Grazing behaviour of young cattle around faecal pats

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Abstract

Young Holstein Friesian bulls grazed four mixed-contour paddocks for a duration of three days on ten occasions between December 2002 and March 2004. For the first seven grazing events, five faecal pats on both easy- (<25°) and steep-contoured land in each paddock were selected for monitoring herbage removal during the subsequent four to five grazing events. After each day of grazing, pasture height was measured at 5-cm intervals for 50 cm from the centre of each pat. The decrease in pasture height was converted to estimates of herbage dry matter removal. For the first three grazing events following pat deposition, avoidance of grazing herbage around pats was greatest on the first day of the three-day grazing duration. The mean distance of grazing from the centre of the pats was 21, 14, 10 and 7 cm for the first to fourth grazing events following deposition. Avoidance was greatest around pats that were deposited in late spring/early summer with little difference occurring between pats located on easy or steep land. Increased grazing pressure appeared to override the natural behaviour of young cattle to avoid grazing close to faecal pats. Grazing management of young cattle should ensure residuals of at least 1500 kg DM/ha in order to minimise the grazing of herbage surrounding faecal-pat areas which are highly contaminated with parasite larvae.

Keywords: cattle; grazing behaviour; faecal pats; cattle parasites

Introduction

In New Zealand, young cattle are intensively grazed within a number of different pasture-based farming systems. These include dairy-heifer rearing, dairy-beef finishing and traditional beef cow-calf systems. These systems were described by Smeaton (2007). It is recognised in practice, and reported in the literature, that young cattle avoid grazing around fresh and aged faecal pats (Weeda 1967; Nolan & Connolly 1980; Gruner & Sauve 1982; Burggraaf et al. 2009). This avoidance has implications for future pasture quality and for the infection of young cattle with gastrointestinal nematodes. This latter challenge provides the context of this paper.

Gastrointestinal nematode infections can significantly limit growth in young cattle (Bisset 1994; Charleston 1997). Previous studies have shown that infective third-stage parasite larvae (L3) populations are aggregated around historic faecal pats and few larvae migrate more than 30 cm from the centre of the faecal pat in which they developed, even after significant time and rainfall (Rose 1961; Durie 1961; Williams & Bilkovich 1973; Boom & Sheath 2008). Reducing the ingestion of infective nematode larvae from this highly contaminated zone should, therefore, be considered in the design of grazing management strategies.

The ability of cattle to select herbage is strongly affected by herbage availability and grazing pressure (Litherland & Lambert 2007). Studies by Hansen et al. (1981) concluded that increased grazing pressure reduced the ability of the cattle to select against herbage with high parasitic larvae concentrations. Hutchings et al. (2001) demonstrated the same with sheep, and further developed the concept of how ruminants have a trade-off between nutrition and parasitism in relation to grazing around historic faecal pats.

The study reported in this paper is part of a series (Boom & Sheath 2008; Burggraaf et al. 2009) that aimed to improve the understanding of the relationship between cattle faecal pats, animal grazing behaviour and the removal of herbage and nematode larvae. It provides data that describe the grazing behaviour of young cattle around faecal pats of contrasting age during different seasons of the year and on different land contours.

Materials and methods

Trial location and context

The study was conducted during 2002-2004 at AgResearch, Whatawhata Research Centre, New Zealand. This site is located at latitude 38º South, with a mean annual rainfall of 1655 mm. Pastures were predominantly perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) on easy contoured land (<25º), and a mix of temperate grasses and legumes on sloped land.

Paddocks, grazing conditions and stock

Four mixed-contour paddocks (0.4-0.8 ha) were repeatedly grazed by young cattle between December 2002 and March 2004. Grazing management mimicked New Zealand beef finishing systems, with paddocks grazed when herbage mass reached approximately 2400 kg DM/ha during winter-spring and 2800 kg DM/ha during summer-autumn. Paddocks were grazed for three days and stocked to achieve a herbage residual of approximately 1200 kg DM/ha during winter-spring and 1600 kg DM/ha during summer-autumn. Average paddock herbage mass was assessed prior to grazing (pre-graze), every 24 hours during grazing and after grazing ceased (post-graze) by calibrated visual estimation (Haydock & Shaw 1975). Dates and estimated paddock pre-graze and post-graze herbage mass for each grazing period are outlined in Table 1.

One group of Holstein Friesian bulls was used for all grazing events. These were approximately four months of age at the start of the study (December 2002) and 18 months of age at the completion of the study (March 2004). Mean live weights of these bulls were 110 kg and 420 kg at the start and end of the study period.

Faecal pat selection and monitoring

At the completion of each grazing of each paddock, five freshly deposited faecal pats on easy land (<25º slope) and five on steep land (>25º slope) were identified in each paddock. Chosen pats needed to fit within a 20 cm radius from the centre of the pat and have no other obvious faecal contamination (either new or historic) within 1 m of the edge of the pat. The dry weight of each pat was assessed at the time of identification by visual score and calibrated to ten pats of various sizes which were scored, dried and weighed. The average dry weight of faecal pats increased from 59 to 135 g as the cattle aged. If new faecal material was deposited within a 1 m radius of the historic pat during subsequent grazing, then the pat was considered contaminated and no longer used in the study.

Grazing of herbage adjacent to the faecal pat was measured through changes in herbage height. Herbage height was measured at 5-cm horizontal spacings in four equiangular directions from the centre of the pat, up to a distance of 50 cm. These measures were made just prior to each grazing (pre-graze), then at 24 hours (day 1), 48 hours (day 2) and 72 hours (day 3, post-graze), at which point cattle were removed from the paddock. This approach provided the measurement of herbage height adjacent to faecal pats at three different stages during the grazing period.

These herbage height measurements were made during the four grazing events that followed the deposition of faecal pats in December, August, October and November. Where faecal pats were deposited in February, April and June, herbage height was measured for five subsequent grazing events. To estimate the apparent herbage removed, the decrease in pasture height was converted to pasture mass using the relationships derived by Webby and Pengelly (1986).

Statistical analyses

The patterns of herbage removal at the end of each day during the three-day grazing periods were analysed using a mixed-model smoother Flexi (Upsdell 1994). These patterns combined data for both month of deposition and land contours.

The mean distance of grazing from the pat centre was calculated for each faecal deposition time and the four grazing events that followed. The occurrence of grazing was defined as a decrease in mean pasture height of >0.5 cm from one day to the next. These distance estimates were analysed with Genstat (2003) using covariates of herbage height at the start and end of grazing and faecal-pat dry weight. Aggregated error terms are presented in the tables as raw data were not available for more detailed analysis.

Results

Grazing conditions

The mean herbage mass of the paddocks during each grazing event is given in Table 1. Herbage mass at the start, during and end of the grazing period tended to be greater during the summer months compared with the rest of the year. Available pasture decreased from day one to day three for all grazing events. Herbage removal over the three-day grazing period ranged from 507 to 1219 kg DM/ha and averaged 817 kg DM/ha. The number of days between grazing events varied according to pasture growth rates, being greater during the slower-growing autumn and winter period compared to spring and summer. When averaged across all of the grazing events, the number of days between pat deposition and first, second, third, fourth and fifth subsequent grazing events were 50, 99, 147, 191 and 228 days respectively.

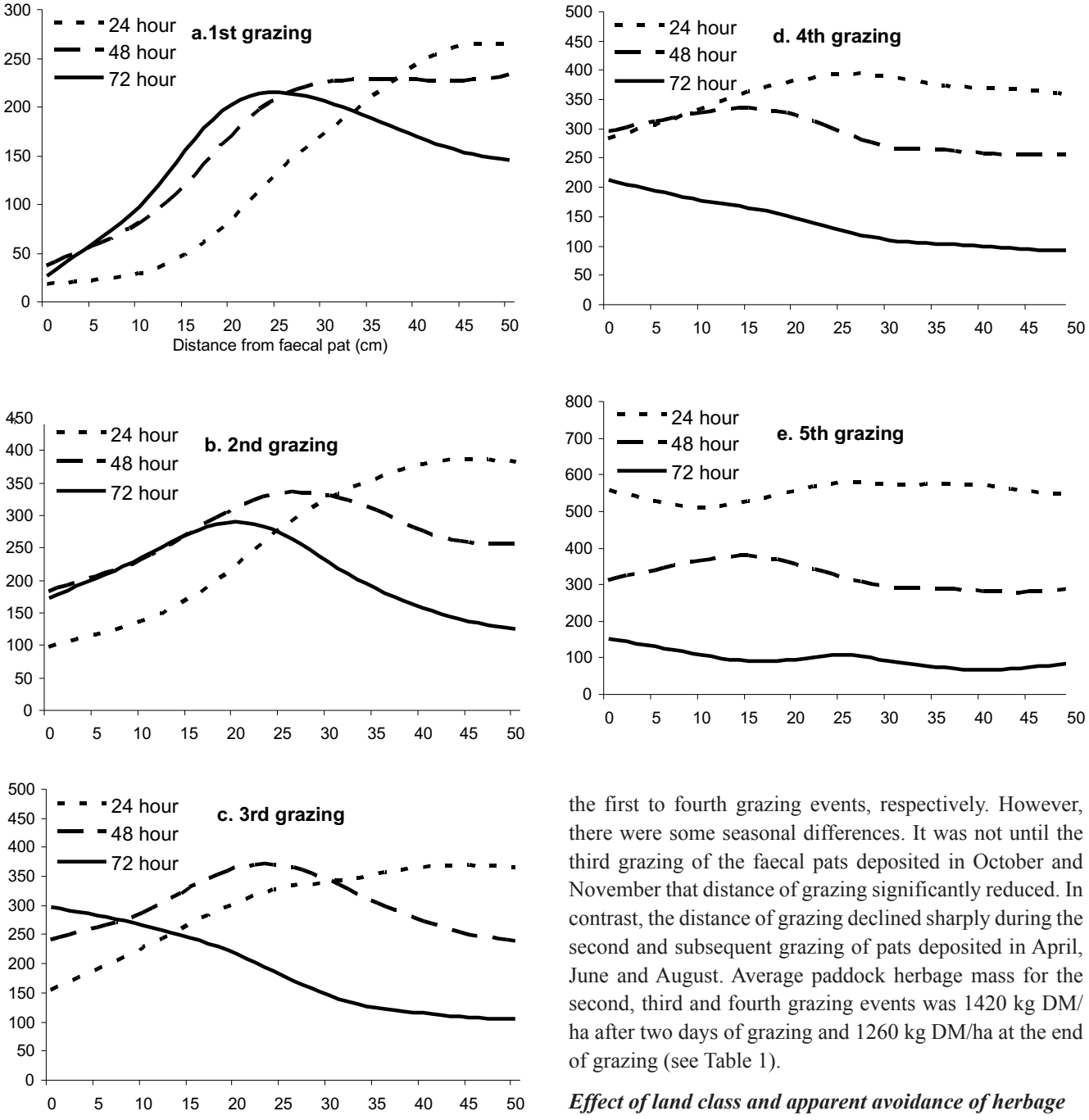
Effects of grazing pressure on herbage removal

The pattern analysis of herbage removal showed that for the first, second and third grazing following pat deposition, the majority of initial herbage removal occurred furthest away from the faecal pat (Fig.1a-c). As paddock herbage mass decreased and grazing pressure increased during the grazing period, the distance between the focal

Table 1 Average herbage mass (kg DM/ha) of paddocks assessed at the start of the grazing event (pre-graze), after 24 and 48 hours, and after grazing finished (post-graze); and the number of days since the previous grazing event.

Grazing event	Pre-graze	24 hours	48 hours	Post-graze	Days since previous grazing
Dec ’02	2831	2550	2315	2156	
Feb ’03	2756	2488	2271	1990	50
Apr ’03	2352	1916	1673	1481	63
Jun ’03	1753	1508	1329	1187	68
Aug ’03	1619	1402	1258	1112	62
Oct ’03	2075	1721	1436	1157	49
Nov ’03	2249	1891	1541	1344	33
Dec ’03	2420	1980	1746	1536	35
Jan ’04	2951	2497	2107	1732	42
Mar ’04	2211	1856	1563	1354	43

Figure 1 Calculated disappearance of herbage (kg DM/ha) in relation to distance from the centre of cattle faecal pats (cm) after cattle grazing for 24, 48 and 72 hours over the 1st to 5th grazing events following faecal pat deposition across all seasons and contour.



point of herbage removal and the faecal pat decreased. This pattern was not apparent for the fourth and fifth grazing events where herbage removal was uniform across all distances from the faecal pats (Fig.1d-e).

Effect of deposition season and age of pat on herbage removal

Estimates of the mean distance of grazing from the faecal pats during each three-day event is provided in Table 2. When data were combined across all deposition times, the apparent avoidance of faecal pats decreased with each subsequent grazing ($P < 0.05$). The mean distances of grazing from the faecal pat were 21, 14, 10 and 7 cm for the first to fourth grazing events, respectively. However, there were some seasonal differences. It was not until the third grazing of the faecal pats deposited in October and November that distance of grazing significantly reduced. In contrast, the distance of grazing declined sharply during the second and subsequent grazing of pats deposited in April, June and August. Average paddock herbage mass for the second, third and fourth grazing events was 1420 kg DM/ha after two days of grazing and 1260 kg DM/ha at the end of grazing (see Table 1).

Effect of land class and apparent avoidance of herbage

The location of faecal pats on the two land contours had limited impact on the grazing behaviour of the cattle (Table 3). Mean distance of grazing from the pat centre was slightly greater on steep land (>25 degrees) during the first day of grazing, but as grazing pressure increased during the second and third day of the grazing period the difference between pats on easy and steep land disappeared.

Discussion

The patterns of herbage removal that are provided in Figures 1a-e clearly demonstrate that young cattle avoided grazing close to recently deposited faecal pats. This avoidance was most noticeable during the early stages of grazing, particularly during the first and second grazing

Table 2 Mean distance (cm) of grazing from the centre of the faecal pats for each deposition time and each of the subsequent four grazing events with the mean standard error of the difference (mean SED)

	Dec '02	Feb '03	Apr '03	Jun '03	Aug '03	Oct '03	Nov '03
1st grazing	28	22	22	15	17	17	22
2nd grazing	17	16	8	8	10	20	22
3rd grazing	12	9	2	7	11	16	12
4th grazing	9	5	4	9	10	5	10
Mean SED				2.34			

Table 3 Mean distance (cm) of grazing from the centre of faecal pats deposited on either easy or steep land after 1, 2 and 3 days of grazing. Results are the mean of all pat deposition and grazing times with mean standard error of the difference (mean SED).

	Pats on easy land	Pats on steep land
Day 1	17	22
Day 2	12	13
Day 3	7	8
Mean SED	0.99	

events following deposition. As grazing continued and grazing pressure increased during the three days, removal of herbage within the 0-20 cm zone eventually occurred. Grazing pressure appeared to override the natural avoidance of faecal pats when paddock pasture mass declined below 1400-1500 kg DM/ha.

The general patterns of herbage removal also indicated that the impact of faecal pats on grazing behaviour had disappeared by the time of the fourth and fifth grazing following deposition. However, there were some seasonal differences with regard to faecal pat age. The distance of grazing from faecal pats that were deposited in April, June and August was significantly closer to the pats during the second grazing event compared to the first. This was despite the paddocks having a similar post-grazing herbage mass of 1100-1200 kg DM/ha for these grazing events. This result may reflect the more rapid disappearance of faecal pats that occurs under moist conditions (Boom & Sheath 2008; Burggraaf et al. 2009).

In this study, grazing conditions were typical of New Zealand beef-finishing systems and varied greatly through the year. This variation makes the interpretation of seasonal differences somewhat confounded by changes in pasture mass, grazing pressure and duration between grazing events. For those pats that were deposited during October to February, avoidance of grazing around them continued during the second and third subsequent grazing events. While this result may reflect slower disappearance rates of faecal pats during drier periods of the year, it should be noted that herbage mass was higher and grazing pressure was lower during these grazing events. Post-grazing herbage mass ranged between 1500-1700 kg DM/ha. This greater avoidance may also have been exacerbated by the accumulation of lower quality grass seed head and dead material which cattle actively select against (Litherland & Lambert 2007).

There was a small difference in grazing behaviour around faecal pats that were deposited on easy- compared to steep-contoured land. Grazing distance was less on the easy-contoured land after the first day, but this difference disappeared during the subsequent two days. The initial preference of livestock to graze easy-contoured land in mixed topography can explain this result (Sheath 1983).

Given that this study on grazing behaviour was conducted within the context of managing gastrointestinal infection of young cattle, the implications of the results deserve consideration. Larvae of gastrointestinal nematodes are highly concentrated around historical cattle faecal pats (Durie 1961; Rose 1961; Williams & Bilkovich 1973) and these levels can remain high for up to five months following deposition, particularly during dry conditions (Boom & Sheath 2008). Therefore, grazing management practices that do not force young cattle to graze this highly contaminated zone should be considered. While young cattle naturally avoid grazing close to faecal dung pats for at least the two grazing events following deposition, grazing pressure can override this behaviour. When paddock herbage mass falls below approximately 1500 kg DM/ha, young cattle will graze the 0-20 cm zone surrounding pat. Grazing management of young cattle should ensure residuals of at least 1500 kg DM/ha in order to minimise the grazing of highly contaminated herbage that surrounds faecal pats.

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