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Intake and liveweight change of hoggets grazing pastures differing in dead matter content in autumn

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ABSTRACT

Intake and liveweight change of 7-month hoggets was measured when *ad lib* grazing steep hill pastures containing 10, 40 and 50% dead matter above 2 cm, in autumn. Two groups of 24 sheep from a "biological" and a "conventional" farming system were used in the trial. Digestible organic matter intake/kg liveweight and liveweight change were affected by dead matter content ($P<0.05$) but were similar for biological and conventional hoggets ($P>0.1$) despite high faecal egg counts in biological sheep. Better performance on high quality pasture was attributed to a higher organic matter digestibility and lower dead matter content in the diet, possibly due to the greater accessibility of green matter in the grazed horizons.

Keywords: intake, hoggets, hill country, pasture quality, gastrointestinal parasites.

INTRODUCTION

The growth rate of hoggets in hill country in autumn is reported to be limited by the poor quality of pastures (Scott *et al.*, 1976). This can be further jeopardised by gastro-intestinal parasitism which can depress intake (Bown *et al.* 1991) and the efficiency of pasture conversion to animal production (Brunsdon, 1966). The effect of sward structure and dead matter content on voluntary intake and liveweight change of hoggets from conventional and biological farming systems was therefore investigated at the AgResearch Ballantrae Hill Country Research Station. The experiment reported in this paper describes the relationship between hogget performance, method of alternative parasite management and sward parameters under medium to steep hill country conditions.

METHODS

Pastures

Three 0.5 ha paddocks were prepared to differ in pasture quality and structure, and nominal dead matter contents of 10, 40, and 50% above 2 cm by hard or lax grazing management over the summer of 1992. The average slope of the paddocks ranged from 17° to 26° and each paddock had a northerly aspect. The paddocks were split, to allow for treatment duplication, and fenced to provide a pasture mass sufficient for 8 hoggets set stocked for 24 days at an *ad libitum* feeding allowance.

On days 1 (16 April), 12 and 24 (9 May) pasture mass was described using a rising plate meter (RPM) calibrated to each pasture type on each measurement occasion. Canopy height was also measured on 15 April, the day before animals were stocked in the paddocks, and on 9 May with an HFRO sward stick by taking 200 measurements of first contact height at 50 cm intervals along two 50 m fixed transects within each paddock.

Sward structure was described at 2 cm height intervals by taking duplicate 0.1 m^2 turfs of short, medium and long pasture from within each of the six paddocks on days 0 and 24. The average height of each turf was determined with a sward stick in the laboratory prior to harvesting the 2 cm horizons. The percent dry weight of legume, green matter non-legume and dead matter in each horizon was determined. Frequency distribution data of paddock canopy heights was used to "weight" structure data from harvested turfs to provide a description of the paddock botanical structure on a dry weight basis. These data were used to estimate the rate of disappearance of botanical components from sward horizons during grazing.

Animals

Twenty-four, 7 month Romney ewe hoggets from the "conventional" management farmlet and 24 hoggets of the same breed from the "biological" management farmlet at Ballantrae were used for the trial (Mackay *et al.*, 1991). Sheep were assigned to their groups and run together from 6 April, with *ad libitum* feeding on pasture similar to the 40% dead treatment, until 15 April. Hoggets were weighed unfasted at weekly intervals and following an overnight fast, on 16 April and 10 May.

Conventional hoggets had been drenched at weaning in January and monthly thereafter. Biological hoggets had re-

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ceived no drench. During the trial four biological hoggets were drenched because their liveweight had declined by >0.5 kg over the preceding week or their consecutive 3-week faecal egg count was >2,500 eggs per gram (epg) and rising.

On day 1 all hoggets were dosed with a Captec chromic oxide capsule (Parker *et al.* 1990). Faeces were collected daily from the rectum of sheep on days 6 to 9 (Period 1) and days 19 to 23 (Period 2). Within each period 5 g/day of dried faeces of each sheep were bulked prior to the determination of the faecal Cr concentration (Costigan and Ellis 1987).

Four mixed aged Romney wethers, with an established oesophageal fistulae (OF), were used to collect dietary samples from each paddock in both periods 1 and 2 for dry matter (DM) and organic matter (OM) digestibility analyses and botanical dissection. Animals were held in the yards for 1-2 hours prior to collection of OF samples. After 20 minutes of grazing OF samples were collected from neck bags tied to the sheep. Botanical composition was determined separately for each animal by identifying plant components at 200 fixed quadrat points in a water tray. *In vitro* digestibility (Roughan and Holland, 1977) was determined on a freeze dried composite sample from the four animals within each paddock for each period.

Statistical analysis

Data were analyzed using a split plot design with pasture quality treatments as the host factor and biological/conventional and periods as split factors. Animals were removed as a source of variance from the error term. Faecal egg count data were transformed ($\log_{10}$+1) before analysis. Data from the four biological hoggets that required drenching during the trial were excluded from the intake analyses.

RESULTS

Pasture

Herbage mass above ground level varied between 3,950 and 5,550 kg DM/ha with the RPM and between 6,000 and 6,300 kg DM/ha with the calibrated SS for the treatments at the start of the trial (Table 1). Compressed canopy height and pasture mass derived from both the RPM and SS methods, decreased during the trial, but residual masses remained above 2,000 kg DM/ha in all treatments at the end of the study. Agreement between the two methods of mass estimation was poor. Using structure data from above 2 cm only, 56; 34 and 20% of the green matter (as a percentage of all DM above 2 cm) was found in upper horizons (6-14 cm) of 10, 40 and 50% dead treatments respectively (data not presented). Data for pasture mass and composition below 2 cm was omitted because sheep apparently grazed little if any of the highly variable amount of herbage from within this horizon.

Organic matter digestibility of oesophageal samples (Table 2) was 5.9 digestibility units higher in April than in May, and declined with increasing dead matter content in the pasture. In Period 1 the OMD of the diet of sheep on the 40% dead treatment was inexplicably low and this had a large influence on the subsequent estimation of intake by hoggets on this treatment. Pasture composition (based on pasture structure analysis) and OF composition presented in Table 3 suggests that this problem relates to sampling procedures rather than a short term change in herbage digestibility. At the start of the trial the legume content was 23 and 12% of total DM above 2 cm in the 10 and 40% dead treatments respectively, compared with only 6% in the 50% dead treatment. The non-legume green component of the sward was markedly higher in 10% dead compared to the other treatments. As the content of dead matter increased the content of non-legume green matter showed little change in any of the treatments, but the legume content in the 10 and 40% dead treatments declined during the grazing period.

TABLE 1: Pasture height and pasture mass above ground level of the 3 pastures estimated from calibration equations for a rising plate meter (RPM) and sward stick (SS) at three sampling dates.

Pasture type[1]	Date	Sward height (cm) RPM	Herbage mass (kg DM/ha) RPM	Herbage mass (kg DM/ha) SS
10%	16 April	9.6	4,800	6,000
	24 April	7.9	4,050	-
	5 May	7.8	4,000	2,400
40%	16 April	11.3	5,550	6,300
	24 April	9.5	4,750	-
	5 May	8.9	4,500	2,800
50%	16 April	7.7	3,950	6,600
	24 April	7.8	4,000	-
	5 May	6.7	3,500	2,200

[1] Percentage dead matter in the pasture above 2 cm at the start of the trial.

TABLE 2: Mean organic matter digestibility (%) of oesophageal fistulae samples bulked between four sheep grazing each paddock (n = 2) within each pasture type in Period 1 (P1) and Period 2 (P2).

Pasture type[1]	Period P1	Period P2
10%	80.1	73.2
40%	72.6	70.3
50%	77.2	68.7
Mean	76.6	70.7

[1] Percentage dead matter in the pasture above 2 cm at the start of the trial.

Diet composition

Sheep showed a selection of non-legume green matter in Period 1, but displayed no selection of legume during the trial (Table 3). Sheep strongly rejected dead matter in the treatments with 40 and 50% dead in Period 1, but not in Period 2. At the lowest level of sward dead matter content, there was an indication of selection for dead matter by the OF wethers in both Periods 1 and 2, although content of dead matter in the diet remained less than in either of the other treatments.

Herbage intake

Conventional and biological hoggets had a similar level of daily intake (DOMI/kg liveweight), and this was higher in Period 1 than in Period 2 (Table 4). There was a significant

TABLE 3: Pasture (P) (above 2 cm) and dietary composition (D) in Period 1 (P1) and Period 2 (P2) (% DM basis).

	Pasture type[1] 10%						40%						50%					
	P1			P2			P1			P2			P1			P2		
	P	D		P	D		P	D		P	D		P	D		P	D	
Green (non-legume)	66	68	(+2)	69	62	(-7)	48	70	(+22)	50	52	(+2)	46	59	(+13)	52	51	(-1)
Legume	23	14	(-9)	10	06	(-4)	12	09	(-3)	04	01	(-3)	06	06	(0)	06	01	(-5)
Dead Matter	11	18	(+7)	22	32	(+10)	40	21	(-19)	46	47	(+1)	48	35	(-13)	42	48	(+6)

( ) Difference between % of component in the pasture an % in the diet. A positive value indicates animal selection and a negative value rejection.
[1] Percentage of dead matter in pasture above 2 cm at the start of trial.

decline in intake across treatments as dead matter content increased (14% P1; 28% P2; P<0.01). Dry matter intake for all animals in both periods averaged 913 g/day, but because Period 2 data were unbalanced following removal of the four drenched biological hoggets, a complex set of $LSD_{0.05}$ values resulted. For simplicity, only an approximate $LSD_{0.05}$ value is presented in Table 4.

TABLE 4: Digestible organic matter intake per kg liveweight (g DOMI/kg LW) of hoggets in Period 1 (21-24 April) and Period 2 (4-8 May).

	g DOMI/kg LW Period 1		Period 2
Conventional	24.1		20.1
Biological	21.2		21.1
$LSD_{0.05}$[1]		2.73	
10% Dead	26.0 a		22.2 a
40% Dead	18.9 c		20.8 a
50% Dead	22.9 b		17.4 b
$LSD_{0.05}$		3.34	

[1] Approximation of LSD (see text)
Means within column subgroups having the different letters are significantly different (P<0.05).

Liveweight and liveweight change

Conventional hoggets were 3.4 kg heavier than biological hoggets at the start of the trial but this difference was not significant (P>0.1) (Table 5). On average biological hoggets lost 0.51 kg over the 24 day trial period. In comparison the conventional hoggets gained 1.34 kg in weight (P<0.001). Liveweight loss by the biological hoggets was smallest for those on pastures with the least dead material. This pattern was similar for conventional hoggets where liveweight gain increased with increasing green matter.

Parasitism

The average strongylate faecal egg count of biological hoggets was higher (2,300 (epg) on both 2 and 24 April) than for conventional hoggets (400 and 200 epg, respectively) (P<0.001). On 26 April four biological hoggets required drenching.

DISCUSSION

The significant depression in both intake and liveweight change with increasing dead matter in the pasture on offer and

TABLE 5: Fasted liveweight at start of trial and fasted liveweight change (kg) of biological and conventional hoggets over 24 days.

Pasture type[1]	Liveweight (16 April) Biological	Conventional	Liveweight change Biological	Conventional
10%	24.9	28.7	-0.3	+2.1 a
40%	25.0	28.5	-0.6	+1.5 b
50%	25.1	27.9	-0.7	+0.5 c
$LSD_{0.05}$	1.76		0.28	

[1] Percentage of dead matter in pasture above 2 cm at the start of trial
Means within columns with different letters are significantly different (P<0.05).

in the animals' diet is consistent with other published data (Arnold, *et al.*, 1966; Guy *et al.*, 1981; Rattray and Clark 1984). Guy *et al.* (1981) found that hoggets in autumn selected a diet 13 digestibility units higher than that of the pasture on offer. They also found that hoggets ate feed of lower digestibility as the proportion of dead matter in the diet increased because of an increasing proportion of dead matter in the pasture. Furthermore, Clark *et al.*, (1982) found sheep had a strong preference for green grass and a strong dislike for dead matter, but neither preference nor rejection of legume material. Similar patterns were observed in the current trial between the lower diet quality in week 3 (Period 2) compared with week 1 (Period 1). This apparently occurred because of the reduced opportunity for selection, and the lower quality diet due to the lower availability of non-legume green in the pasture horizons of 40 and 50% dead treatments compared with the 10% dead treatment. The large range in pasture composition and structure in this trial reflects the range frequently found on hill country farms in autumn and our results confirm that feeding pastures poorly managed during the summer to young sheep will result in low levels of animal production.

However, at an *ad libitum* feeding allowance of pastures with a 10% dead matter content, the conventional hoggets on steep hill country were able to gain 90 g/day which is close to the 100 g/day target for hoggets at this time of the year (Geenty and Rattray 1987). Using Geenty and Rattray (1987) feeding standards these 28 kg animals, eating 1,079 g DM/day at 11.2 MJ metabolisable energy/kg DM could be expected to grow at approximately 75 g/day. It appears that the higher than expected performance reflects the animals' ability to have selected a diet of high quality from the upper horizons of the 10% dead pastures. They were apparently unable to exert this high level of selection on the 40 and 50% dead pasture treatments, particularly in Period 2, despite the pastures having more than 700 kg green DM/ha above 2 cm at the end of the trial. This aspect of grazing behaviour is worthy of further study given that DM allowance is used as a simple indicator of the level of voluntary intake by sheep. Bite size is positively related to pasture height through greater bite depth (Betteridge *et al.*, 1990). Thus the more uniform distribution of both total mass and of green matter between 6 and 14 cm in the 10% dead treatment, combined with the relative absence of dead matter compared to the other two treatments, would have enabled the sheep to take larger bites and therefore to achieve the higher recorded intake of DOMI/kg liveweight compared to the other treatment groups. But without data on biting rate and grazing time, this hypothesis cannot be tested.

The poorer performance of biological, compared to conventional hoggets, was not entirely related to a difference in intake since the difference between groups was estimated to be 7% and non-significant. All groups of animals were provided with sufficient pasture to achieve an *ad libitum* level of intake, and this reflected in an estimated daily DM consumption of between 3.1 to 3.7% of liveweight for the two groups on the three pasture types. Also the quality of feed on offer was the same for both groups.

These data are in conflict with those of Poppi *et al.* (1990) and Dynes *et al.* (1990) and Bown *et al.* (1991) who reported intake depression due to parasitism. In these trials the control animals were drenched weekly or bi-weekly from weaning and hence were virtually worm free. This would have limited the animals ability to become used to or semi-tolerant to, intestinal parasites before trial conditions were imposed. By the start of our trial, biological animals would have started to develop some immunity to internal parasites and thus the intake depression effect may have been lessened. In addition the conventional hoggets may have had a higher worm burden than in the reported trials because of the monthly drenching regimes. It therefore appears that pasture quality, and not parasitism, was the dominant factor controlling intake in the current trial.

No assessment was made of OMD for biological and conventional animals separately. However, Bown *et al.*, (1990) reported no difference in digestibility between parasitised and non-parasitised animals. They reported that DM and OM digestibility was unaffected by *Ostertagia* and *Trichostrongylus* parasites and we have assumed this also applied to our study. Parasite infection in our biological sheep was at a level at which, under conventional farming management, would have required treatment and this was reflected by their liveweight loss. Although liveweight changes ranked similarly for conventional and biological hoggets with respect to pasture quality, the high quality pasture eaten by biological hoggets on the 10% dead treatment apparently did not enable them to compensate for the severe effect of parasitism on utilization of digested feed.

The results of this trial clearly indicate that hill country farmers should aim to provide pastures with low levels of dead matter if target liveweight gains in flock replacements are to be achieved. This confirms the widely reported recommendations that attention needs to be paid to the control of pasture growth, surplus to animal requirements, in late spring-early summer.

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