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Herbage allowance, pasture quality and milkfat production as affected by stocking rate and conservation policy

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ABSTRACT

Results are presented from the first year of a 4-year grazing trial investigating the effects of stocking rate (3.75 and 4.49 cows/ha) and time of conservation, October (early), November (late), on dairy production at the Waimate West Demonstration Farm in South Taranaki.

Both stocking rate and time of conservation had a significant ($P < 0.05$) effect on milkfat yield/cow which resulted in large differences between treatments in terms of milkfat production/ha. At the low stocking rate, milkfat production/ha was 645 and 619 kg, and at the high stocking rate 642 and 705 kg for the respective early and late conservation treatments.

These differences in animal performance are attributed to differences in pasture allowance in early lactation and to the proportion of dead matter in the pasture over summer and autumn. The proportion of stem in pasture had little direct effect on dairy production but over time it may have contributed to the pool of dead matter causing lower milkfat yields in summer and autumn.

The adoption of a high stocking rate and late conservation policy maintained adequate pasture allowance (33 to 35 kg DM/cow/d) in early lactation and a sufficiently intensive grazing pressure in October and November to prepare pastures of low dead and high green content over summer and autumn.

Keywords Dairy; milkfat production; time of conservation; stocking rate; pasture allowance

INTRODUCTION

Information is available on the methods of conserving pasture, its quality and its value as a supplementary feed at various times of the year (Marsh, 1978). However, both Marsh (1978) and Bryant (1980a) have made claims that little evidence is published for basing decisions with regard to how much pasture should be conserved and when conservation should occur. Young (1966) reported that at 4.1 cows/ha the closing of 33% of the farm for conservation produced a higher amount of supplementary feed but less milkfat than closing only 16%. In areas prone to a summer dry spell Scott (1978) recommended early conservation to ensure pastures are back into full grazing before summer.

The decision of when and how much pasture to conserve is not made any easier when considering that, to achieve maximum production cows should be fully fed in early lactation (Bryant and Trigg, 1982) and that lax grazing, the result of full feeding in October and November will cause an accumulation of stem and dead material (Korte, 1982) which will reduce pasture quality and animal performance over summer and autumn. To maintain full feeding of cows in spring and prevent seed head development, the mechanical topping of pastures following grazing has been advocated and generally accepted by farmers. However, in an investigation of the merits of this system Bryant (1982) found that although topping increased milkfat production, the amount of pasture conserved was reduced considerably.

This highlights the conflict facing the farmer; how to maintain high intakes, achieve adequate pasture control and conserve sufficient pasture to meet subsequent feed deficits. More definite information is required on when a pasture surplus occurs and the effect of different conservation policies on immediate and subsequent levels of pasture and animal performance.

EXPERIMENTAL

A farmlet study is currently being conducted at the Waimate West Demonstration Farm in South Taranaki investigating the effect of stocking rate and time of closure for conservation (2×2 factorial design) on dairy production over a 4-year period. The objectives of the 2 times of closure are:

(1) early, to maintain a relatively intensive grazing pressure on pastures over the period of seed head development in October to mid November by closing paddocks for silage in late September or early October.

(2) late, to close paddocks for conservation as hay after cows have reached peak milk production. This usually occurs in late October or early November.

Two stocking rates, 3.75 and 4,49 cows/ha, have been included to give 2 grazing intensities at each time of conservation and to maintain these relative grazing intensities over the conservation periods the same area (29%) on each of the farmlets was closed.

Low stocked paddocks were conserved from Sept 27 - Nov 3 (LE) and Nov 1 - Dec 3 (LL); high stocked paddocks from Oct 4 - Nov 3 (HE) and Nov 3 - Dec 3 (HL).

Calving commenced in the first week of August.

The information presented is a preliminary report on the first year (1982-3) of the trial. The summer of that season was considered abnormal as pasture growth rates 40% greater than the average of the previous 9 years were recorded. This resulted in ranker pastures than normally experienced and may have influenced the treatment effects observed.

RESULTS

Animal Performance

The effects of the treatments on milkfat production, cow live weight and feed conserved are summarised in Table 1.

In the analysis of the effects of stocking rate and time of conservation on milkfat yield/cow a significant interaction ($P<0.05$) between the treatments over the later half of lactation occurred. As a consequence the effects of the treatments on milkfat yield will be discussed as differences between individual farmlets and not treatment averages.

In the early half of lactation (calving to Dec. 1) milkfat yield/cow was greater on the low stocked farmlets and the timing of conservation had little effect. However, at the high stocking rate early conservation resulted in a depression in milkfat yield of 10 kg/cow.

This effect was not repeated in the later half of lactation (Dec. 2 to drying off). At the high stocking rate similar levels of production/cow were recorded on the early and late conserved farmlets but at the low stocking rate milkfat production/cow on the LL farmlet was 9 kg less.

Over the season these effects resulted in the highest milkfat/cow being produced on the LE farmlet (172 kg milkfat/cow) and the least on the HE farmlet (143 kg milkfat/cow). When expressed as milkfat/ha similar levels of production were achieved on the early conserved farmlets (645 and 642 kg fat/ha for LE and HE respectively) but at late conservation the LL farmlet produced only 619 kg fat/ha whilst 705 kg fat/ha was produced on the HL farmlet. Cow live weights tended to reflect these differences in milkfat production.

The amount of feed conserved increased by delaying the time of conservation. The increase was greater at the high stocking rate and due to this some of the feed conserved on the HL farmlet was considered surplus to winter requirements and used to lengthen the lactation by 2 weeks compared with the HE farmlet. On both low stocked treatments, supplementary feed surplus to winter requirements was conserved.

Pasture Production and Composition

Pasture Allowance.

For all treatments the allowance of total DM showed a consistent increase over the season. By comparison, the allowance of green leaf remained relatively constant (Fig. 1). The allowance of total DM at the high stocking rate was lower ($P<0.01$) than at the low stocking rate in each of the 4 periods. When the allowance was calculated as green leaf, the stocking rate effect was reduced but remained significant ($P<0.05$) in 3 of the 4 periods. Conservation had little apparent effect on pasture allowance whether expressed as total DM or green leaf.

Pasture Composition.

The differences in pasture composition over time and between treatments are shown in Fig. 1. The clover content on the LL treatment was lower ($P<0.05$) than the other treatments during and immediately following conservation.

The proportion of stem in pasture showed a very marked seasonal trend, reaching a peak in Nov-Dec

TABLE 1 Cow performance and feed conserved as affected by stocking rate and time of conservation.

Stocking Conservation time	Low Early	Low Late	High Early	High Late	Low/High	Early/Late	Interaction
Milkfat (kg/cow)							
Calving-Dec 1	78	80	65	75	**	*	NS
Dec 2-dry	94	85	78	82	**	NS	*
Total	172	165	143	157	**	NS	NS
Milkfat (kg/ha)	645	619	642	705			
Live weight (kg)							
Dec 1	350	361	337	349	*	*	NS
Drying off	373	366	358	360	*	NS	NS
Hay (20 kg DM bales/cow)							
conserved	16	18	8	13			
fed	7	8	9	14			

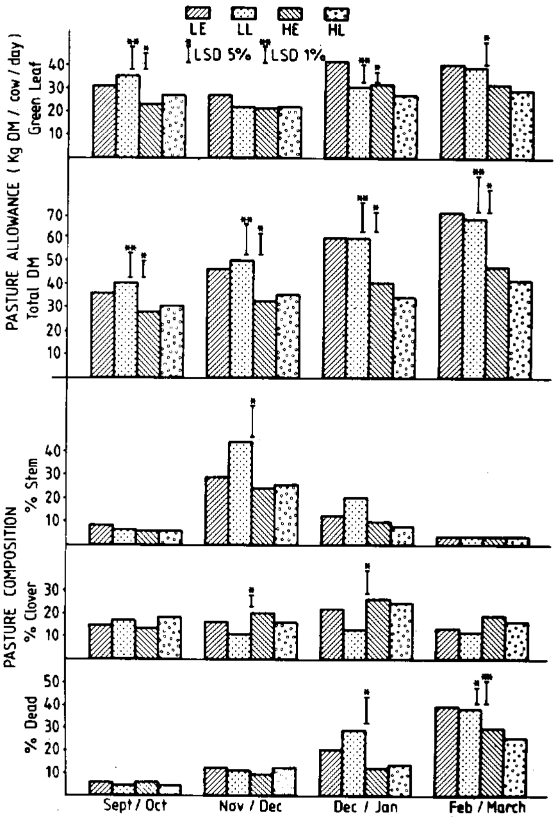

FIG. 1 Changes in pasture allowance (total DM and green leaf) and pasture composition from September to March as affected by stocking rate and time of conservation.

but at a low level early and late in the season. This was similar for all treatments but over the period of rapid stem development (Nov-Dec), a higher ($P<0.05$) proportion of stem was found in the LL pasture.

The proportion of dead material was higher in the later half of the season (Dec-March) and over this period was higher ($P<0.05$) on the low stocked than the high stocked treatment.

Pasture Characteristics and Animal Performance

Regression analysis was conducted (n = 12) comparing the pasture characteristics measured with milkfat yield per cow in each of the 4 periods (each period comprised 3 measurements made at 2-weekly intervals). The correlation coefficients presented in Table 2 summarise the critical relationships.

Over the early part of lactation when pastures were closed for early conservation (Sept-Oct), pasture allowance and milkfat yield/cow were significantly correlated. However, over the late conservation period (Nov-Dec) neither pasture allowance nor pasture composition was correlated with milkfat yield. As the

TABLE 2 Correlation coefficients (r) between pasture characteristics and milkfat yield per cow.

	Available DM		Composition %			
	Total	Green	Green	Dead	Stem	Clover
Sept-Oct	0.60*	0.74**	0.20	0.10	0.01	-0.26
Nov-Dec	0.20	0.38	0.07	-0.48	0.07	-0.30
Dec-Jan	-0.47	-0.07	0.45	-0.61*	-0.12	0.51
Feb-Mar	0.0	0.58	-0.84**	-0.84**	0.53	0.58*

season advanced (Dec-March) the proportion of dead material had an increasingly negative correlation with animal performance. By Feb-March total DM allowance had no influence on milkfat yield but the allowance of green herbage and the content of green material, dead material and clover had significant associations.

At no stage throughout the trial did the content of stem have any influence on animal productivity.

DISCUSSION

The time difference between the early and late conservation treatments was only 4 weeks but it was sufficient to significantly affect pasture allowance and composition and subsequent animal performance.

Over the period when pastures were closed for early conservation, pasture allowance had the major influence on animal performance. Total DM allowance over this period varied from 28 kg DM/cow/d on the HE treatment to 40 kg DM/cow/d on the LL treatment and as a result differences in milkfat production would be expected (Bryant, 1980b; Glassey *et al.*, 1980). This would explain the differences in animal performance recorded between the low and high stocked treatments but it would not be expected that a difference in pasture allowance of 3 kg DM/cow/d between the HE and HL treatments would result in a difference of 10 kg milkfat/cow from calving to December.

The information presented supports the view that there may be a critical pasture allowance which cows in early lactation must be offered if both milkfat production and pasture utilisation are to be optimised. This was possibly achieved with the HL treatment in which a pasture allowance of 33 to 35 kg DM/cow/d was maintained and 75 kg milkfat/cow (337 kg milkfat/ha) produced from calving through to the beginning of December.

The lack of any direct association of plant stem on milkfat production over November and early December is contrary to the current thinking of advisory officers. However, the trial results strongly support this conclusion. In the Nov-Dec period the content of stem in all treatments was at the highest for the season (varying from 24 to 45%) but the allowance of green leaf was lower (21 to 27 kg DM/cow/d) than in Sept-Oct, a period when pasture allowance was significantly correlated with milkfat production. From this it can only be assumed that the allowance of total DM (including green stem) was adequate (33 to 51 kg DM/ha/d) and of sufficient quality to meet the nutritional requirements of the dairy cow.

Over the latter 2 periods (Dec-March) pasture composition, especially the proportion of dead material was negatively associated with milkfat production. Rattray (1978) reported a negative relationship between the dead content of pasture and *in vitro* digestibility and suggested that the dead content of pasture was a major factor affecting animal performance in summer and autumn.

A large proportion of dead material present in pasture in summer and autumn may result from unutilised stem which originated in November (Korte, 1982). Dead stem was not separately dissected but from the high stem preceding the high dead contents recorded for the LL treatment it could be deduced that a large proportion of the dead material probably originated from ungrazed stems.

The high level of animal performance (705 kg milkfat/ha) achieved on the HL farmlet supports the conclusion drawn that green stem can make a worthwhile contribution to the intake of dairy cows in Nov-Dec without any apparent loss in animal production. Once stems are grazed, a higher quality pasture containing less dead material will result over summer.

In late summer the content of dead material was high in all treatments but less ($P<0.01$) for the high stocked than the low stocked treatments (27% and 39% respectively). However, considering the significant negative correlation between dead material and milkfat production, it is assumed that even in the high stocked pastures the proportion of dead material may have been too high for maximum milkfat production. The intensity of grazing and the high level of pasture control maintained on the high stocked farmlets was such that it appeared little more could be achieved in pasture management to further reduce the dead material content.

CONCLUSION

The trial highlighted aspects critical to efficient utilisation of pasture for dairy production—

(1) Cows must be offered an adequate pasture allowance in early lactation. From the trial results the optimum pasture allowance is assumed to be 32 to 35 kg DM/cow/d.

(2) In November and December, green stem can apparently be utilised by dairy cows with no detrimental effects on their performance.

(3) In a year when summer growth of pastures was surplus to the requirements of lactating dairy cows, the proportion of dead material in pasture was found to have a marked depressing effect on milkfat production.

(4) At a relatively low stocking rate (3.75 cows/ha), delaying the time of conservation from October to November depressed total milkfat production by 26 kg/ha, whereas at a high stocking rate (4.49 cows/ha) a similar delay in conservation resulted in an increase in total milkfat production of 63 kg/ha.

This increase was achieved by maintaining an adequate pasture allowance early in lactation and then increasing the grazing intensity at a critical time to consume seed heads and ensure maximum pasture quality over the subsequent summer and autumn.

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