THE EFFECT OF RYEGRASS ENDOPHYTE ON MILK PRODUCTION FROM DAIRY COWS IN NORTHERN NEW ZEALAND

E.R Thom, D.A. Clark, C.D. Waugh, R.J. McCabe, V.T. van Vught and B.J.L. Koch
Dairying Research Corporation, Private Bag 3123, Hamilton, New Zealand

ABSTRACT

The aim of this study was to compare the milk production of cows grazing endophyte-infected perennial ryegrass (*Lolium perenne* L.) pasture with those grazing endophyte-free pastures. High and nil endophyte ryegrass pastures were drilled with and without white clover (*Trifolium repens* L.) in autumn 1993. White clover was completely removed in autumn 1995. High endophyte pastures had >85% of tillers infected but nil endophyte pastures were rapidly contaminated with endophyte-infected ryegrass and had 50% infection by autumn 1996. Losses in milk production due to endophyte were small (<6%), and occurred in only 2 of the 6 three week test periods. Cows showed clinical symptoms of ryegrass staggers in summer/autumn 1995 but not in 1996. Heat stress symptoms were absent. Losses of milk production occurred when lolitrem B levels were low (spring 1994) and when cows did not show clinical staggers (summer 1996). Other chemicals or agronomic factors could be important determinants of the milk production responses.

KEYWORDS

Dairying, grazing, ryegrass, endophyte, lolitrem B, ergovaline, ryegrass staggers

INTRODUCTION

Pasture containing perennial ryegrass and white clover is the major forage for New Zealand dairy cows. Most of the perennial ryegrass is infected with the endophyte *Acremonium lolii* which causes ryegrass staggers (Fletcher and Harvey, 1981), and occasionally heat stress (Easton et al., 1996). These adverse effects on cattle have been associated with the alkaloids lolitrem B and ergovaline, respectively.

There has been little research to measure possible effects of endophyte on milk production apart from McCallum and Thomson (1994) who reported no effect when cows grazed different ryegrass cultivars containing wild and novel endophytes. Australian work (Valentine et al., 1993) on pure ryegrass pastures showed milk production from cows grazing endophyte-infected ryegrass was 4-14% below those grazing endophyte-free.

Thus, a trial designed to measure milk production from cows grazing pastures sown with or without white clover, and containing high and low levels of infection with the 'wild type' or common New Zealand endophyte, was started in autumn 1993. White clover was removed from all treatments in autumn 1995. Thom et al. (1994) reported the results for the first year (1993/94); this paper summarises results for the second and third years.

METHODS

Ryegrass treatments were established by direct-drilling after spraying with glyphosate (0.72 kg a.i./ha); half the trial area (5 ha) received high (H) endophyte seed (85% infection) and the rest nil (L) endophyte (0% infection) seed of the same line. White clover was removed (-C) from 10 of the 20 0.25 ha paddocks, the rest being left with 'normal' levels (+C). The 4 treatments were arranged in paddock pairs within 5 blocks in a 2 x 2 factorial design. The 10 paddocks per treatment represented a farmlet which was rotationally grazed by 15 cows (mainly Friesians).

Details of pasture and animal measurements are given in Thom et al. (1994). Dry matter (DM) accumulation was estimated from cuts in 0.5 m^2 exclosure cages. Herbage samples were analysed for botanical composition, endophyte and alkaloid levels. Animal measurements were made during 3 week test periods in spring, summer and autumn of each year. Cows were grazed on a separate area sown with nil endophyte ryegrass for one week before and after each test period. Milk volume and composition (fat, protein and lactose) were measured twice daily. Heat stress was checked by measuring rectal temperatures and incidence of ryegrass staggers by field observations. Cows were offered similar treatment dry matter allowances during test periods. Data from individual cows were considered as replicates for analysis of treatment differences.

RESULTS AND DISCUSSION

Herbage accumulation was similar for all treatments in both years averaging 13.8 t DM/ha. In 1994/95 the ryegrass content of the +C treatments averaged 70% of DM compared with 81% for -C treatments. The former averaged 13% white clover. In 1995/96, after removal of white clover, treatments contained about 88% ryegrass except in March, 1996 when the summer grass (*Digitaria* and *Panicum* spp.) content (48%) exceeded the ryegrass content (37% of DM).

Herbage alkaloid levels were only available for 1994/95 but they were similar to the previous year (Thom et al., 1994). In spring 1994, lolitrem B levels in herbage from all treatments did not exceed 0.25 µg/g DM and ergovaline levels were <0.40 µg/g DM. Over summer and autumn 1995 (January to March), lolitrem B levels in H herbage were about 2.5 times higher than in L (1.8 vs 0.7 µg/g DM); ergovaline levels were 0.8 and 0.6 µg/g DM, respectively.

The H treatments maintained a high endophyte level (>86%, Table 1), however, in the L treatments, endophyte levels increased from <2% in August, 1993 to 50% by February, 1996.

Effects of endophyte on milk production were small and reached significance in only 2 of the 6 test periods (Table 2); in 1993/94, no significant effects of endophyte were noted (Thom et al., 1994). Milksolids (fat plus protein) responses were similar. In the 1994 and 1995 summers, the effects of white clover and endophyte could not be separated, so white clover was removed. During summer/autumn 1995, cows on the H treatments showed clinical symptoms of ryegrass staggers while those grazing L did not; these symptoms were absent in 1996. Symptoms of heat stress were absent. Ergovaline levels in herbage were generally below 1 µg/g DM (Easton et al., 1996) and ambient temperatures rarely exceeded 25°C.

Lolitrem B levels were low (<0.25 mg/g DM) in spring 1994 when a 6% reduction in milk production due to endophyte was recorded. Valentine et al. (1993) reported a similar result with herbage lolitrem B levels of 0.23 µg/g DM. It was surprising that milk production in summer 1994 (Thom et al., 1994) and summer 1995 (Table 2) was not directly affected, when lolitrem B levels were more than 7 times higher than spring levels and cows showed clinical symptoms of ryegrass staggers. We recorded a smaller reduction in milk production in summer than did Valentine et al. (1993) (5 vs 14%).

Our trial showed inconsistent and small effects of endophyte on milk production, that were not strongly linked to the development of ryegrass staggers or necessarily to high plant levels of lolitrem B.

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Table 1
Endophyte levels (% tillers infected) in ryegrass during summer over three years

Treatment[a]	March 1994	February 1995	February 1996
H + C	94	88	86
H - C	94	98	89
L + C	23	28	50
L - C	30	57	51

[a]Treatments drilled March 1993; clover (+C) treatment removed in March 1995.

Table 2
Effect of endophyte level in ryegrass on milk production (litres/cow/day) of dairy cows over consecutive lactations

		1994/95				1995/96	
Trt.	Spring	Summer	Autumn	Trt.	Spring	Summer	Autumn
H + C)		7.6					
)	16.3		10.7	H	16.7	8.3	7.3
H - C)		7.7					
L + C)		9.4					
)	17.3		11.1	L	16.9	8.8	7.2
L - C)		8.2					
SED[a]	0.38**	0.24***	0.39[NS]		0.26[NS]	0.22*	0.21[NS]

[a] SED for comparison of interaction means in summer 1995.
[NS] = not significant; * = P<0.05; ** = P<0.01; *** = P<0.001.