Intake and Diet Selection by Sheep Grazing Grass/Clover Patches

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ABSTRACT

The effects of the spatial dispersion of ryegrass (*Lolium perenne* L) and clover (*Trifolium repens* L), at the feeding station scale, on diet composition and feeding behaviour were studied for sheep. There were no significant changes in diet composition with changes in the spatial dispersion of sward components. Bite size, bite rate and intake rate did increase as the species became more aggregated.

KEYWORDS

Sheep, grass, clover, intake, diet composition, feeding station

INTRODUCTION

Foraging herbivores make decisions about where to forage, what to forage on and how to forage at a range of scales, from leaves to landscapes (Senft et al., 1987; Gordon & Illius, 1993). These decisions determine the intake rate of forage and the composition of the diet. The ability of animals to exploit the heterogeneity in the environment is primarily determined by the spatial dispersion of the food plants which affects the rates at which the herbivore can consume food because of the process of searching and selecting components from the vegetation on offer.

Whilst there have been several studies of the effects of the spatial dispersion of resources on diet composition there have been none showing the response of herbivores to the dispersion of food items at the level of the feeding station (i.e. the area covered by the herbivore's search without moving its feet, Senft et al., 1987). The aim of this research was to determine the effect of the distribution of plant species on diet selection and intake rate in sheep within a food patch.

MATERIALS AND METHODS

Plastic seed trays were filled with 3l of a mixture of peat-based compost and vermiculite to provide a firm rooting medium. The seed trays measured 320 x 120 x 45mm, giving a sown area of 0.029m^2, with 32 pull-out cellular modules each 30mm x 30mm in size. 400 trays were sown with white clover and 400 trays were sown with perennial ryegrass at a rate of 10 seeds/module. The trays were housed in a greenhouse allowing control over temperature, fertiliser, watering and cutting regimes during germination, establishment and growth.

After sward establishment, the trays were cut to 3 cm above the peat surface every week for 3 months. One week prior to the experiment all the ryegrass swards were trimmed to 5cm. Immediately before the experiment the modules were removed from the trays, pairs of trays were placed side by side, and the modules rearranged to create 4 patterns of distribution of ryegrass and clover (Fig. 1). The paired trays give a grazed area of 0.058m^2, with equal area coverage of the two plant species.

Six mature wether oesophageal fistulated Scottish Blackface sheep, which had been trained in the procedures used in the trials, were presented with test swards (pairs of trays) under controlled conditions. A total of 288 trials were conducted; each sheep received each sward pattern/bite number (see below) combination twice. Before each trial the fistula plug was removed and a plastic collection bag attached to the animal's neck. The animal was allowed to take 10, 20, 30, 40, 50 or 60 bites from the sward and then that trial was terminated. The extrusa samples were removed from the collection bag and stored in plastic zip top bags at -20^{o}C.

The occurrence and timing of each bite within a trial was recorded manually on a hand-held portable computer. These data were analysed in order to summarise the total number of bites taken, the rate of biting, and the number and length of biting bouts within each trial. On occasion an animal paused during a trial and stopped chewing; since the inclusion of these pauses would cause underestimation of the maximum biting rate achieved, a pause of longer than 4 seconds was taken to be a non-grazing interval and excluded from the data.

The weight of herbage removed during the trial were measured by weighing the sward to the nearest 0.1g before and after each trial. Evaporative weight loss for each trial was estimated by concurrently weighing representative ungrazed swards at the start and end of each trial. Weight losses from grazed swards were subsequently corrected for evaporative weight loss. Bite weight (BW, mgDM) was estimated from the dry weight of plant material removed and the total number of bites taken by an animal during the trial. The instantaneous intake rate was calculated from the product of the rate of biting and the dry weight of the bite.

The proportion of grass and clover in the extrusa and herbage was determined using the n-alkane method on the herbage and extrusa samples following a modified version of the procedure outlined in Mayes, Lamb and Colgrove (1986) (R.W. Mayes, pers. comm.).

Mean and standard error of difference values of diet composition, bite size, bite rate and intake were estimated using analysis of variance using the Genstat 5.2 programme (Genstat 5 Committee, 1993). The animal was used as the blocking factor in the analysis in order to overcome the problem of pseudoreplication.

RESULTS AND DISCUSSION

For all analyses there was no significant interaction between the sward pattern and bite number treatments. Therefore, the means for the sward pattern treatments, across bite numbers are given here.

The sheep consumed approximately equal proportions of grass and clover across all sward pattern treatments (Table 1; $F_{3,5}$ =0.382; NS). It, therefore, appeared as though the sheep were not demonstrating a strong preference for or against either one of the two components of the sward (see Illius et al., 1992; Newman et al., 1992). There was a significant change in bite size (Table 1; $F_{3,5}$=4.04; P<0.01) and bite rate (Table 1; $F_{3,5}$=2.98; P<0.05) as the grass and clover became more aggregated (sward pattern treatments P1 - P4). This resulted in a significant increase in intake rate (Table 1; $F_{3,5}$=5.94; P<0.001) as the aggregation of grass and clover increased.

These results suggest that the sheep maintained their diet composition with changes in the spatial dispersion of grass and clover, and they increased their rate of intake as grass and clover were clumped into larger patches.

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Table 1

Changes in the proportion of grass in the diet, bite size, bite rate and intake rate under treatments which comprised differences in the dispersion of clover and grass in the sward (see Fig. 1)

	Sward pattern				
	P1	P2	P3	P4	sed[x]
Prop. grass in diet	0.431	0.403	0.443	0.470	0.0383
Bite size (gDM)	0.056	0.053	0.059	0.067	0.0043
Bite rate (Bites.s^{-1})	0.894	0.913	0.988	0.948	0.0337
Intake rate (gDM.s^{-1})	0.051	0.049	0.059	0.064	0.0040

[x] Standard error of difference of means

Figure 1

Dispersion of grass and clover in artificial swards offered to sheep