

**TIME AND MOTION STUDIES ON  
DAIRY FARMING OPERATIONS**

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**THESIS SUBMITTED TO THE  
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**JULY, 1999**

## CERTIFICATE

**Mr.S. SREEDHAR** has satisfactorily prosecuted the course of research and that the thesis entitled **TIME AND MOTION STUDIES ON DAIRY FARMING OPERATIONS** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any university.

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This is to certify that the thesis entitled **TIME AND MOTION STUDIES ON DAIRY FARMING OPERATIONS** submitted in partial fulfilment of the requirements for the degree of **MASTER OF VETERINARY SCIENCE** of the Acharya N.G. Ranga Agricultural University, Hyderabad is a record of bonafide research work carried out by **Mr.S. SREEDHAR** under my guidance and supervision. The subject of the thesis has been approved by the student's advisory committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All the assistance and help received during the course of investigation have been duly acknowledged by the author of the thesis.

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**(S. SREEDHAR).**

## DECLARATION

I, **S. SREEDHAR**, hereby declare that the thesis entitled **TIME AND MOTION STUDIES ON DAIRY FARMING OPERATIONS** submitted to Acharya N.G. Ranga Agricultural University for the degree of **MASTER OF VETERINARY SCIENCE** is a result of original research work done by me. I also declare that the thesis or any part thereof has not been published earlier elsewhere in any manner.

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## ABSTRACT

A time and motion study was undertaken to establish time requirements for different dairy farm operations at Dairy Experimental Station, Rajendranagar, Hyderabad.

Milking operation constituted major item of work in milch buffaloes. Feeding, washing of animals and cleaning of sheds consumed a considerable time spent on milch buffaloes. Variation in milking time observed may be due to differences in the milk yield and efficiency of labour.

Among the different categories of animals, milch animals required more time to manage due to the additional operation of milking. Bulls also required greater amount of time. Among all the categories of animals labour requirement is the lowest for calf management.

A considerable idle time is left unutilized on farm which requires efficient managerial practices to put it to proper use.

Studies on forage farm operations indicated varied time requirements for different forage crops owing to differences in forage farm operations. Among the various crops studied, paragrass required the highest time owing to the differences in sowing and more number of cuttings in a given period of time.

From the results the labour requirements were calculated for each category of animals and norms were suggested. Measures were also suggested to improve the efficiency of labour and optimum utilisation of man power on diary farm.

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# *Introduction*

## Chapter I

# INTRODUCTION

Organisation of work on dairy farm is a major factor in determining the efficiency level of overall management and profitability. Success in dairy farming requires best of ability to manage resources available in carrying out day to day operations. In dairy farming man power is an important contributing factor for the cost of milk production. Effective utilization of man power along with other inputs is a must to increase the productivity and profitability of dairy farming.

The time and motion study is fundamentally aimed to draw scientific conclusions which are always better than layman's experience. The results of the study will help to incorporate the available scientific knowledge and making best use of the available resources and lead to many mechanical automations and managerial innovations. By these studies productivity of labour can be increased to a considerable extent. To increase the productivity of labour internal comparison between labourers should be done. To do this relevant information with regard to different labourers involved in different dairy farm operations is a must. Then comparisons can be made and steps may be taken to improve the less efficient workers. Further suitable training programmes may be adopted to improve the efficiency of such workers also. Time study is a work measurement technique for recording the time and rates of working for the elements of a specified job carried out under specific conditions.

From the available literature in India, it is evident that there is paucity in application of time and motion study principles in the dairy farming enterprise. Standard norms for labour requirements for different dairy farm operations have also not been established. Some studies particularly those reported by Rawat *et al.* (1973), Singh and Dave (1985) and Devarajulu and Naidu (1989) on dairy farm work analysis may not hold good in the present day context due to increase in labour wages, amend-ment of labour laws and changes in working environment. To keep the dairy farming enterprise on strong industrial footing in the present day competative business, efficient managment involving proper management of labour is a must. Hence the present investigation was under taken with the following objectives.

1. To estimate the time and labour requirements for different dairy farm operations.
  2. To estimate the labour requirements for important agricultural operations of forage farm.
  3. To develop norms for avoiding the wastage and under utilisation of labour force.
  4. To estimate the criteria for efficient and economical dairy and forage farm operations.
-

*Review*  
*of*  
*Literature*

## Character II

### REVIEW OF LITERATURE

In order to have comprehensive idea about the time required for each operation at Dairy Experimental Station and Forage Production Farm, available literature has been reviewed and presented here under:

#### 2.1 DAIRY FARM OPERATIONS

##### 2.1.1 Labour/Time Required for Dairy Farm Routine Work

Haraldson and Joelsson (1964) from their detailed account of labour requirement studies on 36 dairy farms with a herd size ranging from 10 to 150 reported that the effect of different methods of feeding, milking and building designs influence labour requirement.

Yoshimoto *et al.* (1965) reported that the total daily time required for milking, feeding, bedding and miscellaneous works was measured as 40.3 minutes per head in the yard and parlour and 35 minutes per head in the tie up cow shed. Out of the total daily time spent, 21.7 and 20.6 minutes per head were devoted for milking, 5.8 and 5.7 minutes per head for putting bedding and cleaning and 4.3 and 3.7 minutes per head to other miscellaneous works in the yard and parlour and tie-up cow shed respectively.

Time and motion study of milking operation in three Lombardy farms by hand milking, mobile machine milking and in a milking parlour carried out by Grazzani (1965) indicated that milking operations took a

maximum time of 50 per cent, 42 per cent and 45 per cent of the labour followed by 15 per cent, 17 per cent and 18 per cent for feeding. The cleaning operations took 22 per cent, 25 per cent and 26 per cent of time respectively.

Valasek *et al.* (1967) studied labour efficiency in a two row cow shed housing 87 cows and reported that the time required for management of each cow was 28 minutes and 52 seconds.

Abschke *et al.* (1975) suggested that 1935 man hours should be taken as standard available working time per labour unit per year through their study. They also proposed the methods for calculating the available working time per labour unit per year as a basis for standard determination of annual and daily labour requirement on livestock farms.

Ermolenko (1975) studied on prediction of the labour requirements for a dairy farm complex in relation to the herd size, average milk yield, method of mechanised fodder distribution and method of mechanised manure removal in terms of man hours per 100 kg milk.

Hazert and Schleitzer (1975) investigated on problems of labour organisation on farms and in particular with the establishment of manning standards specifying labour requirements, working hours and work sequence. The object of these standards was to optimise yield per animal and utilization of labour and other inputs.

Olfe and Walter (1975) studied on labour requirements and total costs for different types of feeding, milking, manure removal and littering and

reported that for each herd size there were several optimum methods of husbandry with little difference in costs.

Anonymous (1976) found through his study that dairy farmers on average spent 26.5 hours per week on general farm operations. This total included 3.7 hours for maintenance of buildings and equipment, 2.3 hours for maintenance of farm yard and farm roads, 3.5 hours for care of calving cows, 2.1 hours for general animal inspection of mature cows, 1.5 hours for inspection of heifers, 1.8 hours for inspection of calves, 1.4 hours for fiscal book keeping and 0.9 hours for technical farm business administration.

Baidikov (1977) investigated and revealed that the labour requirement for total milk production activity under tie-up and cubicle loose housing conditions to be 28.1 and 17.8 man minutes daily per cow respectively.

Volosozhar (1977) reported that for cows with annual milk yield of 2481 kgs, the labour expenditure per 100 kg milk was reported to be 5.45 man hours. It was further reported that labour expenditure in milking cows with mean milk yields of 1701, 2023, 2429, 2803, 3203 and 3670 kgs was 6.4, 5.6, 4.7, 4.8, 8.8 and 3.4 man-hours for 100 kg milk respectively and 100, 114, 115, 120, 124 and 127 man hours annually per cow respectively.

Claesson (1978) stated that the labour efficiency was effected by the milker himself and the difference between milkers in repeatability being highly

significant. Variation in the milking characteristics of the cows was also found to be significant.

Records of the year 1976 from 114 milk producers in Georgia state of USA were used by Carley (1979) to provide an analytical description of labour utilization and to assess factors associated with labour efficiency and costs. He found that average annual labour per cow was 52 hours vs. 133 hours in 1944 and 93 hours in 1956. The main change since 1956 was in herd size where labour time per cow ranged from 83 hours for herds of <70 cows to 38 hours for herds with >200 cows. High producing herds were found to use less labour/100 lb milk produced. Analysis by least squares regression showed that herd size alone accounted for about 40 per cent of the variation in labour time per cow.

Geneijgen (1980) investigated on the four dairy units of the Waiboerhoeve test farm, Netherlands, on labour utilization and found that the labour inputs per cow per year were 52.3, 37.4, 37.0 and 33.9 man hours respectively which included 17.5, 11.9, 9.3 and 11.3 man hours for work associated with milking.

In another study Visch (1980) from his observations on Waiboerhoeve test farm, Netherlands, reported that labour input per cow was 52, 38, 37 and 34 hours for cow yielding 6039, 6263, 6600 and 6554 kgs milk respectively.

Whipp (1981) reported that on an average daily herdsmen spent about 38 per cent of their total time in milking.

Topikha and Kobzeva (1982) study on "Lvovsky state farm complex" have revealed that the labour expenditure per 100 kg milk production as 2.3 man hours.

Nanda *et al.* (1988) investigated on "Time motion study of labour requirement for management of crossbred cows" and the results revealed that the time required for managerial operations of 42 cross-bred cows was found to be  $49.9 \pm 1.6$  min/cow/labour.

"Time motion studies of some dairy farm operations" by Devarajulu and Naidu (1989) revealed that against the total time of 9120 man minutes available in a day with 19 persons on average, 891 man-minutes were utilized for non-farm activities leaving 8229 man-minutes to manage 308 animals including calves. On an average 43.63 man minutes were spent per milch animal per day. In a study Devarajulu (1986) observed that workers showed a tendency to complete the assigned task before the scheduled time.

Aulakh and Gupta (1995) studied on labour requirement for dairy farm operations and the results revealed that the standard feeding time ranged from 4.14 to 4.63 minutes/animal/man when the fodder was fed unchaffed and 10.41 to 15.92 minutes/animal/man when it was fed after chaffing. On the basis of standard feeding time and presuming eight hours work time/day/worker it was calculated that one person may be required to feed

101 to 115 animals during winter and spring season when the fodder is fed unchaffed and 30 to 46 animals during summer, rainy and autumn months when it was fed after chaffing.

### **2.1.1 Cleaning of Animals and Shed**

Nanda *et al.* (1988) observed that the time consumed for cleaning of byre of milch cows was  $33.1 \pm 0.5$  min/cow/labour where as for dry cows it was  $31.4 \pm 0.2$  min/cow/labour.

Devarajulu and Naidu (1989) found that in heifer (41.2%) and dry (41.3%) animal management the major operation was washing of the shed which consumed nearly 50 per cent of the total time and concluded that one man can look after 11 milch animals or 27 dry cows or heifers under stall feeding conditions.

Aulakh and Gupta (1995) conducted a study on 64 cows and reported that the time taken for cleaning of manger containing unchaffed fodder and chaffed fodder was ranged from  $8.67 \pm 0.99$  to  $12.44 \pm 0.63$  and  $10.13 \pm 1.74$  to  $16.25 \pm 3.81$  minutes respectively.

### **2.1.2 Feeding and Watering**

Prabhakaran and Raut (1979) reported that a worker took 10.8 – 39.6 minutes to feed a cow under field conditions.

Nanda *et al.* (1988) through their time motion study of labour requirement for management of crossbred cows found that the time consumed for feeding and watering the crossbred milch cows was  $9.9 \pm 0.4$  minutes/cow/labour whereas in case of dry cows it was  $8.5 \pm 0.0$  minutes/cow/labour.

Devarajulu and Naidu (1989) observed that the average time taken for feeding 100 milch animals, 27 dry animals and 30 heifers as  $842.5 \pm 11.51$ ,  $104.5 \pm 3.1$  and  $116.6 \pm 5.0$  minutes, respectively. In case of dry animals 21.6 percent of total time was utilized for feeding.

Aulakh and Gupta (1995) conducted a study on labour requirement for dairy farm operations and reported that a group of two workers took  $57.97 \pm 4.87$  to  $76.31 \pm 13.11$  minutes in order to bring fodder from outside the shed to the manger and  $7.85 \pm 1.38$  to  $9.19 \pm 1.73$  minutes for distribution of green fodder (berseem) in a manger of a shed housed 64 cows.

Further these workers reported that the total time for feeding chaffed fodder by a single worker ranged from  $6.76 \pm 0.11$  to  $10.34 \pm 0.07$  minutes/animal. In the case of summer fodders like Chari, Bajra, Maize etc. the time taken for unloading by two workers was found to range from  $17.5 \pm 5.0$  to  $26.5 \pm 2.17$  minutes for 30 quintals. Similarly a group of eight workers as per the report took  $30.0 \pm 10.0$  to  $31.7 \pm 2.27$  minutes for chafing 30

quintals. Regarding the feeding of concentrates the time required per animal ranged from  $2.69 \pm 0.1$  to  $3.19 \pm 0.15$  minutes.

### **2.1.3 Milking Operation**

#### **2.1.4.1 Preparation of Animal for Milking**

Rawat *et al.* (1973) reported that the average time taken to apply milkman rope was to be  $25.17 \pm 1.78$  seconds. Further analysis revealed that in 53.77 per cent cases the operation was done within 16-20 seconds. It was also observed that the time taken for wiping the udder, stimulating the udder and taking out first strips was 11-15, 6-10 and 7-8 seconds, respectively.

Shiralkar and Dave (1975) in their studies on "Time studies on milking of Kankrej cows" reported a mean preparation time of 73.19 seconds for hand milking of cows.

Singh and Dave (1985) conducted a study on 14 cows for 30 days and reported that the average time taken for washing the udder was  $0.38 \pm 0.004$  minutes/cow/day. They also reported that the time taken for massaging the udder as  $0.33 \pm 0.12$  minutes/cow.

#### **2.1.4.2 Milking Time**

Hubenov and Doikov (1965) through their study found that the average milking time per cow and per litre of milk as 7 minutes and 2 minutes and 16 seconds respectively for milking 13 cows by hand. When 1,2 or 3 machine milking units were used for 17, 21 or 26 cows the average milking

time per cow was observed to be 6 minutes 45 seconds, 7 minutes 18 seconds, 5 minutes 22 seconds respectively. The average milking time per litre was 1 minute 53 seconds, one minute 32 seconds and one minute 20 seconds respectively.

Rawat *et al.* (1973) conducted a study on "Time and motion study for the work of hand milking of cows and observed the time taken for each animal to be  $321.20 \pm 25.55$ ,  $319.88 \pm 15.39$  and  $276.68 \pm 16.04$  seconds for Red Sindhi, Sahiwal and Tarparkar breeds with milk yields of  $2.227 \pm 0.323$ ,  $2.287 \pm 0.13$  and  $1.775 \pm 0.159$  kgs per milking respectively. These workers also reported a significant correlation between total milking time and milk yield. Lesser the yield, more was the time required to milk a cow in terms of per kg of milk. He also observed that  $38.14 \pm 1.90$  seconds were taken for walking back to the balance and weighing the milk yield.

Shiralkar and Dave (1975) in their studies on "Time studies on milking of Kankrej cows" reported a mean actual milking time of 190.58 seconds for hand milking of cows. The results also revealed that the variations in time required for hand milking in different methods by different milkers were found to be significant ( $P < 0.01$ ) and the regression coefficient of actual milking time on daily milk yield was found to be 25.04 ( $P < 0.01$ ).

Soloviov *et al.* (1975) studied from the data of 135 Dutch Black - pied, 126 Russian Black - pied and 55 Esterian Black - pied cows and reported

significant correlation between milking rate and yield per milking as 0.33, 0.43 and 0.53 with milking rate and milking time as -0.61, -0.65 and -0.40. The correlation of milking time with yields per milking was found to be 0.40, 0.21 and 0.31 respectively.

Dash *et al.* (1976) carried out a study on milking behaviour of 191 murrah buffaloes and the investigation revealed that the average let down time, rate of milk flow and milking time were one minute and 46 seconds, 0.90 kg/minutes and 4 minutes and 19 seconds respectively. Let down time, milking time and rate of milk flow increased with increase in lactation number.

Baidikov (1977) revealed that the time requirements for milking under tie-up and cubicle loose- housing conditions to be 12.7 and 7.4 man-minutes for milking.

Repka (1978) through his study on the labour expenditure in milk production in 12 large dairy farms reported that the time spent on daily milking ranged from 4.05 minutes per cow in unilateral to 14.12 minutes per cow in parlour milking. For milking of one litre of milk time required was reported as 1.24 to 2.14 minutes (mean 1.68 minutes) in reconstructed farms and 0.67 – 3.1 minutes. (mean 1.49 minutes) in new farms.

Singh and Dave (1985) in their study on cross breed cows observed that the time taken by hand milking was  $6.70 \pm 0.25$  minutes per cow per milking, which included  $6.06 \pm 0.16$  minutes of milk flow time.

The investigation of Nanda *et al.* (1988) on 42 cross bred cows revealed that the time required for milking was  $7.6 \pm 0.7$  minutes per cow by a milker.

Devarajulu (1986) noticed that  $12.7 \pm 0.4$  seconds were spent for carrying milk to the balance and delivering into balance container. In time motion studies of some dairy farm operations carried out in a 100 cow farm by Davarajulu and Naidu (1989) observed that for milking a cow on an average 13.04 minutes per day ( $329 + 5.10$  seconds/milking) were required which constituted 30 per cent of total time.

Thomas *et al.* (1993) studied on "Prediction of cow milking time for milking parlour simulation models" and concluded that pulsation ratio, vacuum and milk yield per milking influenced individual milking time significantly. However, a prediction equation incorporating these factors was unsuitable for simulating milking time for milking parlour simulation models.

#### **2.1.5 Labour Productivity**

Ul' yanova (1981) through his study found that the labour input per 100 kg milk was 7.7 man hours on 271 complexes with 400 – 800 cattle and 95 per cent mechanisation but only 5.3 man hours on 129 complexes with 1200 – 1600 cattle and 97 per cent mechanisation.

### **2.1.6 Total Savings in Time and Labour Economy**

Rawat *et al.* (1973) conducted time and motion study on 100 cows and found that these could be a total time saving of 71 minutes everyday from the time spent by milkers in productive work. As per their studies saving of time was possible to the extent of 2.5 minutes in applying milk man rope, 24 minutes in wiping the udder, stimulation of udder and taking out first strips and 22 minutes if the weighing balance was positioned in inner side of the parlour.

### **2.1.7 Veterinary Aid and Artificial Insemination Services**

Nanda *et al.* (1988) conducted a study on labour requirement for management of crossbred cows and found that the time taken for veterinary aid and artificial insemination services was  $8.9 \pm 0.1$  minutes/cow/labourer in case of milch cows. Where as in dry cows it was only  $6.8 \pm 0.1$  minutes/cow/labourer.

## **2.2 FORAGE FARM OPERATIONS**

### **2.2.1 Tillage Operation**

Govardhan Reddy (1970) conducted an experiment on "Farm work studies and problems of labour management" at Agricultural Research Institute, Rajendranagar, Hyderabad and reported the time taken to till an area of one acre by different implements like Desi plough, Konkan plough and voltas puddler as 16.42, 14.48 and 3.36 hours respectively.

### **2.2.2 Preparation of Field Bed**

Govardhan Reddy (1970) investigated that the time required to prepare field bed of one acre with one man and one pair of bullocks as 84, 44 and 34 hours by using Desi plough + Buckner, M.B. plough + Pata and M.B. plough + Disc respectively.

### **2.2.3 Preparation of Seed Bed**

Govardhan Reddy (1970) through the study reported that the time required to prepare seed bed in puddled condition of one acre with one man and one pair of bullocks by using the combination of tillage implements like Desi plough + Jamboo, Konkan plough + Jamboo and M.B. plough + Puddler as 96, 60 and 37 hours respectively.

Govardhan Reddy (1970) while studying farm operations found that the average time spent in attendance and distribution of labour, taking implements from stores and implement shed, taking implements to work spot, adjusting the implements resting or idle while at work and clearing, arranging and returning the implements took 21.20, 12.16, 14.40, 10.00 and 4.16 minutes and seconds respectively.

### **2.2.4 Sowing of Crops**

Govardhan Reddy (1970) reported the average time spent for sowing of different crops as 1 hour 3 minutes and 16 seconds.

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*Materials*  
*and*  
*Methods*

## Chapter III

# MATERIALS AND METHODS

The investigation on time and motion studies on dairy farming operations was carried out at Dairy Experimental Station and Forage Production Farm, College of Veterinary Science, Rajendranagar, Hyderabad.

### 3.1 TIME SPENT FOR VARIOUS OPERATIONS AT DAIRY EXPERIMENTAL STATION AND FORAGE PRODUCTION FARM

#### 3.1.1 Dairy Experimental Station

The study was conducted for a period of 50 days during April and May months. During the study period the effective strength of the Dairy Experimental Station was 200 dairy animals of different categories which include 40 milch buffaloes, 10 pregnant animals, 44 dry animals, 54 heifers, 42 calves, 4 bulls and 6 working bullocks.

The dairy farm housing is organised into pen type barns and sheds. There are 3 sheds in total out of which milch animals were housed in one shed; pregnant animals and dry animals were housed in another shed and heifers, bulls and working bullocks were housed in the third shed. Calves were accommodated in pen type barn of housing system.

In total, 13 number of labourers were engaged daily on dairy farm for routine operations. These labourers were used to attend the works on dairy farm depending on the need and not by adhering to strict time schedule. These

labourers were engaged in all the managerial operations including milking, washing of animals, cleaning of the sheds, feeding, watering and other miscellaneous works connected with various categories of animals.

### **3.1.1.1 Dairy Farm Routine**

The milch animals were brought from paddock to milking barn between 3.30 and 4.00 A.M. and they were fed with concentrates between 4.00 and 4.30 A.M. After feeding of animals milking operation was carried out by 4 milkmen between 4.30 and 5.30 A.M. Milk was disposed off between 5.30 and 6.00 A.M. Cleaning of sheds of all categories of animals and disinfection of milking barn was done between 6.00 and 8.30 A.M. All categories of animals housed in sheds were supplied with green fodder between 8.30 and 10.30 A.M. Feeding of concentrate mixture to pregnant animals, dry animals, heifers, calves, bulls and bullocks was carried out between 10.30 A.M. and 12.30 P.M. The workers take rest cum lunch between 12.30 P.M. and 1.30 P.M. The workers prepare the concentrate mixture between 1.30 and 2.30 P.M. During this period miscellaneous works like assisting in treatment of sick animals, veterinary aid and Artificial Insemination services etc. were carried out. Washing of all categories of animals was done between 2.30 and 3.00 P.M. Milch animals were fed with concentrate mixture from 3.00 and 3.30 P.M. followed by milking between 3.30 to 4.30 P.M. The evening milk was disposed off and milking barn was cleaned and disinfected between 4.30 and 5.00 P.M. Cleaning of sheds of all categories of animals was carried out between 5.00 and 6.00 P.M. During 6.00 to 7.00 P.M. all categories of animals were supplied with dry fodder.

### **3.1.2 Forage Production Farm**

The forage production farm is spread over 52.20 ha of land and out of that 10 ha had irrigation facility utilizing the water supply from 6 bore wells and 3 open wells for cultivating the fodder crops. The remaining area is used as natural pasture for grazing of animals.

During the study period the important fodder crops cultivated in forage production farm included Jowar, maize, hybrid napier, paragrass and berseem.

The important forage farm operations observed during the study period included land preparation, sowing, fertilizer application, irrigation, harvesting and loading of fodder for different crops.

## **3.2 RECORDING OF DATA FOR DIFFERENT OPERATIONS**

### **3.2.1 Dairy Experimental Station**

The following dairy farm operations for different categories of animals were studied for a period of 50 days.

#### **3.2.1.1 Milking Operation**

Buffaloes were milked twice a day by a group of 4 milk men at 4.30 A.M. and 3.30 P.M. in the milking barn. Milch buffaloes were divided into 4 groups, each group comprising of 10 buffaloes and each milkman milked 10 buffaloes both in the morning and evening. The time taken for different components of milking operation was recorded for a period of 24 days. A total

of 480 observations i.e. 120 observations per one person were recorded during the study period.

Since milking operation is the major activity on dairy farm a detailed study of time spent on each subactivity of milking operation was studied. The subactivities include.

### **Bringing Calf From Calf Pen to Dam and Taking Back**

The time taken for bringing calf from calf pen to her dam in the milking barn and taking back to calf pen was recorded.

### **Calf Suckling**

This operation includes the time taken for the calf to suckle the milk from it's dam before milk let down.

### **Carrying the Empty Milk Pail From Milk Recording Room to Animal**

The time taken to carry the empty milk pail from milk recording room to the animal was recorded.

### **Washing the Udder and Wiping with Cloth**

The time taken for cleaning the udder of the animals with warm water and wiping with cloth was recorded.

### **Actual Milking Time Per Milking**

This operation includes the time required for complete milking of animal including stripping.

### **Time for Milk Handling Before Weighing**

It is the time taken for carrying the milk pail from the animal to the balance located in the centre of the milking barn and delivering milk into the weighing balance container.

### **Weighing the Milk and Recording**

It is the time taken to observe the reading of the weighing balance by the recorder, emptying the milk into a can and recording the milk yield of each animal in the specified register.

### **Total Milking Time Per Milking**

It is computed by summing up of the above sub activities of milking operation.

### **Milking Rate Per Milking**

It is the time taken for milking operation to produce one kg of milk. It is obtained by dividing the total time required for milking by number of kgs of milk obtained and expressed as seconds/kg milk obtained.

### **3.2.1.2 Washing the Animals**

This operation included the time taken for removing the neck chains of the animals, bringing the animals from different sheds / pens to water tank, cleaning the animals with water, to return the animals from water tank to sheds / pens and securing the animals with neck chains.

### **3.2.1.3 Cleaning the Shed**

This operation covers the time spent on removing the left over feed, sweeping the floor, removal of dung and cleaning the floor of the shed with water.

### **3.2.1.4 Feeding**

Feeding time was recorded as the time taken for loading the feed into the trolley, weighing the feed, transportation of feed, unloading of the feed and distribution of feed to various categories of animals in different sheds / pens. The time taken for soaking the concentrates and chaffing the green fodder were also included in the total feeding time.

### **3.2.1.5 Watering**

Time taken for watering the animals included the time taken for removing the neck chains of the animals, bringing the animals from different sheds / pens to water trough located in the centre of the dairy farm, for drinking the water, to return the animals from water trough to different sheds / pens and securing the animals with neck chains.

### **3.2.1.6 Miscellaneous Works**

It included the time taken for preparing the concentrate feed by mixing various ingredients, attending to sick animals, veterinary aid and Artificial Insemination services care of pregnant animals and exercise incase of bulls.

### **3.2.1.7 Total Working Time**

The time taken for washing the animals, cleaning the shed / pen, feeding, watering and miscellaneous works for milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was recorded. For milch animals time taken for milking operation was also included in the total working time.

### **3.2.1.8 Idle Time**

It is the labour time which was not utilized for any operation in daily routine of the dairy farm.

### **3.2.1.9 Total Time**

It is computed by addition of idle time to total working time.

## **3.2.2 Forage Production Farm**

### **3.2.2.1 Land preparation**

The time spent on land preparation for all the fodder crops was carried out with the help of farm tractors. It included primary tillage i.e. opening the soil, secondary tillage which was done to break the clods and

pulvarise the soil and finally prepare the land into either flat beds or ridges and furrows. Before the final land preparation the phosphatic and potassic fertilizers were broadcasted manually. The time taken for individual operations were recorded and pooled.

#### **3.2.2.2 Sowing**

All the fodder crops were sown manually. Jowar and maize were dibbled on either side of the ridge. Hybrid napier was planted using either rooted slips or stem cuttings. The preparation of these rooted slips or stem cuttings was a manual practice. Paragrass was planted into a wet puddled soil using stem cuttings. For berseem the seed was broadcasted manually into the thin film of standing water under puddled condition of the soil. The time requirement of each operation was recorded and summed up to arrive at total time.

#### **3.2.2.3 Fertilizer Application**

Top dressing of fertilizer in all the crops was done manually. Usually the fertilizer was broadcasted in the rows on the soil surface and was immediately followed by irrigation. The time required to bring the fertilizer from the store to the field and time utilized in application of fertilizer was recorded.

#### **3.2.2.4 Irrigation**

The land was irrigated by water from bore wells and open wells. The man hours spent on pumping of water to different fields and channeling of water was recorded.

### **3.2.2.5 Harvesting**

The forage crops were harvested at the appropriate stage manually with the help of sickles. The time consumed in cutting the crop was recorded.

### **3.2.2.6 Loading**

This operation included the time taken for baling the fodder into small bundles and loading into a rubber tyred bullock cart. The total time taken for the individual operations was recorded as the time for loading the fodder.

### **3.2.2.7 Total Time**

The total time was obtained by summing up of the time required for land preparation, sowing, fertilizer application, irrigation, harvesting and loading of different fodder crops.

## **3.3 STATISTICAL ANALYSIS**

The data obtained from the study was analysed by using the following statistical tools as per the procedures laid down by Snedecor and Cochran (1967).

1. Mean (X)
2. Standard Error (SE)
3. Coefficient of Variation (CV)
4. Analysis of variance (ANOVA)

# *Results*

## Chapter IV

# RESULTS

The information collected during the study on time and motion studies of operations of Dairy Experimental Station and Forage Production Farm was tabulated and analysed. The results are presented in this chapter.

### 4.1 TIME SPENT FOR VARIOUS OPERATIONS AT DAIRY EXPERIMENTAL STATION

#### 4.1.1 Milch Animals

The time spent for different operations on 40 milch animals is presented in Table 1. The time spent on milking operation was  $570.67 \pm 3.54$  man-minutes / day / 40 animals which is about 36.91 per cent of total time. For washing the animals, cleaning the shed, feeding and watering the animals  $245.00 \pm 3.40$ ,  $148.00 \pm 3.48$ ,  $332.67 \pm 2.06$  and  $77.00 \pm 2.64$  man-minutes for 40 milch animals were utilized respectively. This worked out to 15.84 per cent, 9.57 per cent, 21.52 per cent and 4.98 per cent of total time respectively. The time required for miscellaneous works was  $19.67 \pm 2.26$  man-minutes. The total working time which included all the above operations was  $1393.00 \pm 4.95$  man-minutes. The total time spent for 40 milch animals was  $1545.83 \pm 4.60$  man-minutes out of which  $152.83 \pm 3.57$  man-minutes were spent idle by workers without any work.

**Table 1: Time spent for different operations on 40 milch animals (man-minutes)**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Milking	570.67 $\pm$ 3.54	2.19	36.91
2.	Washing the animals	245.00 $\pm$ 3.40	4.72	15.84
3.	Cleaning the shed	148.00 $\pm$ 3.48	8.18	9.57
4.	Feeding	332.67 $\pm$ 2.06	1.27	21.52
5.	Watering	77.00 $\pm$ 2.64	9.04	4.98
6.	Miscellaneous works	19.67 $\pm$ 2.26	25.86	1.27
7.	Total working time	1393.00 $\pm$ 4.95	1.76	90.11
8.	Idle time	152.83 $\pm$ 3.57	8.33	9.89
9.	Total time	1545.83 $\pm$ 4.60	1.37	100.00

87  
88

On comparison of coefficient of variation (C.V.) (Table 1), it was observed that C.V was highest in case of miscellaneous operations while it was least in feeding time. The C.V. was also lower in case of milking operation.

#### **4.1.1.1 Milking Operation**

Milking operation consumed major share of the time spent on milch buffaloes. Hence it is felt appropriate to study in detail the time spent for various sub-activities of milking operation.

##### **Bringing Calf From Calf Pen to Dam and Taking Back**

The average time taken to bring the calf from calf pen to dam and taking back is presented in Table 2. was ranged from  $48.67 \pm 2.56$  to  $58.00 \pm 4.00$  seconds.

The anova of time taken to bring the calf from calf pen to dam and taking back is presented in Table 3. The time taken to bring the calf from calf pen to dam and taking back to calf pen was not significantly different between persons, sessions, animals and between persons into sessions interaction, sessions into animals interaction, persons into animals interaction and persons into sessions into animals interaction .

##### **Calf Suckling**

The average time taken for calf suckling is presented in Table 4 and was ranged from  $40.33 \pm 2.98$  to  $50.83 \pm 7.01$  seconds.

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**Table 2: Average time taken for bringing calf from calf pen to dam and taking back (seconds)**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	49.67±5.56	53.83±2.67	50.00±2.89	51.83±3.67	55.67±4.71	49.83±3.02	50.00±2.89	55.67±4.71	48.67±2.56	53.00±3.92
	Evening	51.83±3.67	55.67±4.71	49.83±3.02	50.00±2.89	55.67±4.71	48.83±2.79	53.00±3.92	53.17±3.80	53.50±2.63	50.00±2.89
2	Morning	54.83±4.52	54.33±4.64	58.00±4.00	53.67±3.94	50.33±4.75	53.83±4.06	51.50±4.75	53.67±2.69	53.83±3.34	55.33±4.99
	Evening	53.67±6.10	51.67±4.71	53.33±6.10	53.50±3.77	53.83±3.24	50.50±3.59	50.83±4.30	53.50±4.35	54.00±5.26	52.67±4.89
3	Morning	52.50±3.64	54.00±3.70	50.67±5.19	54.50±4.11	55.33±4.07	52.83±5.58	54.50±4.96	51.67±3.54	50.83±3.02	54.83±4.60
	Evening	50.00±2.89	53.17±3.80	54.00±2.94	53.00±3.92	48.83±2.79	52.67±4.35	55.67±4.71	49.83±3.02	50.00±2.89	55.83±4.60
4	Morning	51.83±3.67	55.67±4.71	49.83±3.02	50.00±2.89	55.67±4.71	51.00±4.62	53.00±3.92	53.17±3.80	57.50±3.91	54.17±4.91
	Evening	51.83±3.67	54.17±4.91	57.50±3.91	55.67±4.71	53.17±3.80	49.83±3.02	53.00±3.92	50.00±2.89	50.17±3.62	53.67±4.85

Mean±Standard Error

**Table 3: ANOVA of time taken for bringing calf from calf pen to dam and taking back.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	41.2194NS
2.	Sessions	1	2.7250NS
3.	Animals	9	29.1064NS
4.	Persons x sessions	3	23.4472NS
5.	Sessions x animals	9	28.4935NS
6.	Persons x animals	27	23.1793NS
7.	Persons x sessions x animals	27	38.2157NS
8.	Error	400	19.5505

NS : Not significant.

**Table 4: Average time taken for calf suckling (seconds)**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	43.33±2.69	47.00±6.93	47.33±4.82	43.17±2.11	45.33±5.37	49.67±6.80	45.50±5.06	44.67±5.37	43.50±4.50	42.33±5.99
	Evening	46.17±3.39	45.33±6.29	44.50±7.32	41.50±3.10	44.33±5.37	42.00±3.51	42.50±3.59	44.17±3.39	45.00±5.26	46.50±7.85
2	Morning	44.33±2.69	47.67±6.97	48.00±4.76	44.17±2.11	45.83±5.76	50.83±7.01	47.33±6.32	45.50±5.85	44.50±4.50	43.50±6.29
	Evening	45.00±4.40	44.67±4.61	48.67±4.57	45.83±6.20	42.50±5.53	50.00±5.94	46.67±2.43	48.00±6.23	49.00±6.83	42.33±4.78
3	Morning	43.33±3.82	47.83±5.15	47.50±6.16	42.17±2.11	44.50±5.62	48.67±6.80	44.50±5.06	42.00±3.96	44.50±5.44	41.33±5.99
	Evening	45.17±3.39	44.33±6.29	43.50±7.32	40.33±2.98	43.33±5.37	41.00±3.51	41.50±3.59	43.17±3.39	44.00±5.26	45.50±7.85
4	Morning	43.30±2.69	46.67±6.97	47.00±4.76	43.17±2.11	45.00±5.80	48.50±8.10	47.50±5.44	44.50±5.85	43.83±5.01	42.50±6.29
	Evening	44.00±4.40	44.00±4.28	47.67±4.57	44.83±6.20	41.50±5.53	49.00±5.94	45.67±2.43	47.00±6.22	48.00±6.83	40.83±4.30

Mean±Standard Error

**Table 5: ANOVA of time taken calf suckling.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	110.4458**
2.	Sessions	1	94.4708**
3.	Animals	9	99.0578**
4.	Persons x sessions	3	1.5541NS
5.	Sessions x animals	9	1.4013NS
6.	Persons x animals	27	49.3949NS
7.	Persons x sessions x animals	27	1.1050NS
8.	Error	400	33.1537

\*\* Significant at P<0.01 :: NS - Not significant

The analysis of variance of time taken for calf suckling is presented in Table 5. The time taken for calf suckling was significantly different ( $P<0.01$ ) between persons, sessions and animals and not significantly different between persons into sessions interaction, sessions into animals interaction, persons into animals interaction and persons into sessions into animals interaction.

### **Carrying the Empty Milk Pail From Milk Recording Room to Animal**

The time taken for carrying the empty milk pail from milk recording room to animal is presented in Table 6. The time taken to carry the empty milk pail from milk recording room to animal ranged from  $6.17\pm 1.34$  to  $12.67\pm 0.75$  seconds.

The analysis of variance of time taken for carrying the empty milk pail from milk recording room to animal is presented in Table 7. This time was significantly different ( $P<0.01$ ) between persons, sessions and animals and between persons into animals interaction. However, it was not significantly different between persons into sessions interaction, sessions into animals interaction and persons into sessions into animals interaction.

### **Washing the Udder and Wiping with Cloth**

The time taken for washing the udder and wiping with cloth is presented in Table 8. The time taken to wash the udder and wipe with cloth ranged from  $53.50\pm 5.50$  to  $78.00\pm 5.23$  seconds.

**Table 6: Average time taken for carrying the empty milk pail from milk recording room to animal (seconds).**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	7.50±1.71	8.67±1.11	7.17±1.34	9.50±0.76	8.17±0.90	7.67±0.94	9.17±1.07	9.17±1.07	9.50±0.96	8.83±1.34
	Evening	8.83±1.95	9.00±1.00	8.17±0.69	10.00±0.00	9.67±1.49	8.00±0.58	10.33±0.75	9.83±0.69	9.33±0.47	9.50±1.12
2	Morning	11.33±0.75	10.33±0.94	11.67±1.60	12.67±0.75	11.67±1.49	10.83±1.21	12.00±1.29	11.50±1.61	11.33±1.49	10.33±1.49
	Evening	11.00±1.00	10.17±0.90	11.67±1.25	12.17±0.90	9.17±1.57	10.83±0.69	11.50±1.26	12.33±1.37	10.50±1.50	10.50±1.26
3	Morning	6.50±1.71	7.67±1.11	6.17±1.34	8.50±0.76	7.17±0.90	6.67±0.94	8.17±1.07	8.17±1.07	8.50±0.96	8.17±1.07
	Evening	7.83±1.95	8.00±1.00	7.17±0.69	9.00±0.00	8.67±1.49	7.33±0.47	9.33±0.75	8.83±0.69	8.33±0.47	8.50±1.12
4	Morning	10.33±0.75	9.33±0.94	10.67±1.60	11.67±0.75	10.67±1.49	9.83±1.21	11.00±1.29	10.50±1.61	10.33±1.49	9.33±1.49
	Evening	10.00±1.00	9.17±0.90	10.67±1.25	11.17±0.90	8.17±1.57	9.83±0.69	10.50±1.26	11.33±1.37	9.50±1.50	9.50±1.26

Mean ± Standard Error

**Table 7 ANOVA of time taken for carrying the empty milk pail from milk recording room to animal.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	217.6973**
2.	Sessions	1	116.0338**
3.	Animals	9	17.1009**
4.	Persons x sessions	3	0.0109NS
5.	Sessions x animals	9	0.0147NS
6.	Persons x animals	27	5.2959**
7.	Persons x sessions x animals	27	0.0173NS
8.	Error	400	1.5902

\*\* Significant at P<0.01 :: NS - Not significant

**Table 8: Average time taken for washing the udder and wiping with cloth (seconds)**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	66.67±5.53	71.17±3.85	60.33±5.79	73.17±6.77	72.33±8.46	68.17±6.18	67.33±8.69	72.33±7.95	72.33±6.94	69.00±8.58
	Evening	66.17±5.70	78.00±5.23	72.17±7.20	72.50±8.85	73.17±10.67	73.00±8.52	75.00±6.98	70.33±4.07	73.33±9.46	72.33±5.88
2	Morning	68.83±5.34	62.50±5.80	76.17±3.85	71.33±6.47	72.00±8.52	74.00±7.39	72.33±8.28	72.83±6.79	70.00±9.04	76.50±8.08
	Evening	75.17±6.84	65.83±8.09	70.33±8.79	75.50±5.50	71.00±8.89	72.83±8.93	68.67±7.70	67.33±8.84	67.50±5.12	71.50±3.99
3	Morning	60.00±6.35	69.00±4.32	56.50±4.43	68.17±6.69	67.17±8.69	63.33±6.02	62.67±8.46	67.33±7.97	67.50±7.34	65.67±7.43
	Evening	66.67±7.43	68.50±7.34	68.33±7.97	63.67±8.46	64.33±6.02	67.17±9.63	67.17±6.31	62.67±9.10	60.33±7.41	67.33±4.64
4	Morning	60.67±5.53	68.17±3.85	54.50±5.50	67.17±6.77	67.17±9.19	62.17±4.74	61.33±8.69	66.33±7.78	66.50±7.04	63.33±8.34
	Evening	59.50±5.74	67.17±3.85	53.50±5.50	66.17±6.77	66.17±9.19	61.17±4.74	60.33±8.56	65.33±7.43	67.00±7.37	60.83±7.13

Mean±Standard Error

**Table 9: ANOVA of time taken for washing the udder and wiping with cloth.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	135.5277NS
2.	Sessions	1	5713.2500**
3.	Animals	9	152.1759**
4.	Persons x sessions	3	61.4055NS
5.	Sessions x animals	9	76.6388NS
6.	Persons x animals	27	73.8796NS
7.	Persons x sessions x animals	27	79.8314NS
8.	Error	400	53.4265

\*\* Significant at P<0.01 :: NS - Not significant

The time taken for washing the udder and wiping with cloth was significantly different ( $P < 0.01$ ) between sessions and animals but not significantly different between persons, persons into sessions interaction, sessions into animals interaction, persons into animals interaction and persons into sessions into animals interaction (Table 9).

### **Actual Milking Time Per Milking**

The overall milking time per milking per animal is presented in Table 10 and this time ranged between  $182.67 \pm 12.01$  and  $297.83 \pm 15.23$  seconds.

The analysis of variance of time taken for milking Table 11 indicated that the average milking time was significantly different among persons, sessions, animals, between persons into sessions interaction and sessions into animals interaction at 1 per cent level and between persons into animals interaction at 5 per cent level but not significantly different between persons into sessions into animals interaction.

### **Milk Handling Before Weighing**

The time taken for carrying milk from the animal to the balance and delivering the milk into the weighing balance container is presented in Table 12. This time ranged from  $9.67 \pm 0.47$  to  $13.67 \pm 0.94$  seconds.

On analysis it was observed that the time taken for carrying milk from the animal to the balance and delivering the milk into the weighing balance container was significantly different ( $P < 0.01$ ) between persons, animals and between persons into animals interaction but not significantly different between

**Table 10: Average time taken for milking (actual milking time per milking) (seconds).**

Person	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	239.50±11.76	229.00±19.69	226.67±19.67	232.67±19.32	225.83±21.65	224.50±14.10	227.17±18.00	239.17±19.96	236.67±20.62	218.83±18.35
	Evening	277.50±10.77	266.67±14.69	265.50±15.39	262.33±16.78	272.00±15.25	271.17±5.70	267.00±5.54	263.67±4.03	262.67±6.05	271.50±6.02
2	Morning	293.17±12.32	288.17±12.80	290.67±6.42	289.33±15.24	281.67±12.71	289.17±15.81	292.83±13.87	286.00±15.60	297.83±15.23	274.67±10.96
	Evening	276.17±15.70	259.50±5.53	291.17±14.30	277.00±17.57	275.83±6.84	271.83±10.25	289.17±10.54	279.50±18.80	275.17±14.56	269.67±14.76
3	Morning	198.50±15.06	188.33±3.30	226.33±6.87	194.00±17.94	206.50±10.66	188.83±15.77	208.67±16.20	205.67±22.78	210.67±16.87	192.50±20.35
	Evening	198.50±14.89	194.50±9.11	222.00±18.40	199.50±16.70	214.00±9.73	205.67±13.78	204.67±15.52	208.67±23.40	219.67±15.07	182.67±12.01
4	Morning	190.83±12.25	196.83±8.91	229.33±21.52	207.83±9.81	221.33±12.67	211.33±9.81	207.00±16.77	226.67±17.90	208.00±16.48	200.67±20.06
	Evening	185.67±3.94	197.67±3.94	243.67±3.94	203.67±3.94	231.67±3.94	211.33±6.34	213.67±17.58	236.67±3.94	203.67±11.06	218.33±12.45

Mean±Standard Error

**Table 11: ANOVA of time taken for milking (actual milking time per milking).**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	26489.8671**
2.	Sessions	1	401191.1875**
3.	Animals	9	2235.4072**
4.	Persons x sessions	3	13549.9599**
5.	Sessions x animals	9	1585.5717**
6.	Persons x animals	27	364.2370*
7.	Persons x sessions x animals	27	305.8069NS
8.	Error	400	234.2992

\*\* Significant at P<0.01 :: \* Significant at P<0.05 :: NS - Not significant

**Table 12: Average time taken for milk handling before weighing (seconds).**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	11.00±0.82	10.17±0.37	9.83±0.37	10.83±0.37	9.83±0.37	9.67±0.47	10.17±1.07	10.17±1.07	10.33±0.74	10.83±0.37
	Evening	11.00±0.58	10.17±0.37	9.83±0.37	11.00±0.00	11.00±1.00	9.67±0.47	11.50±0.76	10.67±0.47	10.17±0.37	10.83±0.37
2	Morning	12.33±0.75	11.33±1.14	12.92±1.69	13.67±0.94	13.25±1.52	12.25±1.15	13.58±1.02	13.08±1.72	12.42±1.43	12.50±1.61
	Evening	12.17±0.90	11.08±0.89	12.83±1.34	13.17±0.90	11.42±1.62	11.33±0.47	13.33±1.11	13.67±0.90	11.67±0.90	11.67±1.11
3	Morning	10.00±0.82	10.17±0.37	9.83±0.37	10.83±0.37	9.83±0.37	9.67±0.47	10.17±1.07	10.17±1.07	10.33±0.94	10.83±0.37
	Evening	11.00±0.58	10.17±0.37	9.83±0.37	11.00±0.00	11.00±1.00	9.67±0.47	11.50±0.76	10.67±0.47	10.17±0.37	10.83±0.37
4	Morning	12.33±0.75	11.33±1.14	12.92±1.69	13.67±0.94	13.25±1.52	12.25±1.15	13.58±1.02	13.08±1.72	12.42±1.43	12.50±1.61
	Evening	12.17±0.90	11.08±0.89	12.83±1.34	13.17±0.90	11.42±1.62	11.33±0.47	13.33±1.11	13.67±0.90	11.67±0.90	11.67±1.11

Mean±Standard Error

**Table 13: ANOVA of time taken for milk handling before weighing.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	184.6001**
2.	Sessions	1	0.0005NS
3.	Animals	9	12.8417**
4.	Persons x sessions	3	0.0001NS
5.	Sessions x animals	9	0.00005NS
6.	Persons x animals	27	3.3021**
7.	Persons x sessions x animals	27	0.00002NS
8.	Error	400	1.0479

\*\* Significant at P<0.01 :: NS - Not significant

sessions, persons into sessions interaction, sessions into animals interaction and persons into sessions into animals interaction (Table 13).

### **Weighing the Milk and Recording**

The time taken for weighing the milk and recording is presented in Table 14 and ranged from  $3.50 \pm 0.50$  to  $6.00 \pm 1.15$  seconds.

The analysis of variance of time taken for weighing the milk and recording is presented in Table 15 and this time was significantly different ( $P < 0.01$ ) between sessions and animals but not significantly different between persons, persons into sessions interaction, sessions into animals interaction, persons into animals interaction and persons into sessions into animals interaction.

### **Total Milking Time Per Milking**

The average total milking time per milking is presented in Table 16 and it ranged from  $366.67 \pm 10.27$  to  $501.75 \pm 10.52$  seconds per animal.

The analysis of variance of total milking time per milking is presented in Table 17. The total milking time was significantly different among persons, sessions, animals, between persons into sessions interaction and sessions into animals interaction at 1 per cent level and between persons into animals interaction at 5 per cent level but not significantly different between persons into sessions into animals interaction.

**Table 14: Average time taken for weighing the milk and recording (seconds)**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	5.00±0.58	4.67±0.75	4.33±1.11	5.50±1.50	5.00±1.00	4.33±1.11	5.67±0.75	5.17±1.34	4.67±0.94	5.17±1.07
	Evening	4.00±0.82	6.00±0.82	5.00±0.58	5.83±0.69	5.50±0.96	4.50±0.96	5.67±1.11	5.33±0.47	6.00±0.82	5.17±0.69
2	Morning	5.00±0.58	4.67±0.75	4.33±1.11	6.00±1.15	5.00±1.00	4.33±1.11	5.67±0.75	5.17±1.34	4.67±0.94	5.17±1.07
	Evening	4.00±0.82	6.00±0.82	5.00±0.58	5.83±0.69	5.50±0.96	4.50±0.96	5.67±1.11	5.33±0.47	6.00±0.82	5.17±0.69
3	Morning	4.50±0.50	4.00±0.58	3.83±0.69	4.83±1.07	4.50±0.76	4.00±0.82	4.67±0.75	4.33±1.11	4.00±0.58	4.50±0.96
	Evening	3.50±0.50	5.00±0.82	4.00±0.58	4.83±0.69	4.50±0.96	3.83±0.69	4.67±1.11	5.00±0.82	4.33±0.47	4.67±1.25
4	Morning	4.50±0.50	4.00±0.58	3.83±0.69	4.83±1.07	4.50±0.76	4.00±0.82	4.67±0.75	4.33±1.11	4.00±0.58	4.50±0.96
	Evening	3.50±0.50	5.00±0.82	4.00±0.58	4.83±0.69	4.50±0.96	3.83±0.69	4.67±1.11	5.00±0.82	4.33±0.47	4.67±1.25

Mean±Standard Error

**Table 15: ANOVA of time taken for weighing the milk and recording.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	1.9632NS
2.	Sessions	1	69.7689**
3.	Animals	9	7.4261**
4.	Persons x sessions	3	0.4464NS
5.	Sessions x animals	9	0.6205NS
6.	Persons x animals	27	1.3397NS
7.	Persons x sessions x animals	27	0.1872NS
8.	Error	400	0.8792

\*\* Significant at P<0.01 :: NS - Not significant

Table 16: Average total milking time per milking (seconds).

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	421.67±11.44	427.50±17.77	405.67±28.72	426.67±24.38	422.17±30.08	413.83±19.51	415.00±15.60	436.33±22.03	425.67±22.26	408.00±16.01
	Evening	465.50±9.64	470.83±13.23	455.00±12.27	453.17±19.19	471.33±14.85	457.17±9.81	465.00±15.03	457.17±5.08	460.00±14.94	465.83±13.33
2	Morning	489.83±12.18	479.00±12.95	501.75±10.52	490.83±22.30	479.75±25.00	495.25±14.98	495.25±18.31	487.75±18.35	494.58±12.21	478.00±15.51
	Evening	477.17±13.06	448.92±9.44	493.00±15.75	483.00±17.44	469.25±7.13	474.83±10.70	485.83±11.58	479.67±20.14	473.83±20.39	463.50±20.76
3	Morning	375.33±14.67	381.00±6.83	400.83±11.11	383.00±18.71	395.00±14.27	374.00±17.35	393.33±21.94	389.33±21.75	396.33±16.58	377.83±25.04
	Evening	382.67±15.01	383.67±11.79	408.83±24.71	381.33±17.11	394.67±12.30	387.33±16.11	394.50±16.50	388.83±18.00	396.83±19.39	375.33±18.61
4	Morning	373.83±15.37	392.00±9.38	408.08±30.10	398.33±14.56	417.58±14.16	399.08±12.23	398.08±16.37	418.58±16.67	402.58±18.15	387.00±33.63
	Evening	366.67±10.27	388.25±3.09	429.83±14.02	399.50±10.11	416.58±9.97	396.33±14.08	401.17±15.06	429.00±10.48	394.33±17.15	399.50±15.69

Mean±Standard Error

Table 17: ANOVA of total milking time per milking.

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	39479.2890**
2.	Sessions	1	541964.2500**
3.	Animals	9	2195.8518**
4.	Persons x sessions	3	16928.8945**
5.	Sessions x animals	9	1326.6390**
6.	Persons x animals	27	526.3999*
7.	Persons x sessions x animals	27	460.5425NS
8.	Error	400	335.6572

\*\* Significant at P<0.01 :: \* Significant at P<0.05 :: NS - Not significant

### **Milk Yield Per Milking**

The average milk yield per milking is presented in Table 18 and ranged between  $2.93 \pm 0.05$  and  $4.75 \pm 0.05$  Kgs. This data was utilized in arriving at milking rate for individual animal.

### **Milking Rate Per Milking**

The average milking rate per milking (i.e. the time taken per obtaining one kg milk from each animal) is presented in Table 19 and it ranged from  $101.29 \pm 3.16$  to  $141.87 \pm 4.47$  seconds/kg.

The average milking rate per milking was significantly different ( $P < 0.01$ ) among persons, animals, between persons into sessions interactions, sessions into animals interaction and persons into animals interaction but not significantly different among sessions and between persons into sessions into animals (Table 20).

#### **4.1.2 Pregnant Animals**

The time spent for different operations on ten pregnant animals is presented in Table 21. The time required for washing ten pregnant animals, cleaning the shed, feeding, watering and miscellaneous works was  $345.17 \pm 2.77$ ,  $39.50 \pm 2.29$ ,  $40.17 \pm 2.42$ ,  $18.67 \pm 1.74$  and  $118.17 \pm 3.07$  man minutes which constituted 16.72 per cent, 14.62 per cent, 14.87 per cent, 6.91 per cent and 43.76 per cent of total time with coefficient of variation of 17.00 per cent, 13.28 per cent, 14.55 per cent, 16.13 per cent and 7.96 per cent respectively. The total time required for 10 pregnant animals was  $270.00 \pm 3.30$  man-minutes

Table 18: Average milk yields per milking (kg).

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	3.48±0.11	3.67±0.11	3.58±0.11	3.48±0.11	4.13±0.09	3.57±0.11	3.50±0.12	3.92±0.09	3.60±0.10	3.78±0.11
	Evening	3.28±0.09	3.55±0.05	3.42±0.04	3.32±0.04	4.00±0.15	3.45±0.05	3.35±0.05	3.83±0.05	3.42±0.04	3.58±0.09
2	Morning	4.48±0.11	4.35±0.05	4.58±0.04	4.30±0.06	4.68±0.04	4.45±0.05	4.75±0.05	4.20±0.06	4.28±0.04	4.72±0.07
	Evening	4.17±0.05	4.22±0.04	4.37±0.19	4.20±0.00	4.53±0.07	4.27±0.05	4.57±0.05	4.10±0.00	4.20±0.00	4.50±0.00
3	Morning	2.93±0.05	3.22±0.04	3.22±0.04	3.10±0.00	3.50±0.14	3.28±0.09	3.10±0.00	3.57±0.05	3.20±0.00	3.20±0.00
	Evening	3.15±0.05	3.47±0.05	3.38±0.04	3.28±0.04	3.77±0.05	3.43±0.05	3.32±0.04	3.78±0.04	3.47±0.07	3.45±0.05
4	Morning	3.02±0.11	3.18±0.07	3.25±0.10	3.10±0.06	3.50±0.18	3.30±0.14	3.18±0.13	3.57±0.09	3.20±0.06	3.20±0.06
	Evening	3.48±0.11	3.60±0.06	3.48±0.04	3.52±0.11	4.12±0.16	3.55±0.05	3.48±0.04	3.95±0.10	3.60±0.06	3.77±0.12

Mean ± Standard Error

**Table 19: Average milking rate per milking (seconds)**

Persons	Sessions	Animals									
		1	2	3	4	5	6	7	8	9	10
1	Morning	121.10±3.02	116.74±6.66	113.28±8.35	122.63±8.52	102.20±7.70	116.13±6.42	118.75±6.85	111.52±7.07	118.31±6.69	108.02±6.88
	Evening	141.87±4.47	132.66±4.44	133.16±2.80	136.63±5.40	117.95±4.47	132.52±2.22	138.88±6.14	119.26±0.87	134.67±5.04	130.06±4.24
2	Morning	109.30±3.26	110.11±2.74	109.48±2.61	114.23±6.62	102.42±4.95	111.32±4.05	104.27±3.85	116.18±5.26	115.49±3.47	101.38±4.02
	Evening	114.52±2.84	106.46±1.98	113.17±7.05	115.00±4.15	103.52±1.41	111.31±3.24	106.41±3.09	116.99±4.91	112.82±4.86	103.00±4.61
3	Morning	127.94±4.25	118.46±2.21	124.61±3.23	123.55±6.03	112.96±4.27	113.89±3.77	126.88±7.08	109.18±6.29	123.86±5.18	118.07±7.83
	Evening	121.53±5.50	110.73±4.63	120.86±7.45	116.15±5.14	104.82±4.20	112.87±5.48	119.00±5.91	102.77±4.47	114.50±5.70	108.83±5.93
4	Morning	123.96±4.06	123.23±4.85	125.63±9.57	128.54±5.23	119.70±8.41	121.30±8.56	125.26±7.29	117.42±5.10	125.86±6.34	121.12±12.25
	Evening	105.30±2.61	107.87±1.77	123.38±3.25	113.74±5.33	101.29±3.16	111.69±4.91	115.14±3.47	108.63±2.23	109.57±5.09	105.92±3.17

Mean±Standard Error

**Table 20: ANOVA of milking rate.**

S.No.	Source of variation	d.f.	Mean Sum of Squares
1.	Persons	3	3007.4111**
2.	Sessions	1	6.5666NS
3.	Animals	9	945.1666**
4.	Persons x sessions	3	5605.3886**
5.	Sessions x animals	9	189.3222**
6.	Persons x animals	27	141.9913**
7.	Persons x sessions x animals	27	48.3148NS
8.	Error	400	32.7099

\*\* Significant at P<0.01 :: NS - Not significant

**Table 21: Time spent for different operations on 10 pregnant animals (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	45.17 $\pm$ 2.77	17.00	16.72
2	Cleaning the shed	39.50 $\pm$ 2.29	13.28	14.62
3	Feeding	40.17 $\pm$ 2.42	14.55	14.87
4	Watering	18.67 $\pm$ 1.74	16.13	6.91
5	Miscellaneous works	118.17 $\pm$ 3.07	7.96	43.76
6	Total working time	261.67 $\pm$ 3.08	3.63	96.91
7	Idle time	8.33 $\pm$ 1.61	30.98	3.09
8	Total time	270.00 $\pm$ 3.30	4.04	100.00

SE : Standard Error

CV: Coefficient of variation

which included  $261.67 \pm 3.08$  and  $8.33 \pm 1.61$  man-minutes of total working time and idle time respectively.

It was observed that highest coefficient of variation (30.98%) was noticed in idle time and lowest in total working time (3.63%). About 96.91 per cent of total time was utilized for total working time.

#### 4.1.3 Dry Animals

The time spent for different operations on 44 dry animals is presented in Table 22. The time required for washing the animals, cleaning the shed, feeding and watering the animals was  $214.00 \pm 3.22$ ,  $170.50 \pm 3.11$ ,  $164.67 \pm 3.05$  and  $81.17 \pm 2.81$  man-minutes/day/44 dry animals which comprised 27.17 per cent, 21.65 per cent, 20.91 per cent and 10.30 per cent of total time respectively. For miscellaneous works  $65.00 \pm 2.11$  man-minutes/day/44 dry animals was spent. The total time taken for various operations was  $787.50 \pm 4.38$  man-minutes/day, out of which the total working time and idle time was  $695.33 \pm 3.78$  and  $92.17 \pm 4.05$  man-minutes/day per 44 dry animals.

The coefficient of variations was observed to be highest (17.77%) in case of idle time and lowest (2.06%) in total working time.

#### 4.1.4 Heifers

The time spent for various operations on 54 heifers is presented in Table 23. The workers took  $260.17 \pm 2.59$ ,  $215.67 \pm 2.56$ ,  $205.17 \pm 2.23$  and  $102.00 \pm 2.83$  man-minutes/day which worked about 23.97 per cent, 19.87 per

**Table 22: Time spent for different operations on 44 dry animals (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	214.00 $\pm$ 3.22	4.84	27.17
2	Cleaning the shed	170.50 $\pm$ 3.11	5.67	21.65
3	Feeding	164.67 $\pm$ 3.05	5.67	20.91
4	Watering	81.17 $\pm$ 2.81	9.75	10.30
5	Miscellaneous works	65.00 $\pm$ 2.11	6.88	8.25
6	Total working time	695.33 $\pm$ 3.78	2.06	88.30
7	Idle time	92.17 $\pm$ 4.05	17.71	11.70
8	Total time	787.50 $\pm$ 4.38	2.43	100.00

SE : Standard Error

CV: Coefficient of variation

**Table 23. Time spent for different operations on 54 heifers (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	260.17 $\pm$ 2.59	2.58	23.93
2	Cleaning the shed	215.67 $\pm$ 2.56	3.03	19.84
3	Feeding	205.17 $\pm$ 2.23	2.42	18.87
4	Watering	102.00 $\pm$ 2.83	7.87	9.38
5	Miscellaneous works	66.00 $\pm$ 2.50	9.49	6.07
6	Total working time	849.00 $\pm$ 3.71	1.62	78.10
7	Idle time	236.17 $\pm$ 4.28	7.75	21.72
8	Total time	1085.17 $\pm$ 2.71	0.68	100.00

SE : Standard Error

CV: Coefficient of variation

cent, 18.90 per cent and 9.39 of the total time respectively. The time spent on miscellaneous works was  $66.00 \pm 2.50$  man-minutes/day for 54 heifers. The total working time required for various operations was  $489.00 \pm 3.714$  man-minutes/day which was about 78.24 per cent of total time. The total time spent for 54 heifers was  $1085.17 \pm 2.71$  man-minutes per day out of which  $236.17 \pm 4.28$  man-minutes were observed as idle time which accounted for 21.76 per cent of total time.

The coefficient of variation was lowest (0.68%) for total time spent on various operations of 54 heifers and the same was higher (9.49%) for miscellaneous works.

#### 4.1.5 Calves

The time spent for various operations on 42 calves on dairy farm is presented in Table 24. The total working time required for various operations for 42 calves was  $464.17 \pm 6.04$  man-minutes/day. The time spent on washing the calves was  $160.83 \pm 3.08$  man-minutes/day where as it took  $123.83 \pm 2.13$ ,  $120.00 \pm 2.75$  and  $55.17 \pm 2.65$  man-minutes/day for cleaning the pen, feeding and watering the calves which accounted 32.81 per cent, 25.26 per cent and 11.25 per cent of total time respectively. The workers spent  $12.00 \pm 1.97$  man-minutes per day for miscellaneous works. The total time required for various operations was  $490.17 \pm 6.42$  man-minutes per day out of which  $26.00 \pm 3.06$  man-minutes per day was idle time without any work.

On comparison of coefficient of variations it was observed that lowest coefficient of variation (3.66%) was seen in case of time spent on cleaning of 42

**Table 24: Time spent for different operations on 42 calves (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	160.83 $\pm$ 3.08	5.92	32.81
2.	Cleaning the pen	123.83 $\pm$ 2.13	3.66	25.26
3.	Feeding	120.00 $\pm$ 2.75	6.30	24.48
4.	Watering	55.17 $\pm$ 2.65	12.74	11.25
5.	Miscellaneous works	12.00 $\pm$ 1.97	32.49	2.45
6.	Total working time	464.17 $\pm$ 6.04	7.85	94.70
7.	Idle time	26.00 $\pm$ 3.06	36.08	5.30
8.	Total time	490.17 $\pm$ 6.42	8.42	100.00

SE : Standard Error

CV: Coefficient of variation

calf pens and highest coefficient of variation (32.49%) was seen among miscellaneous works.

#### 4.1.6 Bulls

The time spent for various operations on four bulls is presented in Table 25. For washing the four bulls, cleaning of the shed, feeding and watering the bulls,  $22.00 \pm 2.02$ ,  $17.00 \pm 1.85$ ,  $15.50 \pm 1.81$  and  $10.00 \pm 1.97$  man-minutes were required. This is 16.68 per cent, 12.89 per cent, 11.75 per cent, and 7.58 per cent of total time for the above operations respectively. About  $45.83 \pm 2.61$  man-minutes were spent for miscellaneous works per day for four bulls. The total time spent on different works of four bulls was  $131.83 \pm 2.38$  man-minutes which included  $110.33 \pm 3.49$  and  $21.50 \pm 2.72$  man-minutes of total working time and idle time per day respectively.

Highest variation was observed in the time spent on watering of bulls where as least variation was noticed in total working time.

#### 4.1.7 Bullocks

The time spent for various operations on six bullocks is presented in Table 26. The time required for washing six bullocks, cleaning the shed, feeding and watering was  $25.00 \pm 2.14$ ,  $23.00 \pm 2.26$ ,  $38.00 \pm 1.80$  and  $13.33 \pm 1.87$  man-minutes per day which worked out to 18.47 per cent, 16.99 per cent, 28.08 per cent and 9.85 per cent of total time respectively. For miscellaneous works  $7.83 \pm 1.39$  man-minutes were utilised per day. For various operations of six bullocks  $135.33 \pm 1.94$  man-minutes were spent per day

**Table 25: Time spent for different operations on 4 bulls (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	22.0 $\pm$ 2.02	18.63	16.68
2	Cleaning the shed	17.0 $\pm$ 1.85	20.03	12.89
3	Feeding	15.50 $\pm$ 1.81	21.10	11.75
4	Watering	10.0 $\pm$ 1.97	38.99	7.58
5	Miscellaneous works	45.83 $\pm$ 2.61	14.82	34.76
6	Total working time	110.33 $\pm$ 3.49	11.05	83.69
7	Idle time	21.50 $\pm$ 2.72	34.53	16.31
8	Total time	131.83 $\pm$ 2.38	4.30	100.00

SE : Standard Error

CV: Coefficient of variation

**Table 26: Time spent for different operations on 6 bullocks (man-minutes).**

S.No.	Operation	Mean $\pm$ SE	C.V.%	% of total time
1	Washing the animals	25.00 $\pm$ 2.14	18.24	18.47
2	Cleaning the shed	23.00 $\pm$ 2.26	22.17	16.99
3	Feeding	38.00 $\pm$ 1.80	8.49	28.08
4	Watering	13.33 $\pm$ 1.87	26.27	9.85
5	Miscellaneous works	7.83 $\pm$ 1.39	24.78	5.78
6	Total working time	107.17 $\pm$ 3.44	11.05	79.19
7	Idle time	28.17 $\pm$ 3.20	36.30	20.81
8	Total time	135.33 $\pm$ 1.94	2.79	100.00

SE : Standard Error

CV: Coefficient of variation

out of which the total working time and idle time was  $107.17 \pm 3.44$  and  $28.17 \pm 3.20$  man-minutes per day respectively.

Highest coefficient of variation was observed in idle time and lowest coefficient of variation was noticed in total time required for various operations. About 80 per cent of the total working time was utilized out of the total time.

#### 4.1.8 Comparison of Time Spent for Various Operations on Different Categories of Animals 3655

The time spent for various operations on different categories of animals is presented in Table 27. The total time spent for milking operation was  $14.26 \pm 0.56$  man-minutes per milch animal/day. The time taken for washing the milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was  $6.12 \pm 0.54$ ,  $4.52 \pm 0.88$ ,  $4.86 \pm 0.49$ ,  $4.82 \pm 0.35$ ,  $3.83 \pm 0.48$ ,  $5.50 \pm 1.01$  and  $4.17 \pm 0.87$  man-minutes per animal per day respectively. Milch animals and bulls required more time for washing, while the calves required less time. The time taken for cleaning the shed of milch animals, pregnant animals dry animals, heifers, calves, bulls and bullocks was  $3.70 \pm 0.55$ ,  $3.95 \pm 0.72$ ,  $3.88 \pm 0.47$ ,  $3.99 \pm 0.35$ ,  $2.95 \pm 0.33$ ,  $4.25 \pm 0.92$  and  $3.83 \pm 0.92$  man-minutes per animal per day respectively. Less time was observed for cleaning the calf pens while more time was spent for cleaning the bulls shed.

The time taken for feeding of milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was  $8.31 \pm 0.33$ ,  $4.02 \pm 0.76$ ,  $3.74 \pm 0.46$ ,  $3.80 \pm 0.30$ ,  $2.86 \pm 0.42$ ,  $3.88 \pm 0.90$  and  $6.33 \pm 0.73$  man-minutes per animal per day respectively.

**Table 27: Time spent for various operations on different categories of animals (man-minutes/animal/day).**

	Milch animals Mean $\pm$ SE	Pregnant animals Mean $\pm$ SE	Dry animals Mean $\pm$ SE	Heifers Mean $\pm$ SE	Calves Mean $\pm$ SE	Bulls Mean $\pm$ SE	Bullocks Mean $\pm$ SE
1. Milking operation	14.26 $\pm$ 0.56	.	.	.	.	.	.
2. Washing the animals	6.12 $\pm$ 0.54	4.52 $\pm$ 0.88	4.86 $\pm$ 0.49	4.82 $\pm$ 0.35	3.83 $\pm$ 0.48	5.50 $\pm$ 1.01	4.17 $\pm$ 0.87
3. Cleaning the shed	3.70 $\pm$ 0.55	3.95 $\pm$ 0.72	3.88 $\pm$ 0.47	3.99 $\pm$ 0.35	2.95 $\pm$ 0.33	4.25 $\pm$ 0.92	3.83 $\pm$ 0.92
4. Feeding	8.31 $\pm$ 0.33	4.02 $\pm$ 0.76	3.74 $\pm$ 0.46	3.80 $\pm$ 0.30	2.86 $\pm$ 0.42	3.88 $\pm$ 0.90	6.33 $\pm$ 0.73
5. Watering	1.92 $\pm$ 0.42	1.87 $\pm$ 0.55	1.84 $\pm$ 0.42	1.89 $\pm$ 0.39	1.31 $\pm$ 0.41	2.50 $\pm$ 0.99	2.22 $\pm$ 0.76
6. Miscellaneous works	0.49 $\pm$ 0.36	11.82 $\pm$ 0.97	1.48 $\pm$ 0.32	1.22 $\pm$ 0.34	0.29 $\pm$ 0.30	11.46 $\pm$ 1.30	1.31 $\pm$ 0.57
7. Total working time	34.82 $\pm$ 0.78	26.17 $\pm$ 0.97	15.80 $\pm$ 0.57	15.72 $\pm$ 0.51	11.05 $\pm$ 0.93	27.58 $\pm$ 1.75	17.86 $\pm$ 1.40
8. Idle time	3.82 $\pm$ 0.56	0.83 $\pm$ 0.51	2.09 $\pm$ 0.61	4.37 $\pm$ 0.58	0.62 $\pm$ 0.47	5.38 $\pm$ 1.36	4.69 $\pm$ 1.31
9. Total time	38.64 $\pm$ 0.73	27.00 $\pm$ 1.04	17.90 $\pm$ 0.44	20.10 $\pm$ 0.37	11.67 $\pm$ 0.99	32.96 $\pm$ 1.19	22.56 $\pm$ 0.79

SE : Standard Error

The time spent for watering the milch animals, pregnant animals, *dry* animals, heifers, calves, bulls and bullocks was  $1.92 \pm 0.42$ ,  $1.87 \pm 0.55$ ,  $1.84 \pm 0.42$ ,  $1.89 \pm 0.39$ ,  $1.31 \pm 0.41$ ,  $2.50 \pm 0.99$  and  $2.22 \pm 0.76$  man-minutes per animal per day respectively. It was observed that calves took less time for watering where as bullocks took more time.

The time spent on miscellaneous works for milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was  $0.49 \pm 0.36$ ,  $11.82 \pm 0.32$ ,  $1.48 \pm 0.32$ ,  $1.22 \pm 0.34$ ,  $0.29 \pm 0.30$ ,  $11.46 \pm 1.30$  and  $1.31 \pm 0.57$  man-minutes per animal per day respectively.

The total working time for various operations of milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was observed as  $34.82 \pm 0.78$ ,  $26.17 \pm 0.97$ ,  $15.80 \pm 0.57$ ,  $15.72 \pm 0.51$ ,  $11.05 \pm 0.93$ ,  $27.58 \pm 1.75$  and  $17.86 \pm 1.40$  man-minutes per animal per day respectively. Milch animals required more total working time while for calves it was less.

The idle time for milch animals, pregnant animals, dry animals, heifers, calves, bulls and bullocks was  $3.82 \pm 0.56$ ,  $0.83 \pm 0.51$ ,  $2.09 \pm 0.61$ ,  $4.37 \pm 0.58$ ,  $0.62 \pm 0.47$ ,  $5.38 \pm 1.36$  and  $4.69 \pm 1.31$  man-minutes per animal per day respectively. Highest idle time was observed in case of bulls while the lowest was recorded in calves.

## 4.2 TIME SPENT FOR VARIOUS OPERATIONS AT FORAGE PRODUCTION FARM

The average time required for land preparation, sowing, fertilizer application, irrigation, harvesting and loading of fodder for different crops on forage production farm is presented in Table 28 and its analysis of variance in Table 29.

The time taken for land preparation by tractor ploughing for jowar, maize, napier, paragrass and berseem crops was  $2.5 \pm 0.28$ ,  $2.5 \pm 0.28$ ,  $4.0 \pm 0.28$ ,  $2.5 \pm 0.28$  and  $5.5 \pm 0.28$  hours/labour/acre respectively. The time taken for land preparation was significantly different ( $P < 0.01$ ) between crops.

The time taken for sowing jowar, maize, napier, paragrass and berseem crops was  $14 \pm 1.15$ ,  $20.67 \pm 1.76$ ,  $23 \pm 1.52$ ,  $48 \pm 1.15$  and  $6.0 \pm 0.57$  hours/acre respectively and different significantly ( $P < 0.01$ ) between crops.

The time taken for fertilizer application was  $12.33 \pm 0.88$ ,  $12.0 \pm 1.15$ ,  $12.33 \pm 0.33$ ,  $5.0 \pm 0.57$  and  $8.0 \pm 0.57$  hours/acre for jowar, maize, napier, paragrass and berseem crops respectively. On analysis it was observed that the time taken for fertilizer application was significantly different ( $P < 0.01$ ) among the crops.

The time required for irrigation of jowar, maize, napier, paragrass and berseem fodder crops was  $60 \pm 6.92$ ,  $90 \pm 6.92$ ,  $51 \pm 10.81$ ,  $60 \pm 3.46$  and  $40 \pm 2.0$  hours/acre respectively. Statistically significant differences ( $P < 0.01$ ) were observed in time required for irrigation among different fodder crops.

**Table 28: Average time required for various forage farm operations of different fodder crops (man hours/acre)**

S. No.	Name of the fodder crop	Land preparation Mean $\pm$ SE	Sowing Mean $\pm$ SE	Fertilizer application Mean $\pm$ SE	Irrigation Mean $\pm$ SE	Harvesting Mean $\pm$ SE	Loading Mean $\pm$ SE	Total time Mean $\pm$ SE
1	Jowar	2.5 $\pm$ 0.28	14.0 $\pm$ 1.15	12.33 $\pm$ 0.88	60.0 $\pm$ 6.92	74.67 $\pm$ 2.66	39.0 $\pm$ 7.93	202.50 $\pm$ 5.39
2	Maize	2.5 $\pm$ 0.28	20.6 $\pm$ 1.76	12.00 $\pm$ 1.15	90.0 $\pm$ 6.92	86.67 $\pm$ 10.91	42.0 $\pm$ 6.00	253.77 $\pm$ 11.65
3	Napier	4.0 $\pm$ 0.28	23.0 $\pm$ 1.52	12.33 $\pm$ 0.33	51.0 $\pm$ 10.81	86.67 $\pm$ 10.91	72.0 $\pm$ 10.39	249.00 $\pm$ 8.03
4	Paragrass	2.5 $\pm$ 0.28	48.0 $\pm$ 1.15	5.00 $\pm$ 0.57	60.0 $\pm$ 3.46	144.00 $\pm$ 20.78	54.0 $\pm$ 10.39	313.50 $\pm$ 15.17
5	Berseem	5.5 $\pm$ 0.28	6.0 $\pm$ 0.57	8.00 $\pm$ 0.57	40.0 $\pm$ 2.00	144.00 $\pm$ 20.78	72.0 $\pm$ 10.39	275.50 $\pm$ 30.86

SE = Standard Error

**Table 29: ANOVA of time required for various forage farm operations of different fodder crops.**

Source of variation	d.f.	Mean sum of squares					
		Land preparation	Sowing	Fertilizer application	Irrigation	Harvesting	Loading
Fodder crops	4	5.40**	748.66**	32.90**	1035.60**	3457.60*	750.59**
Error	10	0.25	5.06	1.73	90.60	665.60	253.80

\* Significant at  $P < 0.05$

\*\* Significant at  $P < 0.01$

The harvesting time for jowar, maize, napier, paragrass and berseem fodder crops was found to be  $74.67 \pm 2.66$ ,  $88.67 \pm 10.91$ ,  $86.67 \pm 10.91$ ,  $144.0 \pm 20.78$  and  $144.0 \pm 20.78$  hours/acre respectively and significantly different ( $P < 0.05$ ) between crops.

The loading time for harvested jowar, maize, napier, paragrass and berseem fodder crops was observed to be  $39 \pm 7.93$ ,  $42 \pm 6.0$ ,  $72 \pm 10.39$ ,  $54 \pm 10.39$  and  $72 \pm 10.39$  hours/acre respectively and statistically significant differences were observed in the loading time among the crops.

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# *Discussion*

## Chapter V

# DISCUSSION

The results presented in the previous chapter have been discussed here under.

### 5.1 TIME SPENT FOR VARIOUS OPERATIONS AT DAIRY EXPERIMENTAL STATION

#### Dairy Experimental Station

##### 5.1.1 Milch Animals

From the results it can be seen that milking operation in buffaloes constituted major operation which accounted for 36.91 per cent of total time. These findings are in agreement with those observed by Whipp (1981). However, Devarajulu and Naidu (1989) observed that milking operation took about 30% of total time. This lower time reported in cows may be due to soft teats of cows where less effort is required over buffaloes whose teats are hard. Nanda *et al.* (1988) observed that the milking time was dependent on the milk yield of the cow, viz., the higher time being in the low yielders and vice versa.

Another major operation in milch animal management was feeding followed by washing the animals. Milch animals require specialized feeding and washing for producing clean milk and hence these operations took higher time.

In the present study 9.89 per cent of total time was observed to be idle time without any productive work. This idle time may be due to the delay

in commencing routine work and leaving of workers from the farm earlier than the scheduled time. In a time study Devarajulu (1986) observed that workers showed a tendency to complete the assigned task before the scheduled time to leave earlier.

#### **5.1.1.1 Milking Operation**

Milking is one of the most important operations on a dairy farm. The time required to milk a buffalo depends on number of factors and sub activities which form a part of major operation i.e milking.

#### **Bringing Calf From Calf Pen to Dam and Taking Back**

The average time taken to bring the calf from pen to dam and back was below one minute. Though apparently there is some variation from calf to calf and between persons and sessions, but statistically they were insignificant indicating that persons and sessions have no role to play on time required to bring the calf for milking operation. However, the apparent variation from calf to calf may be due to speed of calf to reach its dam which in turn is dependent on state of hungryness of calf and age of calf. In the present study it was observed that comparatively less time is required to bring the calf from calf pen to dam and back which may be due to nearness of calf pen to milking barn.

#### **Calf Suckling**

The average time allowed for calf to suckle it's mother ranged between 40 and 50 seconds. Under scientific management, calf sucking is not

practised. However, most of the farmers feel that calf sucking is a prerequisite for efficient letting down of milk by the animal. In the present investigation it was observed that the time allowed for calf sucking varied significantly between animals, between persons and between sessions. This clearly indicated that the persons involved in this operation are not adhering to strict calf suckling timings and may be partly due to improper guidance of calf to its dam. Som times the calf may move to other buffalo and to guide to its mother may lead to certain lapse of time. This may be the reason for variation of time among the calves.

Interestingly when the statistical comparison was made between persons and sessions, persons and animals, sessions and animals and persons, sessions and animals the difference was not significant which indicated that in group comparison the difference was not much and non-significant.

### **Carrying Empty Milk Pail From Milk Recording Room to Animal**

The time taken to carry the empty milk pail from milk recording room (which is centrally located in the milking barn) to animal ranged between 6.17 and 12.67 seconds per animal. This time varied significantly between persons, among animals and sessions. This variation may be attributable to difference in efficiency of individuals, the distance between milk recording room to the animal and time of the day.

### **Washing the Udder and Wiping with Cloth**

Washing the udder and subsequent wiping it with cloth is an important preparation before milking which has lot of bearing on the microbial

quality of milk and subsequently on its keeping quality. This operation took around 53.5 to 78.0 seconds depending on the animal, session and person. However, there was no statistically significant difference in the time consumed by various milkers. Singh and Dave (1985) observed that  $0.38 \pm 0.004$  minutes were required to clean the udder of milch cows. This time was lower than that of the observed time in the present investigation. This may be probably due to non inclusion of time spent on wiping of udder. Rawat *et al.* (1973) observed that on an average 11-15 seconds were required to wipe the udder with a wet towel soaked in an antiseptic solution.

### **Actual Milking Time Per Milking**

This is the time taken to actually milk the animal including strippings. This time depends on the milk yield of animal, teat size and hardness, person who is milking and time of the day (i.e., morning and evening). In the present investigation there was a significant difference in the actual milking time between persons, animals and sessions. In the present study the actual milking time ranged between  $182.67 \pm 12.01$  and  $297.83 \pm 15.23$  seconds which could be attributed to the differences in the total milk yield of animals and also due to difference in the milk yields between morning and evening which in turn was due to unequal milking intervals. The present findings are in agreement with those observed by Rawat *et al.* (1973), Shiralkar and Dave (1975), Singh and Dave (1985) and Devarajulu and Naidu (1989).

### **Milk Handling Before Weighing**

This time includes the time spent on carrying milk pail from the animal to the balance and delivering milk into the weighing balance container. The milking parlour studied has a tail to tail animal arrangement with a total capacity of 40 buffaloes standing in two rows on either side of the milk recording room. In the present investigation the time taken for milk handling differed significantly among the persons and between the animals. The difference in time among the persons may be due to the differences in the activeness of the individuals. The difference in time among the animals may be attributed to the distance of animal from the central recording room. Weighing balance and milk recording were placed in the centre of the milking shed to minimise the distance to be covered by milkman before delivering the milk. No further minimisation of the distance is possible under the existing circumstances. In the present investigation  $9.67 \pm 0.47$  to  $13.67 \pm 0.94$  seconds were required to handle the milk. The present findings are in agreement with those reported by Devarajulu and Naidu (1989). However, Rawat *et al.* (1973) reported a higher time of  $38.4 \pm 1.90$  seconds.

### **Weighing the Milk and Recording**

The average time taken for weighing the milk (by the recorder) and emptying the milk into a can did not differ significantly among the persons. This indicates that the persons engaged in this operation were equally trained and had enough experience to do this operation. However, statistically significant differences were noticed between sessions and among the animals. This

difference may be attributed to the differences in milk yield of animals and variation in quantity of milk obtained between morning and evening milkings. In the present investigation about  $3.5 \pm 0.50$  to  $6.0 \pm 1.15$  seconds were utilized in weighing the milk and recording. However, Rawat *et al.* (1973) reported a higher time of 14.10 seconds which he attributed to the waiting of milkers in queue for emptying their milk into the weighing container.

### **Total Milking Time Per Milking**

In the present investigation the average milk yield of buffaloes ranged between  $2.93 \pm 0.05$  and  $4.75 \pm 0.05$  kg per milking and the total time taken for milking ranged from  $366.67 \pm 10.27$  to  $501.75 \pm 10.52$  seconds. These values are in agreement with those reported by Rawat *et al.* (1973), Singh and Dave (1985) and Devarajulu (1986). Significant differences were noticed in the total milking time taken by different persons, among various animals and between morning and evening sessions. The significant difference observed in the present study in the total milking time between morning and evening milkings was also observed by Devarajulu (1986) who opined the difference due to unequal milking intervals between morning and evening sessions. Significant differences among the animals may be attributed to the difference in milk yields of animals and may be partly due to difference in softness of teats of animals. Dash *et al.* (1976) also opined that lactation number has significant effect on milking time. Significant variation in milking time among the persons may be due to the variations in the efficiency of workers in that particular operation.

## **Milking Rate Per Milking**

Since there are wide variations in the total milking time owing to the differences in milk yield, it is felt appropriate to compare the time required to milk one kg of milk. Average milking rate is the time taken for milking one kg of milk from each animal. This is dependent on the rate of milk flow and milking skill of the milkers. In the present investigation the average milking rate ranged from  $101.29 \pm 3.16$  to  $141.87 \pm 4.47$  seconds/kg of milk. A higher time of 202.18 seconds was recorded by Rawat *et al.* (1973) and a slightly lower time of  $99.60 \pm 1.375$  was recorded by Devarajulu (1986). The average milking rate was significantly different between persons and sessions. The significant difference observed in the milking rate between morning and evening milkings was due to difference in milk yields between morning and evening sessions.

### **5.1.2 Pregnant Animals**

These animals include the buffaloes which are in advance stage of pregnancy (down calvers) and whose milk has been dried off before calving. These animals require special care and handling and housed separately. The miscellaneous works which accounted for 43.76 per cent of total time includes separation and housing of the pregnant animals in calving box 15 days prior to expected date of calving and providing breeding, watering during calving. About 14.87 per cent of total time was spent in feeding the animals which also includes steaming up of animals for next location.

### 5.1.3 Dry Animals

From the results it was observed that a major amount of time was spent in washing the dry animals followed by cleaning the shed. Nearly more than 50 per cent of the total time being spent on washing the animals and cleaning the shed. Devarajulu and Naidu (1989) observed that about 41.3 per cent of total time was spent on washing the animals and shed.

About 20.91 per cent of total time was spent on feeding of dry animals. These findings are in agreement with those reported by Devarajulu and Naidu (1989) who noted that 21.6 per cent of total time was spent on feeding of dry animals.

Miscellaneous works which include major items of work like veterinary treatment and artificial insemination consumed 8.25 per cent of total time. More time amounting to 11.70 per cent of total time was wasted as idle time and hence there is a scope for efficient utilisation of time.

### 5.1.4 Heifers

Washing the animals, cleaning the shed and feeding constituted major works in heifers shed. Nearly 21.76 per cent of time was wasted as idle time which was more than the time spent in cleaning the shed and feeding of heifers. Since there no fixed routine for heifer management, this higher idle time might have resulted. Spending 1/5th of the total time idle, without any constructive work reflects on the management of labour on farm. To avoid this kind of wastage in human labour, either less number of labour should be allotted to

heifers or the labour should be diverted for other activities on farm when they have no work in heifer shed. About  $20.09 \pm 0.37$  man-minutes/day were spent per heifer. This value is slightly higher than those (17.85 man-minutes) reported by Devarajulu (1986) who noticed that 17.88 man-minutes were spent in heifer shed.

Highest coefficient of variation observed in miscellaneous works of heifers indicates highest variation on the nature of these works. Higher coefficient of variation in idle time amply proves that the workers are not adhering to strict time schedule, instead they are showing a tendency to complete the assigned task before the schedule time to leave earlier.

### 5.1.5 Calves

Calves are the foundation stock for next generation in dairy farm. Hence, lot of care is exercised in bringing up of calves. Washing of calves, cleaning the calf pens and feeding constituted major works in the management of calves on dairy farm. Only 5 per cent of total time is wasted in idle time indicating a fixed schedule of operations in calf rearing. Feeding of calves is a specialized operation which requires more time. But contrary to this more time was spent in washing. A good amount of time spent in cleaning the shed is justifiable owing to the fact that calves require clean and disease free environment to live in.

### **5.1.6 Bulls**

Bull is said to be 'Half the herd' because the off springs receive 50 per cent of inheritance from the bull. The quality of future herd depends on the bull and its management. About 34.76 per cent of total time was spent on miscellaneous works which included grooming the skin, exercise and servicing. Because of variations in day to day activities of the bulls much labour time is wasted as idle time. Higher coefficient of variation (38.99%) was observed in watering of bulls. This may be due to nature of bulls which are difficult to control.

### **5.1.7 Bullocks**

Bullocks are the important draught power on dairy farm. A farmer spends more time and care in management of bullocks as they are pillars for his agriculture works. Feeding constituted a major item of work in the management of bullocks which accounted for 28.08 per cent of total time in the present study. As in the case of other category of animals, lot of time was being wasted as idle time.

### **Comparison of Time Spent for Various Operations on different categories of animals**

On comparison of time spent for various operations of different categories of animals studied, it was noted that more time is spent on milch animals and least time is spent on calves. Devarajulu (1986) observed that nearly 50 per cent of time on dairy farm was spent in attending milch animals.

This is mainly due to the additional time spent for milking and intensive care required by milch animals. This indicated that milch animals require more attention and time than other categories of animals. On average  $38.64 \pm 0.73$  man-minutes were spent per milch buffalo. This value is lower than the value reported by Devarajulu (1986) for cows and higher than the reported value of Baidikov (1977). The differences in time required per buffalo per day may be due to the differences in managerial practices of buffaloes.

Milking was the major operation taking more time than another single operation in management of milch animals. Miscellaneous works constituted major item of work for pregnant animals and bulls. Management of down calvers and exercise for bulls are the major miscellaneous works in these category of animals.

Lot of variation existed between time requirements for feeding of different categories of animals. Feeding of milch animals took almost double time over the other categories of animals. This higher time requirement may be due to additional work involved in soaking of concentrate mixture two times prior to milking.

Comparatively large amount of time was wasted as idle time in case of bulls, bullocks and heifers. This may be due to lack of proper time schedule for various works and tendency of workers to leave early completing the assigned work.

## **5.2 TIME SPENT FOR VARIOUS OPERATIONS AT FORAGE FARM**

A well maintained fodder production unit is born for a profitable dairy farming since considerable labour are required for various forage farm operations, time study is required for efficient management of labour on the forage farm.

Among the various crop operations harvesting required more labour followed by irrigation and loading of fodder into the transport vehicle. Land preparation consumed less time among the operations. The time required for land preparation for jowar, maize and paragrass was similar, where as napier and berseem required more time. The higher time requirement for land preparation in napier crop cultivation is due to the additional operation of making ridges, in addition to common operation like ploughing, disc harrowing for other crops. Among all the crops berseem required higher time because of the additional operations of levelling and making the plots.

The time required for various operations of various crops differed significantly owing to the fact the different sowing methods are required for different crops. Berseem required less time for sowing because of simple broadcasting. The higher time required for maize sowing is due to dibbling the seed on the ridges at a specified space when compared to jowar which is sown behind the plough without maintaining the inter plant spacing. Napier and paragrass required higher sowing time because of transplanting the stem cuttings and in particular paragrass required more time for transplanting cuttings at a denser level.

The fertilizer application took the same time for jowar, maize and napier crops. Berseem and paragrass required less time in fertilizer application owing to the basal application and broadcasting.

The time taken for irrigation was highest for maize crop because the quantum of water requirement is higher than that of other crops. The time required for irrigation of berseem is lower than that of other forage crops studied because berseem is generally grown in winter months which requires less watering.

Jowar, maize and napier grass highly accessible for cutting and hence they took less time. The higher time requirement for harvesting paragrass is due to the fact that more number of cuttings are obtained in a given period over the other crops. Because of close spacing and dense population more time was also spent in harvesting berseem crop.

From the results it was observed that the time taken for loading the harvested crops into transporting vehicle varied among the forage crops studied. Higher time consumption in loading of napier grass is due to higher yield of napier grass over the rest of the crops. More time was also consumed in loading berseem owing to the more time spent on bundling process and handling of small plants.

On comparison of the total time requirement for the important forage farm operations it was observed that paragrass required more time than the

other crops owing to the difference in sowing methods and more number of cuttings obtained during a given period of time. Lower total time requirement for jowar crop may be attributed to simple sowing and harvesting methods.

### **5.3 NORMS FOR LABOUR REQUIREMENTS ON DAIRY FARM**

From the results, the time required for various operations for different categories of animals was worked out. From this idle time which is of no constructive work was subtracted and actual working time required for each category of animals was arrived at. Considering 35 man-minutes required for each milch animal, one labour working for 6 hours a day can look after 10 milch animals. For dry animals 15.80 man-minutes time is required and at this rate of work one worker will be sufficient to look after 22 dry animals. The labour requirement for pregnant animals is slightly high with a labour looking after 13 pregnant animals. Bulls require more or less similar labour as in case of pregnant animals i.e., 13 bulls can be looked after by one labour. One labour each may be required to manage either 17 heifers or 32 calves or 20 bullocks.

The average labour requirement per cow is about 25 minutes per day as per Farm Management Hand Book, Ministry of Agriculture, Government of India (Jagdish Prasad, 1995) under cow shed systems of management. However, in the present investigation 35 man-minutes are required for each milch buffalo per day. This higher value may be due to differences in management of buffaloes over cows. However, steps should be taken to bring down this time by efficient managerial practices.

*Summary  
and  
Conclusion*

## Chapter VI

### SUMMARY

A time and motion study was undertaken to suggest time requirements for various dairy farm operations. The study was carried out at Dairy Experimental Station and Forage Production Farm, College of Veterinary Science, Rajendranagar, Hyderabad. A total of 200 dairy animals comprising various categories were covered by the study in a time duration of 50 days. The data was tabulated, analysed and suitably interpreted.

From the results it was observed that milking operation constituted the major item of work in milch buffaloes. Feeding washing of animals and cleaning of sheds consumed good share of total time spent on milch animals. Variations in milking time was observed due to differences in milk yield and efficiency of labour.

Around 40 to 50 seconds of time was spent on calf suckling and this practice should be avoided from the scientific management point of view. Washing the udder and wiping the udder with a cloth took 53.5 to 18.0 seconds where as the actual milking time ranged between  $182.6 \pm 12.01$  and  $297.83 \pm 15.23$  seconds. In the present investigation the average milk yield of buffaloes ranged between  $2.93 \pm 0.05$  and  $4.75 \pm 0.05$  kg per milking and total time taken for milking ranged from  $366.67 \pm 10.27$  to  $501.75 \pm 10.52$  seconds.

Among the different categories of animals milch animals require more time to manage due to additional time requirements of milking. Bulls also required large time for various operations and time required for exercise and servicing might be the contributing factors for this higher requirement of labour time.

Among all the categories of animals, time spent on calves is the lowest. This may be partly due to their small size and easiness in handling and partly due to less importance given for calves in farm operations.

A considerable amount of time is wasted as idle time due to lack of strict time schedule for each operation for every category of animal and natural tendency of workers to leave early by completing the assigned work before time.

From the study daily labour requirement per category of animal was calculated. For milch animals  $38.64 \pm 0.73$  man-minutes are required per day per animal. While for dry animals, pregnant animals, heifers, calves, bulls and bullocks the labour requirement is about 17.90, 27.00, 20.10, 11.67, 32.96 and 22.56 man-minutes per animal per day respectively.

From the results the labour requirement for each category of animal was arrived at. One labour working for 6 hours a day will be required to attend to 10 milch buffaloes or 22 dry buffaloes or 13 pregnant animals or 13 bulls or 17 heifers or 32 calves or 20 bullocks.

From the study it was observed that lot of time is wasted under each category of animal and hence norms for labour requirements on Dairy farm was calculated.

The following suggestions are made to improve the labour efficiency on dairy farm and optimum utilisation of labour:

1. Proper planning of cattle housing and other sheds should be done for saving time and energy of labour in unnecessary movements.
2. Good planning and scheduling of work should be done for efficient utilisation of time.
3. Idle time should be minimised by avoiding delay in commencing routine work and stop workers leaving the farm earlier than the scheduled time.
4. A comparative internal competition between workers should be encouraged to improve the efficiency of the individuals.
5. Proper supervision on workers should be exercised to avoid unfruitful chatting among the workers.
6. Since more time is spent on washing of animals and cleaning of shed, cheaper and efficient mechanical devices may be introduced to reduce the time spent on these works.

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