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**THE EFFECT OF HERBAGE SPECIES ON
INTERNAL PARASITE
DYNAMICS IN SHEEP**

**A THESIS PRESENTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY AT MASSEY UNIVERSITY**

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1996

ABSTRACT

A series of experiments was undertaken to determine the effect of different grass species on gastrointestinal nematode parasitism and performance of lambs and the effect of a broader range of herbage species on nematode larval population dynamics. All of the experiments were undertaken at AgResearch Flock House, located in the southern North Island of New Zealand.

In the first of two unreplicated grazing experiments, four grass species browntop (*Agrostis capillaris* cv Muster), tall fescue (*Festuca arundinacea* cv Au Triumph), Yorkshire fog (*Holcus lanatus* cv Massey Basyn) and perennial ryegrass (*Lolium perenne* cv Nui) were compared in single species swards grazed by weaned lambs in each of two years (1991/92 and 1992/93). Swards were grazed to a target sward height of 5 cm by altering stock numbers. On each grass, one third of the lambs were suppressively drenched fortnightly (SD) and two thirds were trigger drenched (TD), when mean faecal egg count on any treatment reached 1500 eggs per gram (epg) in 1991/92 and 1000 epg in 1992/93. In both years, lamb faecal egg counts were higher ($P < 0.05$) in lambs which grazed browntop and tall fescue than in lambs which grazed ryegrass or Yorkshire fog. Parasitism, as measured by tracer lamb nematode burdens, was highest in lambs which grazed browntop, lowest

in lambs which grazed ryegrass and Yorkshire fog, and intermediate in lambs which grazed tall fescue ($P < 0.05$). In 1991/92, production losses due to parasitism as measured by the difference in liveweight between SD and TD lambs were higher ($P < 0.05$) in lambs which grazed browntop, tall fescue or ryegrass than in lambs which grazed Yorkshire fog. This pattern was not repeated in the second year.

In the second grazing trial, undertaken in 1992/93, lambs grazed tall fescue or Yorkshire fog swards to target heights of 3, 5, or 8 cm. On the tall fescue swards, decreasing sward height increased ($P < 0.05$) tracer lamb nematode burdens, but this was not observed on the Yorkshire fog swards. Also, on the tall fescue swards, there was a significant ($P < 0.05$) production loss associated with parasitism (as measured by liveweight differences between SD and TD lambs), but such a pattern was not observed on the Yorkshire fog swards.

In a comparison of the recovery of *Trichostrongylus colubriformis* larvae from a range of herbages using the modified Baermann technique, greatest numbers were recovered from cocksfoot (*Dactylis glomerata* cv Wana) and chicory (*Chicorium intybus* cv Puna), lowest numbers from prairie grass (*Bromus willdenowii* cv Matua), perennial ryegrass (*Lolium perenne* cv Nui), and Yorkshire fog (*Holcus lanatus* cv Massey Basyn), and intermediate

numbers from browntop (*Agrostis capillaris* cv Muster), tall fescue (*Festuca arundinacea* cv Au Triumph), and white clover (*Trifolium repens* cv Huia) ($P < 0.05$). There was a greater than two-fold difference in the number of larvae recovered between chicory, which had the highest number of larvae recovered from it, and prairie grass, which had the lowest.

In a series of experiments undertaken outdoors, faeces containing known numbers of *Ostertagia circumcincta* and *Trichostrongylus colubriformis* eggs were deposited on mini-swards of a range of herbage species, browntop, chicory, cocksfoot, tall fescue, lucerne (*Medicago sativa* cv Otaio), ryegrass, prairie grass, white clover, and Yorkshire fog. Larvae were recovered from four strata (0-2.5, 2.5-5, 5-7.5, and >7.5 cm above the soil surface) at 2, 4, 6, 8, 11 and 14 weeks after the faeces was deposited on the herbage. These “contaminations” were carried out four times in 1992/93 and 1993/94.

Larval development success, defined as the maximum number of larvae recovered on herbage after contamination, differed significantly ($P < 0.05$) between herbage species, being greatest on Yorkshire fog and ryegrass, least on white clover and lucerne and intermediate on the other herbages. The proportion of larvae recovered from the bottom stratum, an inverse measure of the ability of the larvae to migrate vertically, differed ($P < 0.05$) between

herbages. It was greatest on Yorkshire fog and prairie grass, least on white clover, ryegrass and browntop with the other herbages intermediate. Larval survival, as estimated by the decline in larval numbers on the herbage, did not differ ($P>0.05$) between herbages.

Two experiments to compare larval development success and migration were done in a glasshouse with mini-swards established in 20 cm diameter plant pots. Four grass species, ryegrass, tall fescue, Yorkshire fog, and browntop were compared. Faeces containing known numbers of *Ostertagia circumcincta* and *Trichostrongylus colubriformis* eggs were deposited on swards after cutting to one cm, and the larvae recovered from the four strata (0 - 2.5 cm, 2.5 - 5 cm, 5 - 7.5 cm and >7.5 cm) 4 weeks later.

Larval development success did not differ ($P>0.05$) between grasses. However, the vertical migration patterns were similar to those observed in the outdoor larval dynamics experiments, with larvae concentrated in the bottom stratum of Yorkshire fog but more evenly spread over the four strata in the other grasses.

The results from these trials show that, under New Zealand conditions, pasture species can have marked effects on larval development success and

larval migration on herbage. This translated into differences in lamb parasitism between grass species. Combining the results from the studies in this thesis with other published results suggests that differences in lamb parasitism between herbage species may vary depending on whether a continuous or discontinuous grazing strategy is used.

The studies also demonstrate that on Yorkshire fog swards production losses due to parasitism were lower than for other grasses. It is suggested that parasite levels in lambs which grazed this species were restricted either by physical means through restricted larval migration on herbage or through biochemical means by limiting larval establishment in the gastrointestinal tract of grazing lambs.

*This thesis is dedicated to Michael and Rebecca
Niezen*

ACKNOWLEDGEMENTS

There are a large number of people whom I wish to thank for their assistance with this thesis.

The very capable technical assistance of Sam Atkinson, Don MacDougall, Chris Miller, Michelle Power, Heather Robertson, Tania Waghorn, Kathy Walker, and Sue Wilson is greatly appreciated. In particular, Heather Robertson spent much of her past year working on aspects of this research, for which I am most grateful.

My supervisors, Professor John Hodgson and Associate Professor W.A.G. Charleston were very supportive of the research and extremely cooperative in revising manuscripts.

I would like to thank all the administrative and farm staff at Flock House for their cooperation with all the various trials.

Most of this work was funded by the New Zealand Meat Research and Development Council (MRDC). Without their funding, this work would not have been possible. Both MAF Technology, and later AgResearch, were supportive of this work and I thank them for the opportunity of doing a PhD while being employed by them.

Finally, a special thank you to my wife, Jenny, for her patience and support through the entire ordeal.

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