

Some Observations on the Grazing Behaviour of European Cattle in the Mid-Country of Sri Lanka

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Abstract : Two studies, namely a barn study and a field study were carried out to acquire knowledge on the behaviour of exotic dairy cattle in the mid-country of Sri Lanka. Observations on behaviour patterns were carried out with six milking cows, two from each breed: Friesian, Ayrshire and Jersey, at the Experimental Dairy Unit of the Department of Animal Husbandry, University of Sri Lanka, Peradeniya Campus. The average time spent in zero-grazing in the barn and free-grazing in the field was 8.80 h and 9.55 h per day, respectively. The corresponding grazing to rumination ratios (G/R) were 1.47 and 1.34. These values were higher than those reported from temperate regions and may be attributed to intrinsic differences between temperate and local forages. Both studies indicated that the greater proportion of effective grazing was accomplished during daylight hours. However, under both systems of management there appeared to be a major consumption peak of about one hour's duration, during the night. It seems essential, on the basis of these observations, that exotic dairy cattle in the mid-country of Sri Lanka be given maximum daytime on pasture. If zero grazed, grass should be offered at least in three feeds, corresponding to the major periods of consumption. Since about 30% of the grazing or zero grazing occurred between 6.00 p.m. and 6.00 a.m., it is also suggested that cattle be enclosed at night where they could do a reasonable amount of grazing or be provided with adequate cut fodder at night in order to ensure maximum production.

1. Introduction

Adequate information is available on the grazing behaviour of cattle in the temperate regions. However, only few such studies have been made under tropical conditions specially with temperate breeds of cattle.

Evidence from literature indicate that in warm weather animals graze at night for long periods. Wallace and Kennedy¹⁶ reported that night grazing accounted for 40% of total grazing time of beef cattle during the summer months in New York State. Day temperatures of 80°F to 95°F in Louisiana resulted in a complete reversal of temperate climatic pattern of grazing ; over 70% of the total grazing time of 7.2 hours being done at night.¹⁴ Even with day temperatures in the range of 72°F to 82°F, Friesian cows in Fiji did 67% of their grazing at night,¹³ suggesting that the grazing habits of cattle in the tropics were radically different from those in temperate zones.

In Sri Lanka, only a few studies of this nature have been undertaken. At the Coconut Research Institute, Gunasekera⁶ made observations on the time spent in grazing by indigenous Sinhala Cattle tethered to coconut palms. He observed that on an average these cows grazed 10.3 hours and that the bulk of the grazing occurred during the hottest part of the day. At the Dry Zone Agricultural Research Station, Fernando and Sivalingam^{3,4} made two studies on the grazing habits of Zebu cattle. They found that Sahiwal heifers grazed mostly during daylight hours, while the nights were mainly devoted to rest. They suggested that the condition of the pasture was a major factor which influenced grazing habits of cattle.

Several investigations have been reported where behavioural studies have been successfully used in solving grazing management problems. Hughes and Harker¹⁰ showed how behavioural studies can be used to improve animal weighing methods, when cattle are at grazing. In Sri Lanka, there is little information available on the precise management practices that should be adopted in order to gain the maximum benefit from our established pasture. At a time such as this when a tremendous emphasis is being placed on dairy farming, specially in the mid-country of Sri Lanka where diversification of marginal tea lands are being considered, it would be most appropriate to gather precise information on grazing habits of cattle, in order that maximum benefit can be achieved from grassland management.

The main objective of the present investigation was therefore to gain knowledge on the grazing habits of three exotic dairy breeds (Holstein-Friesian, Ayrshire and Jersey) in the mid-country of Sri Lanka and to make tentative recommendations for maximizing yields through improved grazing management practices. The investigations which included a barn study (zero-grazed) and a field study (free-grazed) was conducted at the Experimental Dairy Unit of the Department of Animal Husbandry, University of Sri Lanka, Peradeniya Campus.

2. Experimental

Two studies were undertaken :

- (a) Study I — A barn study where zero-grazing was practised.
- (b) Study II — A field study where free-grazing was practised.

2.1. Animals

Both studies were undertaken with six milking cows from the exotic breeds (2 of each) Friesian, Ayrshire and Jersey. They were familiar to being handled both in the barn and in the field without causing any disturbance.

2.2. Herbage

For Study I, animals were given *ad libitum* good quality Pusa Giant Napier fodder in feed troughs in weighed quantities of 18 to 20 kg. Feed refusals by individual animals were recorded every 24 hours.

Study II was conducted in a 1 acre paddock of *Brachiaria brizantha* (Hoscher) stapf. fertilized with urea at the rate of 336 kg nitrogen per hectare per year, one month prior to the commencement of the experiment.

2.3. Weather

Since both trials fell within the Maha Season (North-East Monsoon), climatic conditions were much similar, except for the slightly heavier rain during the barn study.

A record of hourly meteorological data are given in Appendix Table I. Rainfall data for the 48 hour period were obtained from the Central Agricultural Research Institute, Peradeniya, located about 16 km from the experimental site.

2.4. Housing

Study I—Animals were housed in a half brick-walled, asbestos roofed and well ventilated barn having a row of tie points on either side of a middle passage. Animals were kept tied with chains which were well adjusted to allow comfortable movement.

Study II—The 0.4 ha paddock (70 yds × 70 yds) in which the animals grazed during the field study, had a tree by the fence on one side which provided shade to the animals. A shed constructed at the centre of the paddock was used for making observations.

2.5. Milking

During both studies animals were milked by hand at the milking parlour located in the barn, which was about 450 m away from the paddock used for Study II. Milking was done at 6.00 a.m. and 2.00 p.m.

2.6. Water and feed supplements

The amounts of concentrates ('Morlac' by B.C.C. Ltd.) given to the cows varied according to the milk yield. During both studies, the appropriate quantity of concentrates were given at the time of milking, in two equal feeds. All cows were provided with adequate mineral mixture which was fed along with the concentrates.

All animals had access to drinking water. The quantity of water consumed by all six animals was measured during both studies.

2.7. Observation techniques

Observations were made for a period of 48 hours in both studies. The activities of each animal were recorded continuously at 5 minute intervals. During Study I, a pressure lamp was used to facilitate observations in the night. In addition to a pressure lamp in the observation shed, a flashlight was also used in the night during the field study.

The activities of the animals were classified into :

1. Grazing or zero-grazing—time spent consuming pasture grass in the field or cut herbage in the barn.
2. Concentrate feeding—time spent eating concentrates.
3. Ruminating—time spent ruminating, both while standing and lying down.
4. Idling—time spent without any activity, both while standing and lying down.
5. Milking—time spent on milking. (Time spent waiting at the gathering yard during Study I and time spent in walking to and from the milking parlour during Study II, were also included under this activity.)

During both studies, the frequency of defaecations and urinations, and the total weight of dung voided by three labelled animals in Study I and one labelled animal in Study II, were also recorded.

The distance walked by one particular animal during the 48 hour period in Study II was measured using the technique of Hancock.⁷

The total quantity of water used for bathing cows and washing the barn was also measured.

A sample taken from herbage and concentrate offered and the faeces voided, were analysed for dry matter, ash, crude protein, crude fibre and calcium by conventional methods.

3. Results

The mean chemical composition of feed and faeces for both studies is given in Table I.

3.1. Behaviour Observations

The time spent in various activities by cattle during the 48 hour period for both barn and field studies is presented in Table 2. In the barn, animals spent an average of 8.80 hours/day (range 7.78 h to 9.92h) zero-grazing, while in the field the average time occupied in grazing was 9.55 h/day (range 8.33 h to 10.83h). There was a

marked difference between the ruminating time in the field (7.12 h/day) and the ruminating time in the barn (6.00 h/day). Animals were found to idle more when in the barn than when in the field. However, the total time spent lying down was similar under both conditions (Table 2).

TABLE 1. Average Chemical Composition of feed and faeces

	Dry matter %	Crude protein	Crude fibre (% in dry matter)	Ash	Calcium
STUDY I					
Fodder	17.83	15.37	29.07	12.29	—
Concentrate	89.63	21.77	—	—	—
Faeces	16.12	9.88	—	—	0.879
STUDY II					
Grass (at commencement of experiment)	17.90	13.63	22.16	12.27	—
Grass (at the end of experiment)	18.16	10.74	24.92	11.86	—
Faeces	14.46	7.28	—	20.83	1.32

TABLE 2. Time spent per animal in various activities (minutes)

Activity	Barn Study			Field Study		
	Day 1	Day 2	Mean	Day 1	Day 2	Mean
Grazing or zero grazing	537	519	528	559	587	573
Concentrate feeding	2	3	2	—	—	—
Ruminating	315	404	360	428	426	427
Idling	514	403	459	283	272	277
Milking	72	111	91	170	155	163
TOTAL	1440	1440	1440	1440	1440	1440
Times spent lying down	98	439	537	74	429	503
Ratio of grazing/ruminating (G/R)	1.7048	1.2847	1.4667	1.3061	1.3779	1.3419
Number of dungs	17.5	16.0	16.8	6.3	9.8	8.1
Number of urinations	20.3	23.2	22.0	5.0	17.2	6.1
Quantity of fresh faeces voided (kg)	19.7	18.8	19.3	7.3	8.2	7.7
Quantity of faeces voided/defaecation (kg)	1.03	1.20	1.11	1.21	1.02	1.10
Distance walked (metres)	—	—	—	1897	1586	1741

The average time spent per animal in various activities during day and night is shown in Table 3. Since it was difficult to observe the exact time of sunrise and sunset during both studies because of the cloudy weather, time of sunrise and sunset were arbitrarily fixed at 6.00 a.m. and 6.00 p.m. respectively.

TABLE 3. Average time spent per animal in various activities during day and night (minutes).

Activity	Barn Study		Field Study	
	Day	Night	Day	Night
Grazing or zero grazing	389	139	357	216
Ruminating	67	293	146	281
Idling	171	288	54	223
Time spent lying down	98	439	74	429
Ratio of grazing/ruminating (G/R)	5.8050	0.4744	2.4452	0.7687
Number of dungings	9.2	7.6	5.6	2.5
Number of urinations	13.6	8.4	3.5	2.6
Quantity of fresh faeces voided (kg)	0.98	9.53	5.44	2.27
Quantity of faeces voided/ defaecation (kg)	1.10	1.12	1.21	0.91
Distance walked (metres)	—	—	1139	602

On this basis under both systems of management over 60% of the total grazing was during the day. Night grazing ranged between 30% to 40%. On the contrary, animals spent more time ruminating during the night; 81% and 66% of the total ruminating time for barn and field study respectively, was during the night. However, the total time spent on rumination was comparatively higher under free-grazing than under zero-grazing conditions. The pattern and the time spent lying down, both during day and night, appeared to be similar under the two systems of management (Figure 1).

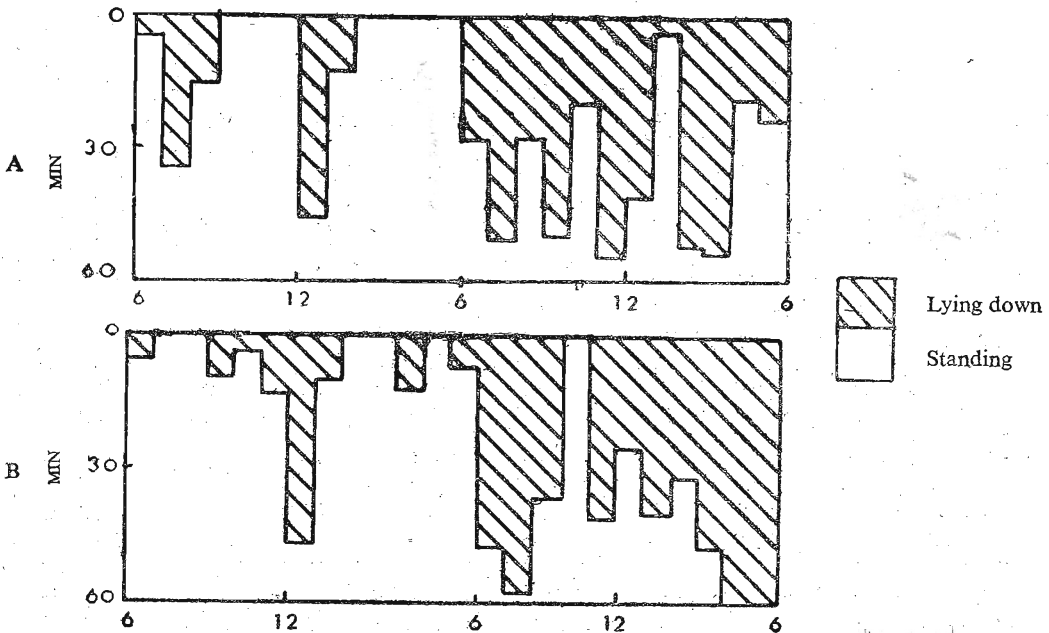


Figure 1. The pattern and time spent lying down during day and night.

A. Barn Study.

B. Field Study.

The pattern of zero-grazing and free-grazing habits are shown in Figure 2. There were three major periods of consumption of grass for both barn and field study. Although the forage consumption pattern during the day was similar under both conditions, it differed during the night. The peak night grazing when in the field was around 10.00 p.m., while in the barn this appeared to be around 1.00 a.m.

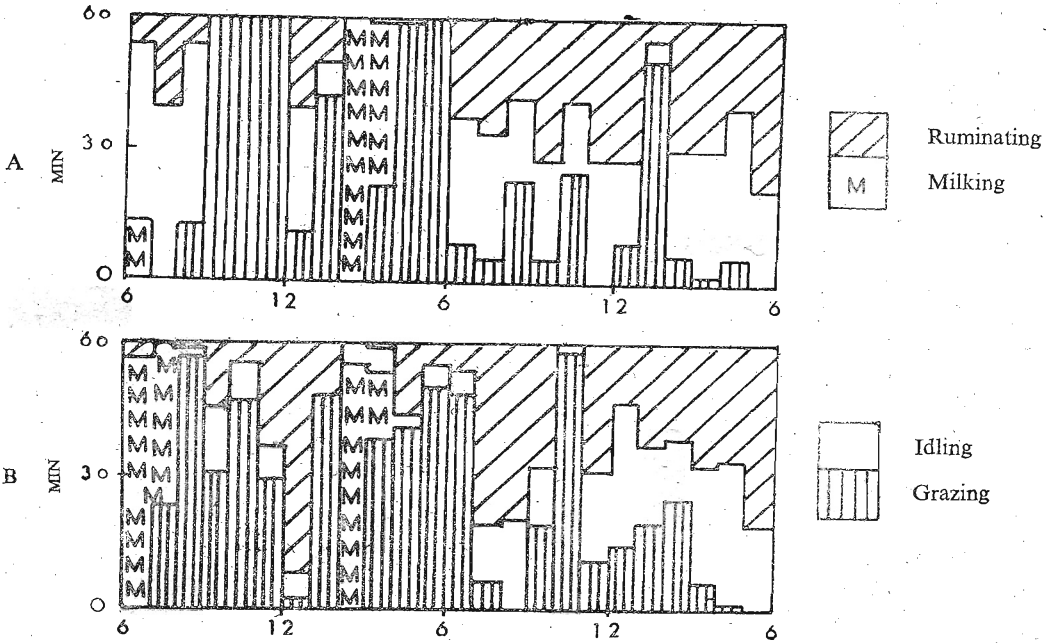


Figure 2. Periodicity of grazing habits under the two systems of management.

- A. Barn Study.
- B. Field Study.

Although there was a significant difference between individuals in the time spent grazing, ruminating and idling, no breed differences were observed in these activities.

3.1.1. *Elimination behaviour* : The number of defaecations/cow per day appeared to be more under zero-grazing conditions (16.8) than under free-grazing (8.1) conditions. The amount of fresh faeces voided per animal per day under zero-grazing was 19.3 kg compared to 7.7 kg under free-grazing. However, the average weight of faeces voided at each dunging was similar under both conditions (Table 2).

3.1.2 *Voluntary intake and rate of intake (R.I.) of herbage dry matter in barn study:* The daily herbage dry matter intake per cow in the barn study was 12.15 kg or 3.2% of the body weight. However, the rate of intake (R.I.) of herbage dry matter appeared to decrease as grazing advanced on to the second day (Table 4).

TABLE 4. Dry matter intake and rate of dry matter intake in barn study

Cow No.	Live Weight (kg)	Intake of herbage D.M. (kg)			Rate of intake (R.I) (kg/100 minutes)		
		1st day	2nd day	Average	1st day	2nd day	Average
1	284.8	9.84	9.39	9.62	1.95	1.69	1.81
2	388.7	11.48	11.16	11.34	2.61	2.12	2.34
3	422.3	14.79	11.57	13.20	2.98	2.18	2.57
4	442.3	14.70	13.97	14.38	3.67	2.91	3.26
5	366.5	13.79	12.61	13.25	2.56	2.06	2.30
6	357.9	10.16	11.20	10.75	2.04	2.16	2.10
Average/cow				12.15	2.40		

3.1.3. *Consumption of water in the field study*: All animals showed a tendency to drink water more frequently during the late mornings and evenings than during early mornings and night. The average quantity of water consumed in the field was 15.4 kg/day and the average number of drinks/day was 2.8.

3.1.4. *Distance walked*: The average distance walked per day by the labelled animal, as measured by the technique of Hancock⁷ was 1.7 km. The relationship between the distance travelled and the grazing pattern for the observed animal is shown in Figure 3.

The total amount of water spent for bathing cows and washing stalls averaged 182 litres/cow/day.

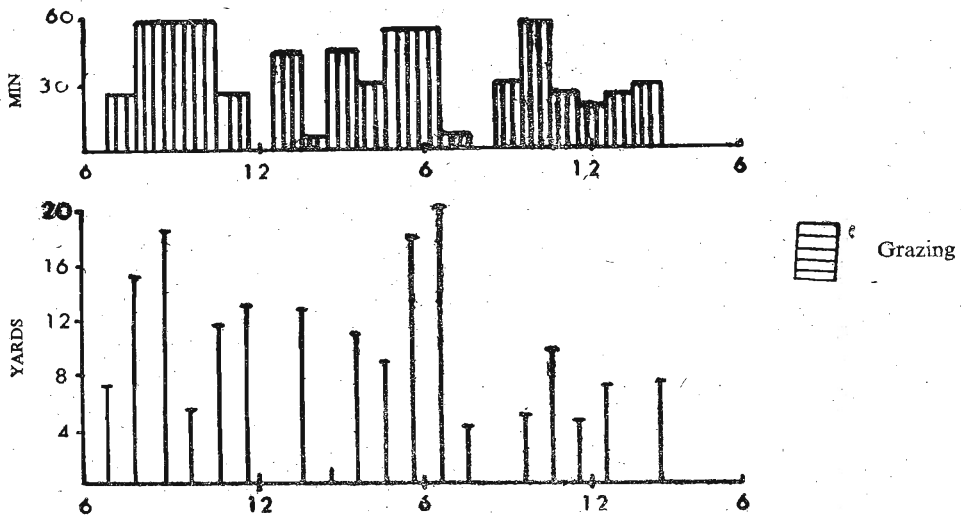


Figure 3. Relationship between distance travelled and grazing pattern in the field study.

4. Discussion

Judging solely from its crude protein content, the pasture consumed in these studies was of relatively good quality (Table 1). Nevertheless, animals exhibited noticeable selectivity while grazing as shown by the longer time spent on grazing.

The time spent grazing in the field (9.55 h/day) was in good agreement with the findings of Goldson,⁵ who reported that grade dairy cattle grazed for 9.6 h per day on pasture under tropical conditions. However, this grazing period appeared to be much longer than what available evidence from temperate regions indicates. Mugerwa *et al.*¹² also suggested that dairy cattle on East African pasture grazed for a much longer time than the evidence accruing from the temperate regions. As reported by Castle *et al.*^{1,2} the quality of pasture would have influenced the duration of grazing. When on good quality pasture animals have been found to graze for a short period and as the pasture deteriorates in quality and quantity, the duration of grazing activity is increased.^{9,15}

If the contention that a certain level of reticulo-rumen fill must be reached before the animals start the process of rumination and that the speed with which this level is attained depends upon among other things, on the rate of herbage consumption which, in turn is influenced by the herbage quality and the degree of selectivity, then the grazing to rumination ratio (G/R) should be an important parameter that would reflect herbage acceptability by the animal. The grazing to rumination ratio reported by Hughes and Reid¹¹ and Castle *et al.*¹ for cattle in temperate regions range from 0.6 to 1.0. Those observed in East African pastures for temperate cattle varied from 1.2 to nearly 2.0.¹² The present study also indicates that the grazing to rumination ratio for temperate cattle in the mid-country of Sri Lanka is similar to that of temperate cattle in East African pastures. The ratio of 1.47 for a zero-grazing system and 1.34 for a free-grazing system therefore reflects the intrinsic differences between temperate and local forages.

Total rumination time is closely associated with the total food intake.⁸ Therefore, a higher grazing to rumination ratio in the barn study would suggest a low pasture dry matter intake by the animals. However, the dry matter consumption by the animals in the barn study was according to expectations. It is, therefore, possible that the grazing animals had a higher dry matter intake than those in the barn.

There was a significant difference in grazing activity between individual cows in the field study. However, no significant difference was found in the zero-grazing activity among cows in the barn study. All animals zero-grazed simultaneously for 6.29 h (71.8% of the total zero-grazing time), while in the pasture, simultaneous grazing occurred only for 4.04 h (42.3% of the total grazing time), suggesting a greater tendency for group activity when housed in a barn.

As a result of less time being spent on grazing, rumination and milking, animals in the barn showed more idling time than those in the field. This coupled with the higher lying down time indicate that the animals in the barn were able to obtain their feed requirements with a smaller expenditure of energy in comparison to those grazing in the field. Thus, the zero-grazing system of management can be considered a more efficient method of obtaining maximum benefit out of the pasture.

There appeared to be highly significant correlations between voluntary dry matter intake and body weight and rate of dry matter intake and body weight ($P = 0.05$), suggesting that both rate of intake and voluntary intake of dry matter are closely related to body weight (Figure 4).

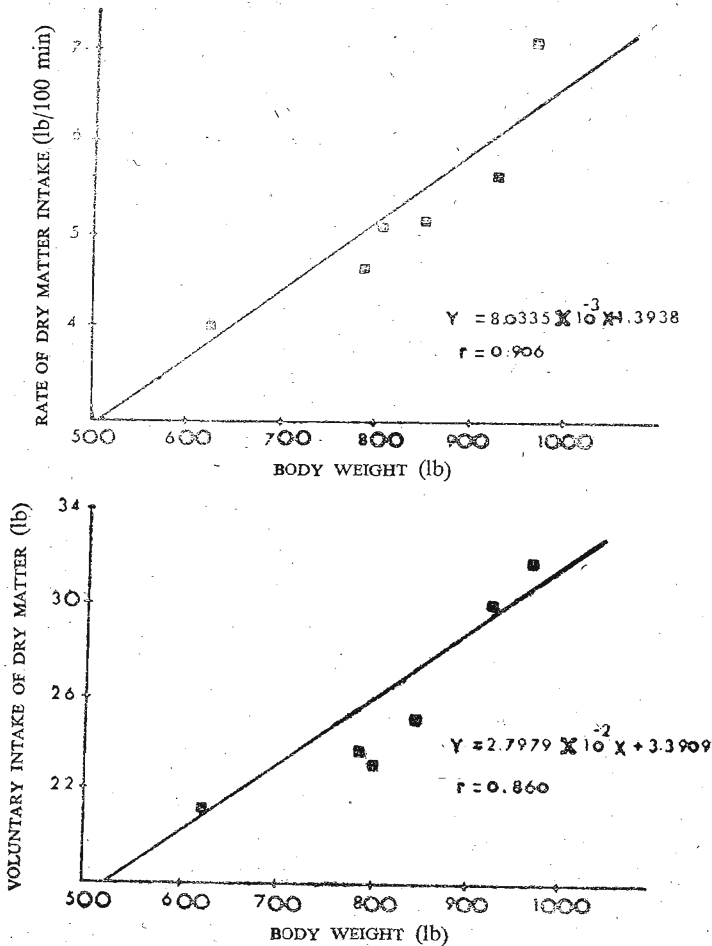


Figure 4. Relationship between rate of dry matter intake and body weight and voluntary dry matter intake and body weight.

The distance walked by a cow during 24 h period appeared to be about half of that reported by Hancock⁷ and Castle.¹ As suggested by Hancock⁷ it is rather difficult to interpret the factors that may influence walking because of their very number and diversity. However, it is known that grass of poor palatability increases the distance walked by animals. When interpreted this way, it appears that the pasture, animals had access to, was of a high quality. This could also be substantiated by the relatively high crude protein and the low crude fibre content of the *Brachiaria* pasture that was grazed.

The general pattern of activities of dairy cattle at pasture as observed in the mid-country of Sri Lanka seems to be similar to those of temperate areas. However, the absolute duration of grazing was much more protracted than in the temperate region. In the present study, the exotic dairy cattle grazed 537 minutes (39.8%) out of 24 hours.

The observation regarding day and night activities made in these studies are in agreement with studies of similar nature carried out in many tropical climates. Both studies indicated that the greater proportion of effective grazing is accomplished during daylight hours. The figures varying between 60% to 70% reported here are comparable with those of Goldson's⁵ 67% and Mugerwa's¹² 60% for grade dairy cattle in Africa. In contrast to the daytime grazing habit, animals under both conditions of management spent most of the night ruminating, suggesting that daytime grazing caused a sufficient rumen-fill to initiate the process of rumination.

In conclusion, it can be tentatively suggested that dairy management systems and practices in the mid-country of Sri Lanka must ensure that animals are allowed the maximum possible time to free-graze or zero-graze during daylight hours, especially when herbage is of marginal quality. But from the point of view of attaining maximum dry matter intake it is also important to provide sufficient feed or allow animals to graze for a short period (about one hour) during the night since there appears to be at least one peak of grazing during the night for both barn as well as field systems of management.

On the basis of these observations, it seems essential that morning milking be accomplished as early as possible and afternoon milking be completed within the shortest possible time, so as to allow the animals maximum possible daylength for grazing or zero-grazing.

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Appendix Table 1—Weather Data

Time (h)	Barn Study		Time (h)	Field Study	
	Dry bulb Temperature °C	Relative Humidity %		Dry bulb Temperature °C	Relative Humidity %
6.00 a.m.	21.5	89	6.00 a.m.	20.8	94
7.00	22.0	95	7.00	21.5	90
8.00	22.8	92	8.00	21.8	89
9.00	24.0	81	9.00	20.8	88
10.00	26.5	70	10.00	21.5	86
11.00	27.0	63	11.00	21.8	85
12.00	27.5	63	12.00	21.4	89
1.00	27.5	63	1.00	20.9	89
2.00	27.0	66	2.00	20.9	89
3.00	27.5	63	3.00	21.0	87
4.00	28.0	63	4.00	20.7	86
5.00	25.0	77	5.00	20.5	88
6.00 p.m.	24.0	81	6.00 p.m.	20.2	88
7.00	24.0	81	7.00	20.0	90
8.00	23.0	85	8.00	20.1	87
9.00	23.0	85	9.00	20.4	83
10.00	23.0	85	10.00	20.4	88
11.00	22.5	85	11.00	20.4	86
12.00	22.5	90	12.00	20.4	85
1.00	21.5	93	1.00	20.3	87
2.00	21.5	93	2.00	20.3	89
3.00	21.8	97	3.00	20.3	92
4.00	21.8	85	4.00	20.5	89
5.00	21.5	88	5.00	19.8	94
6.00 a.m.	21.5	88	6.00 a.m.	19.8	94

Rainfall—80.4 mm/48 h

Rainfall—43.6 mm/48 h

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