0.18.

Table 4.14: Time spent by manpower (in minutes) in miscellaneous activities of dairy farm

S. No.	Activity	Average time
1	Veterinary aid (man-min./animal)	12.63±0.73
2	Rectal palpation (man-min./animal)	1.37±0.04
3	Artificial insemination (man-min./animal)	7.50±0.16
4	Weighing of calves (man-min./animal)	4.97±0.19

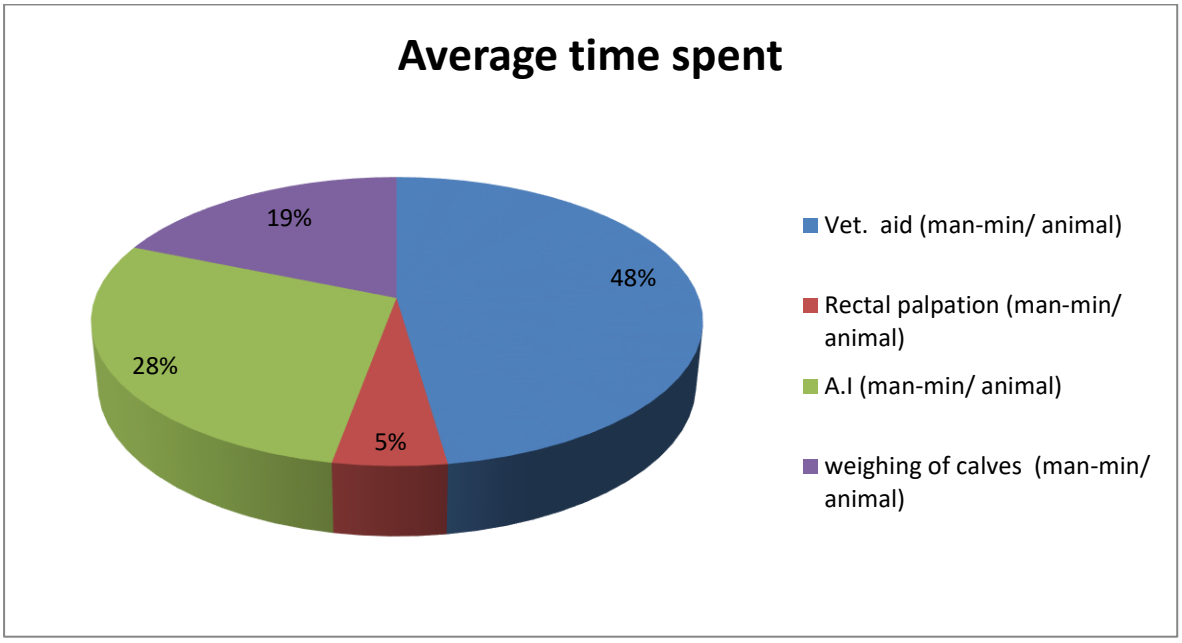

Fig. 4.23. Percentage of time spent in miscellaneous activities of the farm

5 Summary and Conclusions

The present study on manpower utilization pattern in management of livestock farm was conducted at Dairy Unit of Livestock Farm Complex, Bihar Animal Science University, Patna to help in the proper utilization of manpower for different activities in the dairy farm.

The study was carried out at 176 dairy animals which were divided into different categories *viz.* milch cows, milch buffaloes, heifers, calves, dry animals and bulls. The observations of various dairy farm activities were carried out for 120 days while milking activities were recorded for 60 days. The time noted for different activities were done on the Dairy Unit of Livestock Farm Complex viz. pre-milking, milking post-milking, feeding, cleaning, calf management, and miscellaneous operations per day in both morning and evening sessions.

Total time taken per animal per day (both morning and evening) for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, suckling the milk by the calf, tying of legs, washing of the hands and washing the udder in Sahiwal cows were 26.40±0.37, 37.10±0.66, 102.75±3.23, 85.85±4.19, 47.55±1.18, 30.20±0.64, 12.60±0.51 and 25.55±0.47 seconds, respectively.

In crossbred cows, total time taken per animal per day (both morning and evening) for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, suckling the milk by the calf, tying of legs, washing of the hands and washing the udder were 30.15±0.43, 35.15±1.09, 98.90±3.63, 86.45±4.12, 49.50±0.69, 32.10±0.75, 12.55±0.37 and 28.35±0.82 seconds, respectively.

Total time taken per animal per day (both morning and evening) for tying of animals, concentrate feeding, carrying the empty bucket from recording room to milking parlour, bringing the calves from the calf pen, suckling the milk by the calf, tying of legs, washing of the hands and washing the udder by potassium permanganate solution before milking in Murrah buffaloes were 31.25±0.40, 38.40±1.16, 106.05±2.77, 86.45±4.12, 50.50±0.76, 32.10±0.75, 12.60±0.44 and 28.35±0.76 seconds, respectively.

Morning milking took a higher time in comparison to evening milking, in both cows and buffaloes. The average time used in actual milking per day for Sahiwal, crossbred cows, and Murrah buffaloes were 295.72±10.72, 321.15±9.03, and 335.85±10.71 seconds, respectively.

Total milk yield per day by Sahiwal, crossbred cows, and Murrah buffaloes were 4.81±0.17, 5.96±0.37, and 8.62±0.18 kg, respectively. Average milk yield per day in Sahiwal, crossbred cows, and Murrah buffaloes were 2.40±0.09, 2.98±0.18and 4.31±0.09 kg, respectively.

The total time in washing the udder after milking, untying of legs, carrying milk from the animal to the recording room, and delivering the milk into the weighing balance during both morning and evening was 9.30±0.28, 9.35±0.41, 113.30±3.96, 32.55±0.64, and 134.70±1.07 seconds, respectively.

Total time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in the milch animals shed were 38.91±0.45, 73.84±0.40, and 48.88±1.11 minutes, respectively. The average time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in the milch animals shed were 19.45±0.17, 36.92±0.16, and 24.44±0.90 minutes, respectively.

Total time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in heifers shed were 35.86±0.18, 40.83±0.46, and 14.67±0.34 minutes, respectively. Average time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in heifers shed were 17.93±0.07, 20.41±0.20, and 7.33±0.14 minutes, respectively.

Total time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in calves shed were 14.46±0.29, 25.12±0.40, and 13.61±0.18 minutes, respectively. Average time per day in the distribution of wheat straw, preparation and distribution of concentrate and distribution of green fodder in calves shed were 7.23±0.14, 12.56±0.19, and 6.80±0.09 minutes, respectively.

The average time in the distribution of wheat/paddy straw per day in cattle shed, buffaloes shed and heifers shed were 19.45±0.16, 16.78±0.56, and 16.88±0.54 minutes, respectively. Total time in the distribution of wheat/paddy straw per day in cattle shed,

buffaloes shed and heifers shed were 38.90±0.45, 32.75±1.11, and 33.04±1.04 minutes, respectively.

The average time in the distribution of green fodder per day in cattle shed, buffaloes shed, and heifers shed were 11.18±0.14, 9.96±0.19, and 6.19±0.13 minutes, respectively. Total time in the distribution of green fodder per day in cattle shed, buffaloes shed, and heifers shed were 22.36±0.37, 19.93±0.47, and 12.39±0.35 minutes, respectively.

The average time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of the milch animals shed were 20.13±0.21, 49.79±1.28, and 36.50±0.66 minutes, respectively. Total time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of milch animals shed were 40.26±0.38, 99.58±2.22, and 73.01±1.81 minutes, respectively.

The average time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of Sahiwal heifers shed were 11.45±0.17, 34.18±0.59, and 25.77±0.36 minutes, respectively. Total time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of Sahiwal heifers shed were 22.89±0.23, 68.37±1.60, and 51.54±0.77minutes, respectively.

The average time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of the calves shed were 12.16±0.19, 25.95±0.40, and 25.07±0.32 minutes, respectively. Total time per day utilized in removing the dung, cleaning the dirt, and cleaning by the water of calves shed were 24.31±0.44, 51.90±0.93, and 50.15±0.52 minutes, respectively.

Total time per day in cleaning activities in cattle shed, buffaloes shed and heifers shed were 103.04±0.57, 87.08±0.48, and 82.67±0.64 minutes, respectively.

The average time taken per day for feeding of colostrum to the calves, change the bedding, watering of the calves, and washing the utensils were 3.25±0.22, 4.80±0.10, 1.59±0.09, and 2.69±0.09 minutes, respectively. The total time utilized per day in the feeding of colostrum to the calves, changing the bedding, watering of the calves, and washing the utensils were 6.49±0.31, 9.60±0.30, 3.19±0.25, and 5.39±0.26 minutes, respectively.

Average time per day in miscellaneous activities *viz.* veterinary aids, rectal palpation, artificial insemination and weighing of the calves were 12.63±0.73 (man-min. /animal),

1.37±0.04 (man-min. /animal), 7.50±0.16 (man-min. /animal), and 4.97±0.19 (man-min./animal), respectively.

The average time utilized in cleaning of the recording room, cleaning of the weighing room, cleaning of cans, cleaning of buckets, and washing of bulls were 14.12±0.22 (man-min./animal), 10.44±0.20 (man-min./animal), 17.11±0.22 (man-min./animal), 10.03±0.11(man-min./animal) and 5.78±0.11(man-min./animal), respectively.

Conclusions

i. The milk yield, animal behavior and the skills of dairy farm workers are the important factors that determine how much time will be spent in different milking activities of different breeds like Sahiwal, crossbred cows and Murrah buffaloes.

ii. Type of housing, cleaning and feeding methods and the number of animals per shed are some of the important factors that decide the time duration for feeding & cleaning operations, calves management and other miscellaneous activities.

iii. To judicious deployment of manpower in a dairy farm a close observation of manpower utilization is necessary. The training of new untrained workers helps to overcome the scarcity of manpower in adverse conditions.

iv. For all activities of the dairy farm forty manpower are required to manage 200 animals efficiently.

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