

THE EFFECT OF HAY SUPPLEMENTATION AND PASTURE AVAILABILITY ON PASTURE SELECTION AND SUBSTITUTION

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SUMMARY

The effect of hay feeding on pasture selection and substitution was studied using cows' fitted with oesophageal fistulae in a 4 x 4 latin square experiment at a low and high level of pasture availability. The cows were strip-grazed at both levels of pasture availability and were offered 20 kg DM/cow/day of fresh pasture. Cows receiving hay were offered 3 kg of chaffed hay twice daily. The *in vitro* digestibility of the extrusa material collected from each cow was used as an index of pasture selection and used in conjunction with chromic oxide to estimate pasture intake and substitution.

The mean *in vitro* digestibilities of the pasture selected by the cows grazing the low level of available pasture with and without hay and at the higher level of pasture availability with and without hay were 78.1, 76.8, 64.4 and 65.2% DOM (LSD = 5.2; $P < 0.05$) respectively. The estimates of digestible organic matter intake were 5.75, 6.65, 4.27 and 4.80 kg DOM/cow/day (LSD = 0.88; $P < 0.05$) for the respective treatments of low pasture availability with and without hay and high pasture availability with and without hay. The mean intakes of hay for the low and high levels of available pasture were 1.18 and 1.30 kg DOM/cow/day respectively.

Hay feeding did not affect the selection of pasture at either level of availability since the digestibility of the pasture selected by the cows fed hay was not different to that selected by cows not receiving hay. However hay feeding reduced the pasture intake of cows grazing at the higher level of available pasture by 18% compared with only 5% on the shorter and more digestible pasture at the lower level of availability. It was concluded that pasture quality could have a major effect on pasture substitution.

INTRODUCTION

The increasing cost of supplementary feeds warrants a closer study of the efficiency with which supplements may be utilized by the animal. Unfortunately, changes in animal productivity may not be a true gauge of the productive efficiency of a supplement in the grazing situation because of the degree of pasture substitution that may occur and therefore, it is essential to study pasture intake under these conditions. One of the most common methods used to measure pasture intake involves the use of the grazing animal fitted with an oesophageal fistula to determine digestibility of the pasture being consumed in a manner similar to that described by Hodgson and Rodriguez (1971). However, there is little information on the effect that feeding a supplement may have on the selection and digestibility of the pasture that is consumed by the grazing animal. Consequently the experiment reported was designed to determine the effect of that level of pasture availability and hay feeding has on pasture selection and intake by grazing cows fitted with oesophageal fistulae.

MATERIAL AND METHODS

Eight dry cows with oesophageal fistulae were used in a replicated 4 x 4 latin square experiment. The four treatments that were applied to all cows over 4 seven-day experimental periods were:

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Low level of available pasture	(LP)
Low level of available pasture plus hay	(LPH)
High level of available pasture	(HP)
High level of available pasture plus hay	(HPH)

The cows on each level of available pasture were strip-grazed as a group and were offered fresh pasture each day at the rate of 20 kg DM/cow/day. The mean level of pasture available was 3100 and 2000 kg DM/ha for the high and low levels of pasture availability respectively. The cows receiving hay were offered 3 kg of chaffed hay in individual stalls at 0700 and 1600 h each day and the amount of hay consumed was recorded at each feed. All cows were dosed twice daily at feeding times with gelatine capsules containing 20 g of colour-coded granulated alkathene and 10 g Cr_2O_3 from 10 days before the experiment began until the completion of the experiment.

During the last three days of each seven-day experimental period, pasture samples were collected from the oesophageally-fistulated cows at 1100 h. These samples were immediately subsampled, frozen and stored at -15°C ; the subsamples were later freeze-dried and bulked over the three day period for each individual cow. Faecal samples were taken from the rectum at 0800 and 1630 h, dried and then bulked over the three days. Faecal samples were also collected from dung pats each morning from the previous grazing area, individual pats being identified by the colour of the granulated alkathene. These samples were also dried and bulked for each cow over the last three days of each experimental period.

The area of pasture offered to each group of cows was determined each day by using a rising-plate pasture meter (McGowan and Earle 1978). Ten pasture samples were collected from each strip before grazing and used for ash and dry matter determinations.

Statistical analysis was by analysis of variance appropriate to a 4 x 4 latin square replicated twice.

Determination of intake

The concentration of Cr_2O_3 in the faeces was determined by atomic absorption spectrophotometry, corrected for incomplete recovery of Cr_2O_3 and used to estimate faecal output for each animal. The percentage recovery of Cr_2O_3 (92.3%) was used to correct faecal concentration; this figure was determined from a concurrently conducted pen experiment (Eldridge and Kat 1980).

The in vitro digestibilities of hay and pasture samples were determined by the method of Tilley and Terry (1963). The in vitro digestibilities of oesophageal extrusa samples of pasture were corrected for saliva contamination using the method described by Langlands (1973).

Total intakes of DOM were calculated from estimates of faecal output, digestibility and the actual intake of hay. Intake and faecal output data were calculated on a metabolic live weight basis ($\text{kg LW}^{0.75}$) because of the wide range in cow live weight (303 to 620 kg) and then adjusted to the mean $\text{LW}^{0.75}$ for presentation of results.

RESULTS

The mean live weight of the cows over the course of the experiment was 477 kg or $102 \text{ kg LW}^{0.75}$ and the cows grazing at both levels of pasture were offered $16 \pm 1.5 \text{ kg DM}$ (mean $\pm$ SD) of pasture/cow/day. The mean in vitro digestibility of the hay offered was 54.5% DOM and ranged from 50.3 to 57.4% DOM.

Selection of pasture

The pasture selected by the cows grazing at the lower level of availability was significantly more digestible ($P < 0.05$) than that selected at the higher level of pasture availability. However, there was no evidence that hay feeding affected pasture selection (Table 1).

TABLE '1 The in vitro digestibility of pasture selected by cows, total intake, hay intake, and pasture intake for treatments low level of available pasture (LP), LP plus hay (LPH), high level of available pasture (HP) and HP plus hay (HPH).

	LP	LPH	HP	HPH	LSD ⁺
In vitro digestibility (% DOM)	78.1	76.8	64.4	65.2	7.2**
Intake (kg DOM/cow/day)					
Total	5.75	6.65	4.27	4.80	0.88*
Hay		1.18		1.30	-
Pasture	5.75	5.47	4.27	3.50	0.84*

⁺LSD = least significant difference, ** $P < 0.01$, * $P < 0.05$

Faecal output

The faecal output estimated from rectal grab samples was 1.60 ± 0.41 kg OM/cow/day compared with 2.08 ± 0.84 kg OM/cow/day estimated from pat samples. Regression analysis indicated that the sampling methods were not correlated, however it was noted that the estimates of faecal output for one animal were markedly different for the two methods of sampling and if this animal was omitted from the analysis, the methods of sampling were significantly correlated ($R^2 = 0.396$; $P < 0.05$) with means of 1.66 ± 0.42 and 1.86 ± 0.51 kg OM/cow/day for rectal and pat samples respectively. Since there was little difference in variance between the methods of sampling, it was considered that there was little advantage in using the more tedious method of pat sampling and consequently estimates of pasture intake have been calculated from rectal grab samples.

Feed intake

Although there was little difference in the actual intake of hay between treatments (Table 1), hay feeding significantly increased ($P < 0.05$) the total intake of DOM of those cows grazing at the lower level of pasture availability but did not markedly increase the intake of cows grazing at the higher level. Both total and pasture intakes of cows grazing the LP and LPH treatments were significantly greater ($P < 0.05$) than for cows grazing the HP and HPH treatments (Table 1).

DISCUSSION

The pasture at the higher level of availability was longer and more mature than that at the lower availability and this was reflected in the lower digestibility of the pasture selected by the cows grazing this sward. Although the apparent intakes of pasture in this experiment are low when compared to those recorded by Combellas and Hodgson (1979) for milking cows and Reardon (1977) for steers using a similar strip-grazing method to that used in this experiment, the 13 unit difference in pasture digestibility could well account for the significant difference ($P < 0.05$) in pasture intake between the two levels of availability. Grazing technique may have also contributed to some of the difference in pasture

intake since Combellas and Hodgson (1979) found that intake decreased with increasing pasture availability at the same herbage allowance even when there was no difference in pasture digestibility.

Although the oesophageally fistulated cows appeared to have some difficulty in swallowing hay and consumed only about 50% of that offered, the amount of hay eaten represented 18 and 28% of the total dietary intake for the LPH and HPH treatments respectively. Yet despite the difficulties that the cows had in consuming hay and the large differences in digestibility between the two pastures, hay feeding had no apparent effect on the selection of pasture at either level of pasture availability. Hay feeding increased the total intake of those cows grazing only the shorter more digestible pasture (LP and LPH). This lack of increase in total intake due to hay feeding on the less digestible pasture (HP and HPH) would appear to be primarily due to the degree of pasture substitution that occurred with hay feeding at the different levels of pasture availability. The percentage reduction in pasture intake on the shorter, more digestible pasture was only 5% when hay was fed compared to 18% at the higher level of pasture availability. As both groups of cows were offered similar amounts of pasture dry matter per cow per day, it would seem that pasture quality has a major influence on the degree of pasture substitution that occurs during the supplementary feeding of hay.

There can be little doubt that further study of the causes and extent to which pasture substitution may occur in the grazing situation is required in order to determine the productive efficiency of supplements. It is therefore particularly important that the results of this experiment and the related pen study (Eldridge and Kat 1980) show that the digestibility of pasture selected by cows supplemented with hay is not likely to differ from that selected by unsupplemented cows and that there is no associative effect on the digestibility of pasture by the hay. Consequently, if hay is fed as a supplement and the intake and digestibility of the hay is known, faecal output can be used as an index of the relative changes in pasture intake due to the level of hay feeding and the productive efficiency of the supplement, thus eliminating the errors that can be involved in estimating the digestibility of the pasture being consumed by the animal.

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