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Original article

Cattle feeding behaviour at pasture: a methodology related to on farm measurements

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Abstract — In order to study the effects of herbage allowance on cattle behaviour activities on the farm, some methodological aspects had to be defined. Two sets of observations have been conducted on farm using a beef suckler herd containing 24 cows and managed in a rotational grazing system including a total of 6 paddocks. Behaviour activities were recorded on two successive paddocks. In set 1, the herd activities were recorded every 5 min in daylight and 15 min at night for the first two days on the two paddocks. In set 2, ten cows were individually identified among the same herd. On the first and the last day on the two paddocks, daylight activities were recorded with 5-min frequencies. From these individual observations, total grazing and ruminating duration were calculated, simulating records every 5, 10, 15 and 20 min. In set 1,76% of the total grazing and 28 % of the total ruminating activities occurred in daylight. Grazing started at dawn and finished at dusk. In set 2, grazing activity followed the same pattern as in set 1 in daylight. Whatever the frequency of the records, grazing and ruminating time were not significantly ($P > 0.05$) different. However the 10 min frequency gave fewer and lower individual differences than the 15 and 20 min frequencies, compared to the original record (5 min). It is concluded that visual observations of cattle managed in a rotational grazing system can be readily undertaken at the farm level with 5 to 20 min frequencies.

cattle / pasture / feeding behaviour / methodology

Résumé — Comportement alimentaire des bovins au pâturage : méthodologie appliquée aux mesures en ferme. Afin d'étudier ultérieurement en ferme les effets du disponible fourrager sur le comportement au pâturage des bovins, certains aspects méthodologiques devaient être précisés. Deux séries d'observations ont été effectuées sur un troupeau de 24 mères allaitantes conduites en pâturage tournant comprenant 6 parcelles. Le comportement des animaux a été enregistré sur deux parcelles successives. Au cours de la première série d'observations les activités du troupeau ont été enregistrées les deux premiers jours de présence sur chaque parcelle avec une fréquence de 5 min le jour et de 15 min

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la nuit. Dans la deuxième série d'observations, 10 vaches étaient identifiées individuellement au sein du même troupeau. Les activités individuelles diurnes ont été enregistrées le premier et le dernier jour de présence du troupeau sur les deux parcelles, avec une fréquence de 5 min. Les durées totales de pâturage et de rumination ont été calculées sur cette base, en simulant des fréquences d'observation de 5, 10, 15 ou 20 min. Au cours de la première étude, 76 % de l'activité de pâturage et 28 % de l'activité de rumination se déroulaient le jour. Le pâturage débutait à l'aurore et s'interrompait au crépuscule. Dans la deuxième étude, la répartition des activités diurnes de pâturage et de rumination ont suivi le même profil que dans la série 1. Quelles que soient les fréquences d'observation utilisées, les durées de pâturage ou de rumination n'ont pas été significativement différentes ($P > 0,05$.) Cependant les mesures effectuées avec la fréquence de 10 min ont donné des écarts individuels plus petits et moins nombreux que les fréquences 15 et 20 min, par rapport à l'enregistrement de base (5 min). En conclusion, il est possible d'enregistrer visuellement les activités du comportement des bovins dans un système de pâturage tournant, avec une fréquence d'enregistrement de 5 à 20 min.

bovins / pâturage / comportement alimentaire / méthodologie

1. INTRODUCTION

When animal behaviour is observed under natural conditions, measurements are normally undertaken through human observation. However the methodology must be adapted to the environment and farm activity. All these aspects have been described by Hodgson [4].

On the Reunion Island, climate variations and herbage allowances are particularly important factors for grazing cattle, because they are generally managed in a rotational grazing system throughout the year. In order to conduct additional cattle behaviour studies on the farm, several methodological aspects had to be solved: frequency recording of activities, day of measurements, feasibility of night measurements. Thus two sets of observations were conducted to determine optimal conditions for animal measurements.

2. MATERIALS AND METHODS

Observations were conducted during the cold season (July and August 1995) at a beef cattle private farm situated at 650-m altitude.

2.1. Site and system

Cattle were managed in a rotational grazing system of six paddocks of 0.58 to 1.1 ha with a total area of 5.3 ha. The main forage species were kikuyu (*Pennisetum clandestinum*). Paddocks were organised around a distribution platform with a drinking trough. The platform was used for moving animals from one paddock to another and for distributing concentrate (1-kg cereal grain mixture every morning). The rotational system consisted of a mean 30 day cycle. Both sets were conducted on two successive paddocks A and B of 0.67 and 0.9 ha respectively. These paddocks were selected for the ability to observe animals easily with minimum movements for the two observers. The total number of grazing days on paddocks A and B in July and August were 5 and 7 and 5 and 4 respectively. Before being on paddock A, animals were on a paddock of 1.1 ha for 7 days.

2.2. Herd characteristics

The herd was constituted of Limousin (L), Aquitaine Blond (B) and crosses L × B cows and one bull (L). The average live weight of the cows was 533 kg ± 65 kg.

2.3. Animal observations

The objectives of the first observations (set 1) were to determine the grazing and ruminating patterns and whether observations could be undertaken under farm conditions and to investigate if night observations were feasible. Set 1 was conducted in July. All animals were observed during the first two days following movements to both paddocks A and B. The observations were conducted continuously from sunrise of the first day until sunrise of the third day. Grazing, ruminating, resting, walking, and drinking activities were recorded. The number of cows engaged in one of the above activities was recorded every 5 min during daylight and every 15 min during the night. At night, the animals were observed using a powerful flashlight and binoculars.

The objectives of set 2 were to determine the appropriate frequency of observations 5 (F5), 10 (F10), 15 (F15) or 20 (F20) min under four different situations: on the first and the last day on two paddocks (A and B). The observations were conducted in August on the same herd as used in set 1. Ten suckling cows (dry and non-pregnant or less than 6-month pregnancy) were selected for individual observations. Cows were individually identified with a number painted on each flank and side of their hindquarters. Observations were undertaken in daylight only. Animal activities, grazing (G), ruminating (R), resting (S) and other (O), were recorded on the basis of a 5 min frequency.

In order to compare the different observation frequencies, duration activities for each marked cow were calculated assuming observation frequencies of 10, 15 and 20 min calculated from the original 5 min records.

In both sets 1 and 2, the farmers' activities, weather conditions and any other possible disturbing events were also recorded. Observers were always visible to the animals.

2.4. Statistical analysis

In set 2, according to the method proposed by Rook and Huckle [6], for every four observations, the kappa coefficient of agreement [7] was used as a coefficient of synchronisation [6]. This coefficient indicates whether an activity is synchronised or solely due to chance. A table of 5 min × activities was formed. Each cell contained the number of cows engaged in a particular activity for 5 min. Consequently, the row sums are all equal to the total number of cows (10). If there was perfect synchronisation of activities, one cell in each row would equal 10 and the others 0. On the contrary, if activities occurred randomly, the number in each cell in a row would be proportional to the column totals [6].

The frequencies of observations were compared using the non-parametric test of Friedman. This test was chosen because samples were not independent and it was adapted for such data analysis [8].

Statistical analyses were performed with STATISTICA [9].

3. RESULTS

Mean minimum and maximum temperatures recorded for July and August were respectively 12 ^{o}C and 23 ^{o}C. During set 1, precipitation was 30 mm from the afternoon of the second day until the next day on paddock A. On paddock B it did not rain during the recordings. In set 2, precipitation (28 mm) occurred only on the first day on paddock A.

3.1. Animal behaviour

In both sets, cows were sometimes very close to the observers (less than one metre), only separated by a fence.

3.1.1. First set of observations

In both paddocks A and B, grazing activity started with dawn and stopped with dusk (Fig. 1) and the general grazing pattern was the same on both paddocks. Cows drank almost exclusively in daylight. Grazing activity was mainly concentrated in daylight (Fig. 1) with more than 75% of the total grazing time, whereas rumination was mainly concentrated at night. Resting occurred mainly at night. On paddock A, second night activities could not be recorded because heavy rain started late in the afternoon and no shelter was available at this time for the night observations. Rain did not disturb animal activity (mainly grazing) which stopped only with dusk. On both paddocks A and B, grazing started on the first day as soon as the farmers moved the

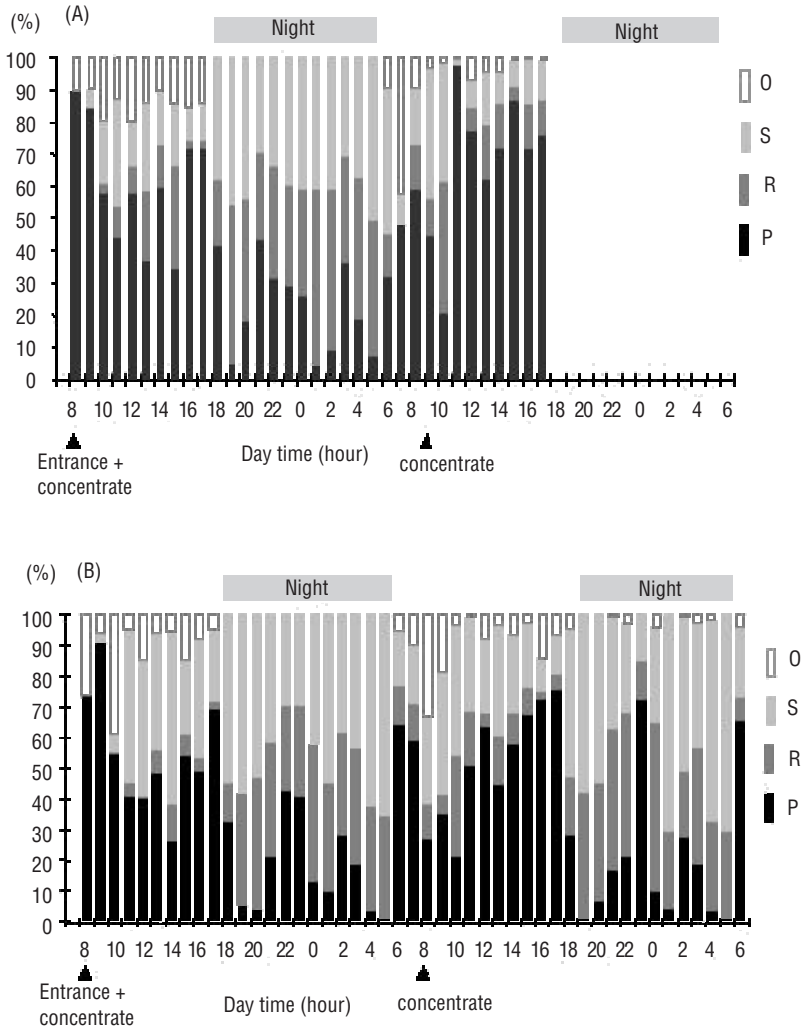

Figure 1. Livestock behaviour the first two days on paddock A and B. P: Grazing; R: Ruminating; S: Resting; O: Other activities.

animals to the paddock (Fig. 1), distributing concentrate in the meantime. Cattle ignored the concentrate distribution and rushed to the new paddock, actively grazing with frenzied behaviour. They walked while grazing and moved frequently from one site to another. This behaviour lasted about two hours and was followed by a resting and quiet period. On this day, less than 60% of the herd grazed in the afternoon and stopped 15 to 30 min after sunset. On the second day in the morning, grazing intensity was less important and animals moved to the platform to eat the concentrate, when the farmers came. The grazing activity in the afternoon was more important than on the first day. There were two main grazing activities: early in the morning and in the afternoon. During the night, it took some time to distinguish rumination from resting with lying cows. With a frequency of 15 min observations, the observers could stay awake without too much difficulty between two sets of observations.

3.1.2. Second set of observations

3.1.2.1. Behaviour activities

During the first day on paddocks A and B, the cows spent 75% and 60% respectively of the total observation time grazing. On the last day, they spent 68% and 70% respectively. Ruminating activity was always low in the four situations.

On the first day on both paddocks A and B, the cows had the same behaviour as described for the previous study (Fig. 2). On the last day, from dawn to the farmers' arrival, the cows did not graze at all (A) or a little (B) and were mostly waiting close to

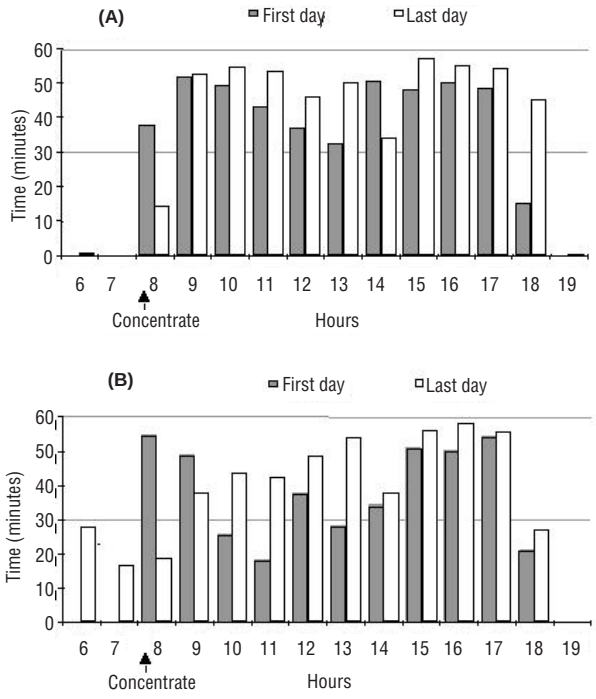

Figure 2. Grazing time activity the first and the last day on paddocks A and B.

the platform. Then, after the concentrate was offered and the farmers had gone, the grazing activity started intensively and remained high almost all over the day until complete darkness (Fig. 2).

For the four observations, we found kappa values ranging from 0.60 to 0.75. The statistical test proposed by Siegel and Catellan [7] gave four highly significant ($P < 0.001$) values indicating well synchronised activities.

3.1.2.2. Observation frequency

Grazing and rumination time, were not statistically ($P > 0.05$) different (Tab. I) whatever the frequency of records (5, 10, 15 or 20 min) used and in any situation. However, when we gathered the four observations, we found that F10 had an individual grazing time close to that observed with F5. The biggest difference was 25 min in one case. On the contrary, when F15 or F20 was used, individual grazing time differences were higher with maximum values of 45 and 65 min respectively.

4. DISCUSSION

Except for the first day on a new paddock, grazing started a few min before sunrise. This is in agreement with previous observations [1, 4]. In both sets, the day when animals had to be moved to the new paddock, they were standing close to the distribution platform, ruminating or idling but not grazing. They apparently were waiting for a move to the next paddock. We did not find any references to such behaviour.

Cattle livestock at pasture have a social behaviour, since they are gregarious animals. In our present study, we observed that cows grazed and moved altogether in the same direction or clustered. We observed a synchronisation of grazing activity, particularly early in the morning and in the afternoon. This is confirmed by the highly significant kappa coefficient of synchronisation and is in agreement with the results of Rook and Huckle [6]. This result confirmed that it is appropriate to study animal behaviour on farms with animals kept in groups as pointed out by Rook and Huckle [6]. The observation of animal activities at pasture with observers moving close to the paddock did not disturb animal behaviour since they sometimes grazed very close to the observer. This observation is in agreement with Hodgson's [4] recommendations on direct observation.

In the present rotational grazing system, on the last day on the paddock, the animals seemed to wait for the farmers to move them to the following paddock. If they were

Table I. Effect of the frequency of observations (5, 10, 15 or 20 minutes) on grazing and ruminating time of ten marked cows observed the first day (in) and the last day (out) on paddocks A and B.

	5	10	15	20	SD	Significance
Grazing						
A in	456	454	458	448	56	NS
A out	487	490	483	480	49	NS
B in	415	415	425	410	34	NS
B out	509	506	504	504	58	NS
Rumination						
A in	33	31	32	36	26	NS
A out	15	15	17	14	15	NS
B in	48	47	42	52	21	NS
B out	71	66	66	70	25	NS

(NS = $P > 0.05$)

moved to the new paddock (B) they ignored the concentrate offered and started grazing actively. Similar behaviour has been observed on strip grazing management with calves [5]. Animal behaviour could express limited amounts of forage availability in the previous paddock on the last day, or a limited quantity of green leaves available for grazing as observed by Hendricksen and Minson [3]. Grazing intensity is high with more than 55 min the first hour on the new paddock (Fig. 2). This behaviour has been observed when cattle were moved every day on a limited area [1, 5].

No significant difference was found at intervals of 5, 10, 15 or 20 min, which is in agreement with previous results [2]. However, F15 and F20 gave some high differences for grazing time and to a lesser extent for rumination. In spite of non-significant statistical results, we would retain a 10 min frequency for further observations. This frequency would also enable, between two records, other behaviour measurements such as bite rate.

5. CONCLUSION

This study, conducted in field conditions, demonstrated that it is feasible to make direct observations for animal behaviour recording. One observer is capable of rapidly observing the activity of 10 animals individually identified within a herd. Among the frequencies tested, any one can be used. However, 10 min frequency would be selected for later observations because it gives the smallest grazing and ruminating time differences compared to F5 and would enable other behaviour measurements. At night, only group activities can be recorded with a 15 min frequency.

In a rotational grazing system, when animals are moved in the morning from one paddock to another, behaviour observations must be undertaken the second day in order to record full day activities and to enable a comparison between different seasons, herbage allowances and other factors.

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