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Managing dairy calves using continuous stocking and sward surface height – a review

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ABSTRACT

The objectives of this review are (i) to examine the role of continuous stocking management in grazing experiments and on farm; (ii) to discuss the measurement of sward surface height; (iii) and to present experimental liveweight gain data obtained from calves continuously stocked from weaning to nine months of age. Sward height can be used as a guide in cultivar evaluations to maintain equal sward conditions between plots and treatments using put-and-take and continuous stocking management. Continuous stocking management can also be used on farm to achieve the recommended liveweight targets for dairy calves. However, further research is needed to determine the optimum sward height for calves. Weaned Friesian dairy heifers continuously stocked from November 2000 to April 2001 at Dexcel, Hamilton, and grazed to a mean sward height of 5 cm, steadily gained 0.8 kg/day, reaching a final mean of live weight of 226 kg at 9 months of age. The average stocking rate over this period was 7.1 calves/ha and the total liveweight gain was 822 kg/ha. These calves achieved the recommended liveweight targets set for replacement dairy heifers.

Keywords: forage evaluation; liveweight gain; pasture management; sward stick.

INTRODUCTION

In a continuously stocked system, animals remain on the same pasture for long periods of time. An extreme form of continuous stocking is set stocking, in which no adjustments to stock numbers are made despite changes in pasture conditions (Matthews *et al*., 1999). In contrast, animals in a rotational-grazing system graze paddocks in sequence, each for a short period of time (varying from hours to days). Sward surface height can be used as a guide for grazing management, particularly in continuously stocked systems, because of its influence on sward structure, pasture growth and utilisation, and on the intake and performance of individual animals (Hodgson *et al*., 1986; Swift *et al*., 1989; Wright & Whyte, 1989).

Experimental data suggest that, under continuous stocking management, pasture intake and animal performance increases at a progressively declining rate towards a maximum value as sward height increases (Hodgson & Brookes, 1999). The critical height for grazing cattle is about 8-10 cm and 6-7 cm for sheep under continuous stocking management (Hodgson & Brookes, 1999). There is little value in providing feed above this critical height as no further improvement in performance will be achieved and herbage production will eventually decline (Hodgson & Brookes, 1999).

In perennial ryegrass-dominant pastures, the surface horizon is predominantly green leaf and the lower horizons contain pseudostem or dead material (Poppi *et al*., 1987). When sward height is increasing, animals are consuming a high proportion of young, highly digestible leaf. When sward height is falling, an increased proportion of the intake will be older leaf and stem of lower digestibility (Swift *et al*., 1989). Patchy grazing and seedhead production on cattle swards is usually minimised when sward height is kept below 8 cm (Hodgson *et al*., 1986). Since pasture growth rates vary within season, and from year to year, stocking rate must change to maintain a target sward height (Swift *et al*., 1989). Target heights must be chosen to meet the production objectives of the particular enterprise (Hodgson *et al*., 1986).

Effect of sward height on liveweight gain

Little work has been published on the relationship between cattle performance and sward height under continuous stocking management in New Zealand. Morris *et al*. (1993) reported that the liveweight gain of continuously stocked finishing cattle increased with sward height up to a maximum of 8-10 cm in spring pasture, while in autumn, heights of 12-15 cm were required to achieve maximum animal performance. Realini *et al*. (1999) also found that a sward height of 10 cm from November to April increased the liveweight gain of two-year-old steers compared with those managed to 5 cm (111 versus 32 kg/head). Despite the decreased stocking rate when sward height was maintained at 10 cm, output per hectare was greater than when pastures were grazed to 5 cm (Realini *et al*., 1999). However, both these studies were conducted with mature cattle, and calves may be better suited to grazing shorter pastures than larger cattle because of their smaller mouth size (Poppi *et al*., 1987). Further research is therefore needed to determine the optimum sward height for calves under New Zealand grazing conditions

Liveweight targets

The recommended liveweight targets for young Friesian dairy heifers (500 kg mature live weight) are: 100 kg at ten weeks (weaning); 150 kg at six months; 200 kg at nine months; and 300 kg at 15 months of age (Dexcel, 2001). It is important that replacement heifers meet all of these liveweight targets to ensure that they are cycling before the start of mating at 13 to 15 months of age and get in calf quickly (Penno *et al*., 1995).

Experimental data

An experiment designed to examine the effects of a novel ryegrass endophyte on dairy calf performance was conducted on No 5 Dairy, Dexcel, Hamilton from 8 November 2000 to 3 April 2001. The effects of endophyte

on calf performance will be reported elsewhere, with the mean of three treatments presented in this paper.

Fifteen plots (each 0.5 ha) were cut for silage in late October 2000 to a mean stubble height of 7 cm. Six weaned Friesian heifer calves (born between mid-July and early August 2000) were initially allocated to each plot in a stratified manner according to live weight. However, one week after the start of the experiment, the stocking rate was reduced to four calves per plot (8 calves/ha). Calves were continuously stocked on plots from 8 November 2000 to 3 April 2001, and grazed to a mean sward height of 5 cm to maintain uniform levels of grazing pressure between plots. Sward height was measured weekly and was maintained using a put-and-take system by adding or removing calves using methods published by Hodgson *et al.* (1986: Table 1). Calves received eprinomectin pour-on every six weeks to control internal and external parasites, a clostridial vaccine in November 2000, a vitamin B_{12} injection in January 2001, a leptospirosis vaccine in February 2001 and were given a zinc oxide intra-ruminal bolus in February 2001 to minimise facial eczema.

Mean sward height in each plot was measured weekly using an automated sward stick (Model SS400M: Jenquip, Fielding, New Zealand). On each occasion, 100 measurements per plot were recorded (50 per diagonal) when the plastic tongue of the sward stick was lowered onto green leaf (Hodgson *et al.*, 1986). Pasture quality of herbage on offer was determined monthly from 10 strips of herbage cut to ground level and bulked for each plot. A sub-sample of herbage was frozen at –20°C, freeze-dried and ground to pass a 1 mm sieve, before being analysed for organic matter digestibility using near infra-red spectroscopy (NIRS) (Corson *et al.* 1999). Unfasted live weight and body condition score was recorded for each calf every three weeks. Mean liveweight gain was calculated from the calves present for the total experimental period. Stocking rate was the mean over the experimental period and the number of grazing days and total liveweight gain per hectare was the total for all calves.

Plots were maintained within 2 cm of the 5-cm target mean sward height (Figure 1). Mean calf live weight was 107 ± 1.4 (SEM) kg at the start of the experiment in November (range = 83 to 132 kg) (Figure 2). Time trends in mean organic matter digestibility of herbage cut to ground level are shown in Figure 1. However, analysis of hand-plucked samples collected during February 2001 indicate that the herbage selected by calves would have been higher in organic matter digestibility than herbage samples cut to ground level (68.3 versus 60.5% DM; Bluett unpublished data). Calves steadily gained 0.8 ± 0.01 kg/day, reaching a final mean live weight of 226 ± 2.1 kg in early April (range = 194 to 254 kg). The average stocking rate over this period was 7.1 ± 0.13 calves/ha. The number of calf grazing days was 519 ± 9.5 and the total liveweight gain was 822 ± 18.3 kg/ha. The calves in this study reached the recommended liveweight target for replacement heifers (Dexcel, 2001), and were greater than 200 kg by 9 months of age.

Use in research

Continuous stocking management can be used in research to compare forages such as perennial ryegrass cultivars (Bluett *et al.*, 1997; 1999a and b). A target sward height is maintained to provide uniform grazing pressure between plots and treatments by adding or removing animals, and this practice is often referred to as put-and-take management (Matches, 1969: Table 2). Using this technique, individual animal performance data, number of grazing days, animal carrying capacity and total production per hectare can be determined for each treatment (Wheeler & Hedges, 1972). Adjustments to stocking rate can be guided according to decision rules (Hodgson *et al.*, 1986: Table 1) to reduce the subjectivity of decision-making. For example, if sward height is increasing, stocking rate is increased to maintain the target sward height and vice versa. Another powerful advantage of the put-and-take method is that when grazing pressure is maintained at definable levels throughout the year, the quality and quantity time trends of the sward can be identified (Matches, 1969: Table 2).

Use on farm

Penno (1994) recommended that young heifers should be regularly shifted onto ample high-quality pasture to

FIGURE 1. Mean sward height (-°-) and organic matter digestibility (-o-) (herbage cut to ground level) of perennial ryegrass pastures continuously stocked with calves from 7 November 2000 to 4 April 2001 at Dexcel, Hamilton. Horizontal dashed line is the mean sward height and vertical bars indicate maximum SEM.

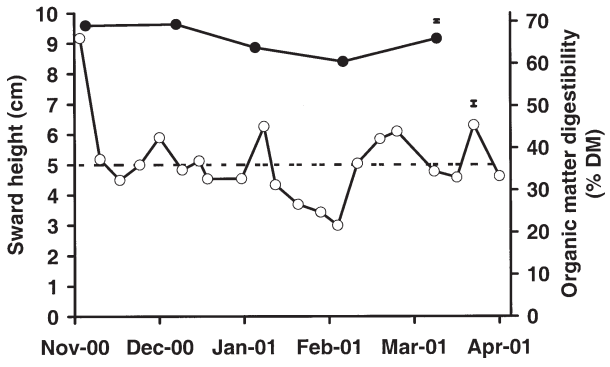

FIGURE 2. Mean live weight of calves born July/August 2000 and continuously stocked on perennial ryegrass pastures from 8 November 2000 to 3 April 2001 at Dexcel, Hamilton. Vertical bar indicates maximum SEM.

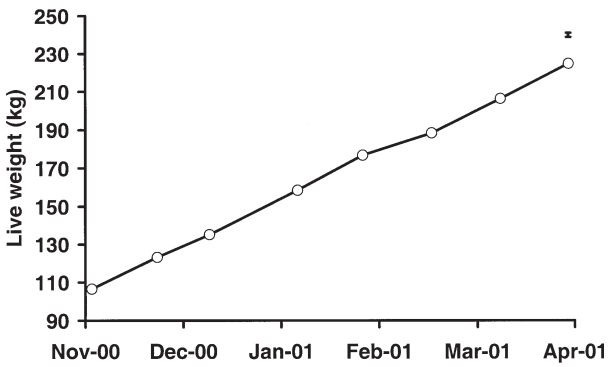

TABLE 1: A guide to making stocking rate (calves/ha) adjustments to compensate for changes in sward height under continuous stocking management (reproduced from Hodgson *et al*., 1986).

Changes in height over previous week		Decrease stocking rate	No change	Increase stocking rate
Current height	High	0	+ 10	+ 20
	On target	- 10	0	+ 10
	Low	- 20	- 10	0

TABLE 2: Reasons presented for and against using a put-and-take system of pasture experimentation (adapted from Matches, 1969).

For	Against
• Grazing pressure is maintained at a uniform level between and within treatments	• Not practical on a farm basis
• Grazing pressure can be defined throughout the season, and the quality and quantity time trends of the sward can be identified	• Subjective judgements involved in adjusting the stocking rate of individual pastures according to the amount of forage which appears to be available
• Can predict carrying capacity of pastures	• Possibility that the larger number of animals in some pastures may lead to greater or smaller intake of herbage due to competition between animals
• Can describe sward conditions and relate them to animal responses	

achieve high levels of performance. However, the experimental data recorded at Dexcel and reported above, indicate that good liveweight gains can also be obtained using a continuous-stocking management system. Sward height needs to be monitored weekly to detect changes in height to enable adjustments to be made as early as possible. The measurement of sward height is simple, inexpensive and fast, and can be carried out with minimal training (Burnham *et al*., 1986). Sward height targets must be maintained to ensure sufficient pasture is available to calves or herbage intake will decline and liveweight gain will be adversely affected. McMeekan (1954) clearly showed how non-adjustment of stocking rate in a continuously stocked system during times of pasture deficit resulted in poorly grown calves compared to their rotationally grazed counterparts.

On most farms it will be easier to maintain the target sward height by altering the grazing area than by adjusting stock numbers (put-and-take management). If sward height increases above target, areas can be shut up as deferred grazing or harvested for silage or hay. If height drops below target the grazing area can be increased or supplementary feed provided (Matches, 1969). Farmers who monitor their sward height and calf live weight should after a few years have sufficient information to produce sward height guidelines specific for their own situations (Burnham *et al*., 1986). Calves managed under continuous stocking may also have a lower labour requirement than rotationally grazed calves by eliminating the regular shifting of mobs and break fencing.

Although regular measurements of calf live weight can provide a good general guide to the well-being of young stock, appraisal by eye is also important in detecting signs of ill thrift before any major drops in liveweight gain occur. This is particularly important under continuous stocking management because stock may not be seen as often as animals moved regularly. Generally, a healthy, thrifty animal will have a glossy, well-kept coat (McMeekan, 1954). Heifers must be kept free of parasites and disease, and their mineral status must be maintained, and preventative measures for facial eczema taken (Penno, 1994). Animals must also have access to good quality drinking water at all times.

CONCLUSIONS

Continuous stocking management using sward height as a guide can be used in research for cultivar evaluations and on farm to achieve target live weights. However, further research is needed to determine the optimum sward height for calves. Dairy heifers managed under continuous stocking management and grazed to a mean sward height of 5 cm at Dexcel, gained 0.8 kg/calf/day from weaning to nine months of age, and achieved the recommended liveweight targets for replacement calves.

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REFERENCES

Bluett, S. J.; Hodgson, J.; Kemp, P. D.; Barry, T. N. 1997: Animal evaluation of Aries HD perennial ryegrass selected for high digestibility. *Proceedings of the New Zealand Grassland Association 59:* 245-249.

Bluett, S. J.; Hodgson, J.; Kemp, P. D.; Barry, T. N. 1999a: Evaluation of the feeding value of Aries HD perennial ryegrass (*Lolium perenne*). I. Performance of lactating ewes in spring. *New Zealand journal of agricultural research 42*: 441-448.

Bluett, S. J.; Hodgson, J.; Kemp, P. D.; Barry, T. N. 1999b: Evaluation of the feeding value of Aries HD perennial ryegrass (*Lolium perenne*). II. Performance of weaned lambs in summer. *New Zealand journal of agricultural research 42:* 449-458.

Burnham, D. L.; Morris, S. T.; Parker, W. J. 1996: A guide to sheep and beef cattle management using sward surface height. Unpublished report. Palmerston North, Massey University. pp 1-18.

Corson, D. C.; Waghorn, G. C.; Ulyatt, M. J.; Lee J. 1999: NIRS: Forage analysis and livestock feeding. *Proceedings of the New Zealand Grassland Association 61*: 127-132.

Dexcel. 2001: Recommended liveweights for young stock. Farm Fact 1-6. Hamilton, Dexcel. www.dexcel.co.nz/farmfacts/view_farmfact.cfm?id=1_6.

Hodgson, J.; Mackie, C. K.; Parker, J. W. G. 1986: Sward surface heights for efficient grazing. *In*: Grass Farmer. *British Grassland Society occasional publication 24*: 5-10.

Hodgson, J.; Brookes, I. M. 1999: Nutrition of grazing animals. *In*:

New Zealand Pasture and Crop Science. White, J, Hodgson, J. *ed*. Auckland, Oxford University Press. pp. 117-132.

Matches, A. G. 1969: Pasture Research Methods. *In*: Proceedings of the National Conference of Forage Quality Evaluation and Utilisation. I1-I32.

Matthews, P. N. P.; Harrington, K. C.; Hampton, J. G. 1999: Management of grazing systems. *In*: New Zealand Pasture and Crop Science. White, J., Hodgson, J. *ed*. Auckland, Oxford University Press. pp. 153-174.

McMeekan, C. P. 1954: Good rearing of dairy stock. *Proceedings of the Ruakura farmers conference 6*: 186-223.

Morris, S. T.; Hirschberg, S. W.; Michel, A.; Parker, W. J.; McCutcheon, S. N. 1993: Herbage intake and liveweight gain of bulls and steers continuously stocked at fixed sward height during autumn and spring. *Grass and forage science 48*: 109-117.

Penno, J. W. 1994: Growing replacements. *Proceedings of the Ruakura farmers' conference 46*: 36-42.

Penno, J. W.; Macmillan, K. L.; Bryant, A. M. 1995: Effect of level of nutrition on age of puberty and reproductive performance of Friesian heifers. *Proceedings of the New Zealand Society of Animal Production 55:* 79-81.

Poppi, D. P.; Hughes, T. P.; L'Huillier, P. J. 1987: Intake of pasture by grazing ruminants. *In*: Livestock Feeding on Pasture. Nicol, A. M. *ed*. New Zealand Society of Animal Production occasional publication 10: 55-63.

Realini, C. E.; Hodgson, J.; Morris, S. T.; Purchas, R. W. 1999: Effect of sward surface height on herbage intake and performance of finishing beef cattle. *New Zealand journal of agricultural research 42*: 155-164.

Swift, G; Lowman, B. G.; Scott, N. A.; Peebles, K.; Neilson, D. R.; Hunter, E. A. 1989: Control of sward surface height and the growth of set stocked finishing cattle. *Research and development agriculture 6*: 91-97.

Wheeler, J. L.; Hedges, D. A. 1972: Assessment of summer forage crops for sheep by the put-and-take grazing technique. *Australian journal of agricultural research 23*: 825-838.

Wright, I. A.; Whyte, T. K. 1989: Effects of sward surface height on the performance of continuously stocked spring-calving beef cows and their calves. *Grass and forage science 44*: 259-266.