

The effect of *Cichorium intybus* and *Lotus corniculatus* on nematode burdens and production in grazed lambs

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ABSTRACT

The study was designed to examine the hypothesis that chicory (*Cichorium intybus*) and *Lotus* sp. (*Lotus corniculatus*) have the potential to affect the naturally acquired nematode burden in grazed lambs. Organic male castrate lambs (48) with a naturally acquired parasite burden grazed replicate combination plots (0.6 ha) of chicory, *Lotus corniculatus*, perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). Lamb performance was determined by weekly weight gain and condition score assessments. Nematode burden was assessed by individual lamb faecal egg count (FEC) before and after drenching (levamisole). The range of parasitic helminths present was assessed by faecal culture and by total worm counts performed on a proportion of the lambs at slaughter. Weekly pasture larval counts (PLCs) were conducted on the trial plots. A concurrent small plot study (6 x 1m² replicates) of each of the forages used in the grazing trial was run to assess the potential effect of forage type on the development and survival of *Teladorsagia circumcincta* assessed by weekly PLCs. Preliminary data suggest that lambs grazing chicory or a combination of lotus and chicory had lower FECs than those grazing PRG/WC, however there was no significant difference in the total worm counts.

Keywords: chicory; Lotus corniculatus; nematodes; sheep

INTRODUCTION

A number of studies have shown that that 'novel' forages such as chicory and *Lotus* sp. have the potential to influence the nematode burden in sheep (and other species, Hoskin *et al.*, 1999) and/or are associated with improved growth rates in lambs which have high faecal parasite egg counts (Scales *et al.*, 1994, Niezen *et al.*, 1998b). Suggested mechanisms for the effect of these forages are 1) they affect the survival/migration of infective larvae in the sward (Scales *et al.*, 1994), 2) their tannin content has a direct toxic effect on the parasite and/or parasite fecundity (Hoskin *et al.*, 2000) or 3) they improve the protein and/or mineral status of grazed sheep thereby enhancing their growth and potentially the immune response corresponding to an improved 'resilience' (Waghorn *et al.*, 1997). The present study aimed to determine whether an affect of forage on internal parasites could be measured in organic lambs in the UK. The trial also

sought to further test the hypothesis that pasture larval dynamics could be the controlling mechanism.

MATERIALS AND METHODS

Grazing Trial: The trial design consisted of 8 x 0.6 ha grazing plots which consisted of two replicates of 4 forage combinations; chicory (C), C/*Lotus corniculatus* (LC), LC/ perennial rye grass (PRG) and PRG/ white clover (WC). Six 6-month old organic Lleyn male lambs grazed each plot for 8 weeks (September-November). Due to the rapid rise in FEC in week 2 of the trial (50 % lambs had a FEC > 2,000) it was decided to drench all lambs with a broad spectrum anthelmintic (8ml Nilzan Gold, levamisole) 3 weeks after the start of the trial. Weekly assessments were made of weight gain, condition score and FEC. Individual lamb FECs were conducted using the modified McMaster method. Parasite eggs were speciated as *Nematodirus* sp., *Strongyloides* sp., *Trichostrongylus* sp., and *Capillaria* sp. the identification of eggs from other members of the superfamily Trichostrongyloidea and Strongyloidea was confirmed using faecal culture (weeks 2, 7 and 8). Pasture larval counts were performed weekly on samples from each plot cut at two heights (Cork *et al.*, 2001). On completion of the trial 5 lambs from each forage group were sent for slaughter and total worm counts were performed on the abomasum, small intestine and large intestine. Forage ground cover was evaluated using botanical assessment of plants growing in exclusion cages. Please note that full statistical analysis is not possible at the time of writing due to the fact that we are still awaiting additional data.

Small Plot Experiments: These were designed to complement the grazing trial; 6 replicate plots of each of the four forage combination plots used in the grazing trial were sown at equivalent rates to those used in the field. Each plot (topped to a sward height of 5cm) received 105g of faeces, which contaminated each plot with 198,000 *Teladorsagia circumcincta* eggs. Each week, for a period of 8 weeks (September/October), herbage was harvested for PLCs according to a predetermined pattern (approximately 200g of forage fresh weight).

RESULTS

Grazing Trial: All lambs on the grazing trial had satisfactory weight gains and condition scores before and after drenching. Mean lamb weight gains appear to be higher in lambs grazing C and C/LC than those grazing PRG/WC or PRG/LC after drenching. Full statistical analysis is yet to be completed. Lambs grazing C and C/LC appeared to have lower FEC (compared to those grazing PRG/WC) both before and after drenching (figures not shown*). Faecal cultures pre-drenching indicated that lambs had a mixed helminth burden with a predominance of *Strongyloides* sp., *Cooperia* sp., *Oesophagostomum* sp., *Chabertia* sp. and *Nematodirus battus*. Total worm counts confirmed that a broad range of helminth species were present. No significant differences ($P > 0.5$) existed in the total worm counts or species present in lambs in different forage groups. In abomasal samples there was a range of *Haemonchus* sp., *Ostertagia* sp., and *Trichostrongylus* sp.. In small intestinal samples *Bunostomum* sp. and

Nematodirus sp., *Cooperia* sp., *Strongyloides* sp. and *Trichostrongylus* sp were present in all samples examined.

Pasture Larval Counts : Initial data for the small plot experiment suggests that 26 days after the application of faecal material containing a known number of *T. circumcincta* eggs larval extraction was greater for PRG/WC than for the other 3 forage combinations studied. Complete pasture larval data was not available at the time of writing.

Forage ground cover was > 94 % in all of the 0.6 ha field plots indicating that forage establishment was satisfactory (Table not shown*). * Figures and tables have been removed to comply with the space restrictions set for the conference proceedings. These are available from the authors on request.

DISCUSSION

Analysis of preliminary data suggests that the organic lambs on all the grazing plots were able to maintain satisfactory weight gains and achieve a good condition score despite having a relatively high nematode burden. This has been observed in concurrent epidemiological studies on organic farms (Frank Jackson, pers. observation). However, it is likely that this will depend on the species of nematode present in the gut, the age and immune status of the lamb, the presence of concurrent disease and the nutritional value of the forages grazed.

We have observed that the mean FECs appear to be higher in lambs grazing PRG/WC than those grazing chicory or C/LC with some evidence that these lambs also had lower weight gains than those grazing chicory or LC/C. These findings are in agreement with similar grazing trials in lambs and deer (Scales *et al.* 1994, Niezen *et al.* 1998c). Preliminary data from the small plot studies suggest that the number of *T. circumcincta* larvae harvested was greatest from the PRG/WC forage. This may be because the larvae have greater survival, increased development, or are better able to migrate up this herbage. Further studies are underway to ensure that observations were not due to a difference in the sensitivity of the harvesting method for novel forages compared with a typical PRG/WC sward. It is tempting to speculate that the combined FEC and PLC results suggest that more larvae, and therefore increased infection risk, would be present for the lambs grazing PRG/WC compared to the novel forages. Indeed an effect of herbage species on larval extraction has previously been observed (Scales *et al.* 1994, Niezen *et al.*, 1998a). However, the interpretation of these results is complicated by the fact that there was no significant difference in the total worm counts recorded in samples obtained from a proportion of the lambs grazing each of the 4 forages. However, the small number and age of the animals examined or possibly the effect of drenching may explain this lack of significance.

Certainly, from the establishment and lamb performance data the use of chicory or *Lotus corniculatus* in a grazing regime may have some value as a tool to maintain satisfactory levels of production in organic lambs without reliance on anthelmintics as long as lamb condition and FEC are monitored. At the Institute of Rural studies we have been able to establish and maintain Chicory for several

seasons and it appears to be highly palatable for lambs. *Lotus* sp. is less easy to maintain from season to season (Marley & Lampkin, 2000).

The lambs in this trial performed well despite high FECs: It is possible that organic lambs have a degree of 'resilience' to a relatively high helminth burden, or may carry a higher proportion of relatively non-pathogenic nematodes and/or a broader range of species. It is important, therefore, to use FEC as a tool for monitoring the nematode burden of an organic flock but not to rely on it totally. Faecal egg culture may be necessary in some cases along with regular assessment of lamb weights and condition scores.

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