Effects of Novel Ryegrass Endophytes on Pasture Production and Milk Production from Dairy Cows in Northern New Zealand

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Introduction The fungal endophytes AR1 and AR37 have been selected to provide insect protection for perennial ryegrass (*Lolium perenne* L.) with less animal toxicity (eg ryegrass staggers) than is associated with the wild-type (WT) endophyte. AR1 is non-toxic to ruminants while AR37 contains a less potent animal toxin than WT. Cows eating ryegrass infected with AR1 produced 9% more milk than those eating WT over 3 years despite no differences in pasture nutritive value or yield (Bluett *et al*., 2005). AR37 controls a broader range of insects than AR1. It is currently being tested in short-term feeding experiments indoors and under rotational grazing (Thom *et al*., 2007) that commenced in 2005. This paper reports some of the early results from this experiment.

Materials and methods Mixtures of Grasslands Commando perennial ryegrass and Grasslands Tribute white clover (*Trifolium repens* L.) were sown into a cultivated seedbed (6 x 0.5 ha paddocks/treatment) in Autumn 2005. Ryegrass plants were infected (> 86%) with either AR1, AR37, WT or had no (Nil) endophyte. Dry matter (DM) production was calculated by cutting 0.2 m^2 of pasture in grazing exclusion cages at 30-day intervals. Argentine stem weevil damage to ryegrass tillers was assessed in summer (January) of each year and African black beetle and root aphid infestations were recorded in soil samples taken in February/March. Cows were grazed on pasture for 12 days and were also fed cut pasture indoors for 12 days in different seasons of the year. Milk yields were recorded for each cow (n=10-15 cows/treatment) using in-line milk meters over the final 5 days of each feeding period.

Results and discussion Endophyte status has not influenced pasture production over the first 2 years but by May 2007 ryegrass tiller density tended to be higher ($P<0.10$) in paddocks with AR37 (6040 tillers/m^2) than with WT (5246), AR1 (4574) or Nil (4192). Subsequently, in the spring of 2007, AR37-infected pasture had higher ($P=0.05$) ryegrass content (85% of DM) than AR1 (74%) or Nil (78%). The AR37-infected pasture had a lower ($P<0.01$) clover content (4%) compared with those with AR1 (13%) or Nil (12%). WT-infected pastures had similar percentage clover as AR37. Stronger ryegrass presence in AR37 than AR1-infected pastures was partly associated with lower populations of black beetle (2.5 versus 5/m^2) and root aphid (2 versus 32% of soil samples).

Milk yields of cows were similar in spring 2005 and 2006, regardless of pasture endophyte status, but indoor feeding in summer 2006 showed cows fed AR37 produced less ($P<0.01$) milk (11.6 kg/cow/day) than those fed AR1 (12.9), even though daily DM intakes were higher ($P<0.01$) than for AR1 (14.9 versus 13.4 kg DM/cow/day). In autumn there was no difference in milk production between AR37 and AR1 (14.5 kg/cow/day), but production was lower ($P<0.001$) from cows grazing WT (11.8 kg/cow/day). Ryegrass staggers has never been detected in cows fed AR37 endophyte, however, those fed WT in summer and autumn 2006 showed clinical signs of staggers (head shaking, body swaying).

Conclusions Further research is necessary to confirm effects of the AR37 endophyte on cow health and production because environmental variables such as weather, pasture alkaloid concentrations, pasture quality and insect populations will influence pasture and cow responses to endophytes. Assessments of cow responses will be made over longer periods as the experimental programme develops.

References

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