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The effects of slurry on the acceptability of swards to grazing cattle

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SUMMARY

Grass plots, designed to provide 4 days grazing for three heifers, were divided into four equal sub-plots which were dressed with cow slurry in March at rates between 0 and 100 t/ha. The heifers were put into the plots 7 and 13 weeks after slurry application and were able to choose in which of the sub-plots they spent their time and grazed.

The main effect of slurry on the pasture at 7 weeks was to increase the height of the sward but to decrease herbage dry-matter production. Herbage dry-matter utilization over the 4 days ranged from 94 % on the no-slurry sub-plot to only 41 % when slurry had been applied at 100 t/ha. The heifers spent most time in and grazed more often in sub-plots with little or no slurry for the first 2 days, but as the grass was eaten down the frequency of grazing on areas with more slurry increased. This was reflected in the amount of grass removed by the heifers from each treatment on each day.

At the beginning of the second grazing, grass height and herbage dry-matter production were both directly related to level of slurry application. The heifers did not distinguish between treatments up to 50 t/ha, but herbage utilization on the 100 t/ha sub-plot was reduced.

INTRODUCTION

Rejection, and subsequent wastage of herbage, is normally associated with dung dropped by grazing animals, the extent of rejection depending on the stocking rate and availability of untainted pasture (Greenhalgh & Reid, 1969). Pain, Leaver & Broom (1974) showed that, when given no choice, dairy young stock ate pasture which had been dressed with slurry at rates up to 100 t/ha only 6 weeks before it was grazed. No significant differences were obtained between herbage intakes of the animals on clean or slurry-dressed swards at any time from 6 to 30 weeks after spreading the slurry. There was some modification of the grazing behaviour of the heifers up to 10 weeks after spreading, but not after 14 weeks. Previous workers (Reid, Greenhalgh & Aitken, 1972) demonstrated that the intake of dairy cows on pasture dressed with slurry at 19 t/ha 3 weeks previous to grazing was significantly lower than that of animals on untreated pasture.

The present experiment was designed as a sensitive test to determine whether or not cattle would distinguish between, or preferred, swards dressed with slurry at different rates and, if so, for how long.

MATERIALS AND METHODS

Eight plots, each measuring 16 m × 16 m with 5-m-wide pathways, were set out on a meadow fescue (*Festuca pratensis*), timothy (*Pleum pratense*), perennial ryegrass (*Lolium perenne*), white clover (*Trifolium repens*) ley on a sandy loam soil (Hurst Series). In each plot, four rates of application of cow slurry were allocated at random to four sub-plots. The slurry was applied at 0, 25, 50 and 100 t/ha (15 % D.M.) to half the plots (Block I) on 15 March 1973 and to the rest of the plots (Block II) on 23 March 1973. All plots received 100 kg/ha N as 'Nitro-Chalk' in early spring and again after they were grazed in May.

Twelve Friesian heifers were used in the experiment. Their live weight at the beginning of the experiment averaged 303 kg (range 273–346 kg) and their age 13 months. The heifers were divided into three groups according to their live weight. On 1 May, one animal from each group was allocated randomly to each of the four plots in Block I where they grazed for 4 days. The three heifers in each plot had free access to the four sub-plots. The animals were re-allocated to the Block II plots in the following week and grazed for 4 days beginning on 7 May. At the end of the 4-day grazing period the plots were cut to a uniform height with a rotary mower and the re-growth grazed for a further 4 days beginning on 11 June (Block I) and on 18 June (Block II).

Five 0·5-m² grass samples were taken from each sub-plot with a powered hedge trimmer immediately before the heifers were put into the plot, and again at the end of the grazing period. The samples from each sub-plot were bulked and weighed. Two 200-g aliquots were used for percentage dry-matter determination. The pre-graze samples were used to determine the amount of herbage dry matter available before grazing. Subtraction of the residue remaining at the end of the grazing period gave an estimate of the amount removed by the heifers.

To monitor the daily preferences of heifers for herbage, the height of the grass in each sub-plot was recorded before grazing and at 24-h intervals during grazing. This was done by measuring the length of individual blades of grass at 20 random points along the diagonals of each sub-plot.

A time-sampling technique was used to record the behaviour of the heifers between 09.00 and 12.00 h on each day of the grazing periods. Each animal was observed at 4-min intervals during this time by an observer sitting on a swivel chair in the centre of the experimental area. A record was made of the sub-plot occupied by the animal, the position of the front legs being used if it was on a border, and whether it was standing (but not grazing), lying, walking, grazing or ruminating.

Table 1. *Effect of slurry application on herbage dry-matter production and on the amount removed by heifers during 4-day grazing periods*

	Amount of slurry applied (t/ha)				S.E.	Linear effect of applying 1 t slurry/ha	
	0	25	50	100	(21 D.F.)		
			Grazing 1				
Herbage D.M. available (t/ha)	2·32	2·36	2·26	1·98	0·122	−0·004*	±0·0017
Herbage D.M. removed (t/ha)	2·20	1·69	1·39	0·89	0·189	−0·013***	±0·0026
Percentage utilization	94·4	71·7	60·0	41·2	5·7	−0·51***	±0·077
			Grazing 2				
Herbage D.M. available (t/ha)	1·89	2·43	2·61	3·00	0·156	0·010***	±0·0021
Herbage D.M. removed (t/ha)	1·53	2·03	2·10	2·08	0·217	0·005	±0·0029
Percentage utilization	79·3	80·6	78·1	65·8	5·0	−0·14*	±0·067

* $P < 0·05$; **$P < 0·01$; ***$P < 0·001$.

Table 2. *Effect of slurry on initial grass length and on the total amount removed by heifers during 4-day grazing periods*

	Amount of slurry applied (t/ha)				S.E.	Linear effect of applying 1 t slurry/ha	
	0	25	50	100	(21 D.F.)		
			Grazing 1				
Initial (cm)	28·6	30·8	32·3	33·2	0·49	0·043***	±0·0066
Removed (cm)	21·7	19·9	20·8	19·4	1·00	−0·019	±0·0135
Removed as % initial	75·9	64·1	64·1	57·4	2·80	−0·16***	±0·038
			Grazing 2				
Initial (cm)	47·0	54·8	55·1	63·5	1·20	0·152***	±0·0163
Removed (cm)	34·9	40·2	39·7	42·8	1·57	0·068**	±0·213
Removed as % initial	74·2	73·3	71·8	67·3	1·95	−0·07*	±0·026

* $P < 0·05$; **$P < 0·01$; ***$P < 0·001$.

Fifteen less frequent activities were also recorded. The total frequency of each activity was calculated and the results for the different slurry application rates were compared using a chi-squared test.

RESULTS

Grass production

The main effect of the slurry applications on the pasture at the first grazing (7 weeks) was to decrease D.M. production (Table 1), but to increase the length of the sward (Table 2). By the second grazing (13 weeks) the slight smothering effect of the slurry evident earlier in the experiment had disappeared. There was a direct relationship between slurry application, the height of the sward and herbage dry matter available.

First grazing (*7 weeks after slurry application*)

Initial preferences

The heifers were able to choose in which of the four sub-plots they spent their time and grazed. Most time was spent in the no-slurry sub-plots on the first day ($P < 0{\cdot}001$) (Fig. 1). Their preference for sub-plots with little or no slurry was evident whether the animals were 'standing', 'lying' or 'grazing' ($P < 0{\cdot}001$ for each measure) (Figs. 2–4).

The activities of the animals were reflected in the amount of grass removed. Most grass was taken from the no-slurry sub-plot and least from the 100 t/ha treatment on the first day (Table 3).

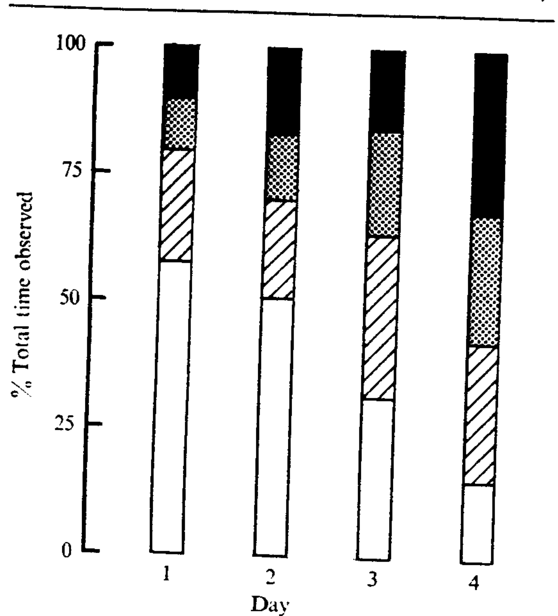

Fig. 1. First grazing (7 weeks). Time spent in each sub-plot; □, no slurry applied; ▧, 25 t/ha slurry applied; ▦, 50 t/ha slurry applied; ■, 100 t/ha slurry applied.

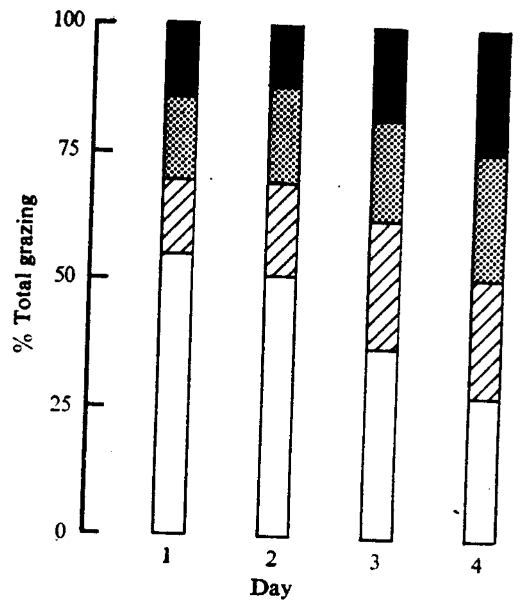

Fig. 2. First grazing (7 weeks). Time spent grazing in each sub-plot; □, no slurry applied; ▧, 25 t/ha slurry applied; ▦, 50 t/ha slurry applied; ■, 100 t/ha slurry applied.

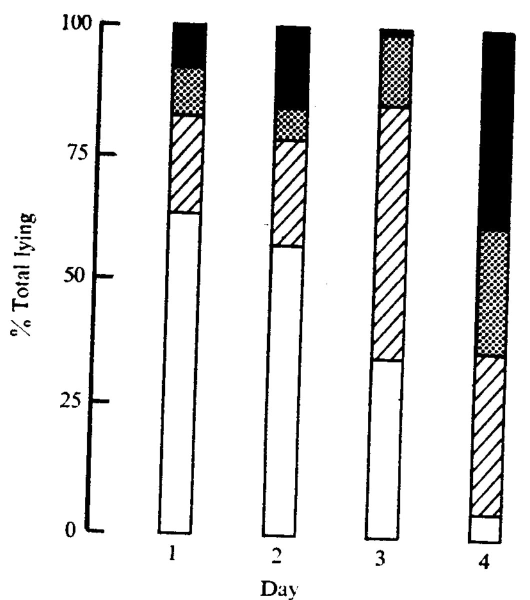

Fig. 3. First grazing (7 weeks). Time spent lying in each sub-plot; □, no slurry applied; ▧, 25 t/ha slurry applied; ▦, 50 t/ha slurry applied; ■, 100 t/ha slurry applied.

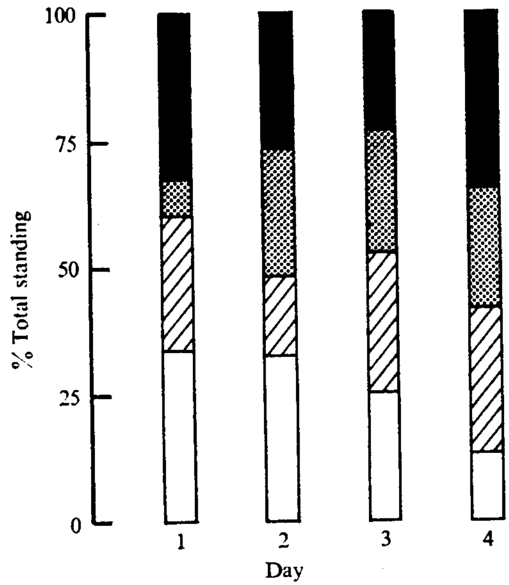

Fig. 4. First grazing (7 weeks). Time spent standing in each sub-plot; □, no slurry applied; ▧, 25 t/ha slurry applied; ▦, 50 t/ha slurry applied; ■, 100 t/ha slurry applied.

Changes in preference with time

For the first 2 days of the grazing period the heifers spent much more time and grazed more frequently on no-slurry sub-plots than on those dressed with slurry (Figs. 1, 2), but on days 3 and 4 there was an increase in grazing on the slurry sub-plots. The grazing continued to be as frequent on the no-slurry sub-plots as on treated sub-plots, even on day 4, despite the small amount of grass available (Table 3).

The length of grass removed, averaged for all the treatments, was 8·8 cm on day 1 and then decreased to 5·1 on day 2, 3·6 cm on day 3 and 3·1 cm on day 4. The proportion of the 3-h observation period spent grazing, however, increased from 13% on day 1 to 25% on day 2, 34% on day 3 and 40% on day 4. Although reduction in grass length is not necessarily directly related to herbage D.M. removal, these results suggest that the heifers needed to increase their grazing time to maintain their intakes. The low value for time spent grazing on day 1 is due partly to an initial period of investigation when the animals were put into the plots.

Changes in the location of 'lying' (Fig. 3) with

Table 3. *Effect of slurry on length of grass removed per day by heifers during 4-day grazing periods*

	Amount of slurry applied (t/ha)				S.E. (21 D.F.)	Linear effect of applying 1 t slurry/ha	
	0	25	50	100			
Grazing 1							
Day 1							
Height (cm)	28·6	30·8	32·3	33·2			
Removed (cm)	12·4	8·4	7·9	6·4	0·67	−0·055***	±0·0091
Day 2							
Height (cm)	16·2	22·4	24·4	26·8			
Removed (cm)	5·4	4·8	5·4	4·6	0·67	−0·006	±0·0091
Day 3							
Height (cm)	10·8	17·6	19·0	22·2			
Removed (cm)	2·6	4·3	2·9	4·3	0·61	0·012	±0·0083
Day 4							
Height (cm)	8·2	13·3	16·1	17·9			
Removed (cm)	1·3	2·4	4·6	4·1	0·75	0·029**	±0·0101
Grazing 2							
Day 1							
Height (cm)	47·0	18·0	16·3	16·3			
Removed (cm)	15·6	18·0	16·3	16·3	1·81	0·000	±0·0245
Day 2							
Height (cm)	31·4	36·8	38·8	47·2			
Removed (cm)	9·9	10·8	13·2	14·9	1·59	0·052*	±0·0215
Day 3							
Height (cm)	21·5	26·0	25·6	32·3			
Removed (cm)	5·4	7·7	5·7	7·0	0·91	0·009	±0·0122
Day 4							
Height (cm)	16·1	18·3	19·9	25·3			
Removed (cm)	4·0	3·7	4·5	4·5	0·84	0·008	±0·0114

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

time followed a similar pattern to 'grazing'. The percentage of time the heifers spent 'lying' on day 3 is based on a much reduced sample size owing to a prolonged period of rain when no lying occurred. The location of standing was less affected by the rate of slurry application (Fig. 4).

Total herbage utilization

During the 4 days of grazing, 7 weeks after slurry application, only 41 % of the available herbage dry matter was removed from the 100 t/ha sub-plots, but 94 % from the controls (Table 1).

The total length of grass removed during the 4 days was similar for each of the treatments (Table 2). Since grass length was directly related initially to slurry application rate, 76 % of the initial herbage was removed from the control, but only 57 % from the 100 t/ha sub-plots.

Second grazing (13 *weeks after slurry application*)

The preferences for sub-plots with little or no slurry, which were apparent at the first grazing, had almost disappeared by the second. The percentage of available herbage dry matter and grass length (Tables 1 and 2) removed was similar for the 0, 25 and 50 t/ha sub-plots. A slightly smaller percentage was removed from the 100 t/ha treatment, even though there was initially more available.

A similar proportion of the observation time was spent grazing in each of the four sub-plots on all 4 days (Fig. 5). The contrast between grazing at 7 and 13 weeks after slurry application is clearly shown by comparing Fig. 2 and Fig. 5.

Comparison of agronomic and behavioural measurements

The herbage dry matter and grass length removed from each treatment during the 4-day periods were compared with the time spent grazing (Figs. 6, 7). There was a close relationship between agronomic and behavioural measurements, especially during the second grazing period. The lower weight of grass per unit length in the sub-plots treated with the most slurry resulted in some masking of the differences between the amounts of grass length taken from the different treatments at the first grazing (Fig. 6).

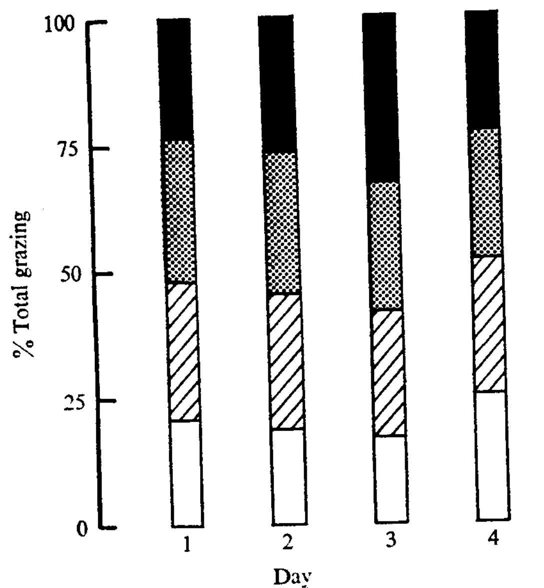

Fig. 5. Second grazing (13 weeks). Time spent grazing in each sub-plot. □, no slurry applied; ▨, 25 t/ha slurry applied; ▦, 50 t/ha slurry applied; ■, 100 t/ha slurry applied.

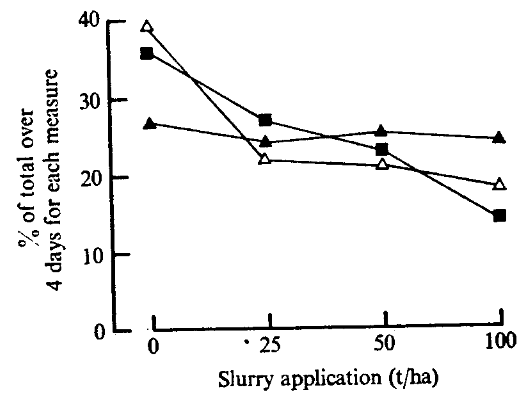

Fig. 6. First grazing (7 weeks). Comparison of grass removal measures and grazing observations. ■, herbage dry matter removed; ▲, grass length removed; △, grazing during observation period.

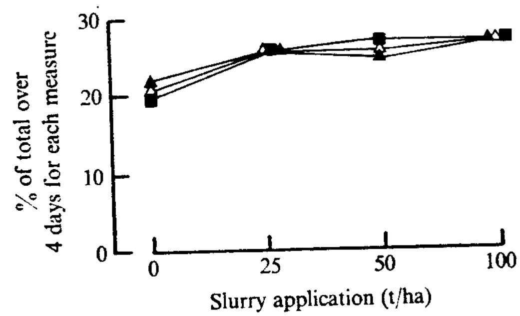

Fig. 7. Second grazing (13 weeks). Comparison of grass removal measures and grazing observations. ■, herbage dry matter removed; ▲, grass length removed; △, grazing during observation period.

DISCUSSION

Heifers not only detected even light slurry dressings 7 weeks after spreading, but also distinguished between different rates of application. Clean pasture was much preferred, even though the slurry remained on the other treatments only as a fibrous mat at ground level. Thirteen weeks after slurry application there was no evidence to suggest that the animals detected slurry on the 25 or 50 t/ha sub-plots. Percentage utilization on the 100 t/ha treatment was still reduced, either because grazing pressure was not great enough to remove the extra herbage or, alternatively, because the heifers still preferred the other swards. The rejection of the slurry plots 7 weeks after application was apparent from other behavioural measures in adding to grazing. As in previously reported work (Pain *et al.* 1974), heifers were less likely to lie on slurry-dressed pasture. This might occur because the animals lie where they have just been grazing. Alternatively, avoidance of tainted pasture is associated with smell (Martin & Donker, 1966) and odours may be more noticeable to animals which are lying rather than standing.

No allowance was made for grass growth on the plots during the grazing periods. This would be important if there were differences between sub-plots due to differential grazing. Previous experience with the type of sward used, however, indicates a maximum growth rate of about 80 kg D.M./day. If maximum growth had occurred on the 100 t/ha sub-plot, the percentage utilization would be increased to 61 %, which is still low compared with the 94 % on the no-slurry sub-plot, even if it is assumed that growth on this treatment was negligible.

Choice situations may not often occur in practice, but the present experiment provided a sensitive test of the ability of young stock to distinguish between different rates of slurry application and emphasizes the need to spread evenly on grazing areas to maximize pasture utilization. Pain *et al.* (1974) showed that mid or late winter applications did not affect later intakes when no choice was offered and where similar quantities of herbage were available but, in the early part of the season, grazing pressures were low on all treatments. In experiments with dairy cows (Reid, Greenhalgh & Aitken, 1972) intakes were significantly reduced by spreading slurry at 19 t/ha 3 weeks before grazing, but grazing pressures were moderately high. The differences between these experiments may be explained either by a difference in grazing pressure, especially in early season, or by the greater sensitivity of lactating cows as compared with young stock. Where ample grass is available, i.e. at low grazing pressures, animal intakes may not be adversely affected by slurry applications because selective grazing can be practised. Where grazing pressures are high or where heavier slurry applications are used it may be necessary to leave a longer interval between spreading and grazing to maintain animal intakes. The optimum intake will also vary according to rainfall, sward composition, soil type and class of livestock. In experiments of Pain *et al.* (1974) the grazing behaviour of heifers was modified in the presence of slurry, although intakes were not affected. No information is available on the effects of the modifications in behaviour on animal performance because of the short duration of the grazing periods in these experiments.

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