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Influence of different proportions of *Lotus corniculatus* in the diet of lambs on dags, flystrike and animal performance

D.M. LEATHWICK AND D.S. ATKINSON

AgResearch, Grasslands Research Centre, Private Bag 11008, Palmerston North, New Zealand.

ABSTRACT

The relationship was investigated between the number of days each fortnight spent grazing *Lotus corniculatus* (lotus) or ryegrass/white clover and dags, flystrike and growth rates in lambs. Lambs which grazed lotus for 7 or more days each fortnight had significantly fewer dags (86-113g) and significantly higher live-weight gains (160-104 g/day) than lambs grazed on ryegrass/white clover (154g, $P < 0.01$ and 73g/day, $P < 0.05$ for dags and live-weight gain respectively). Lambs which grazed lotus continuously had significantly higher live-weight gains than lambs which grazed lotus for 7 or less days each fortnight. Flystrike was positively correlated with dags although this was less obvious over time-period 1 when the incidence of flystrike was low. The incidence of flystrike differed significantly between treatment groups ($P < 0.001$), ranging from 36% of lambs struck in the all ryegrass/white clover groups to 7% in the all lotus groups. Wool growth, faecal dry matter content and faecal nematode egg count (FEC) did not differ between treatments. These results confirm the potential of lotus as a tool in the management of dags and flystrike but indicate that lambs will need to be grazed on lotus for 7 or more days each fortnight in order to realise significant benefits.

Keywords: flystrike; dags; lambs; nematodes; *Lotus corniculatus*.

INTRODUCTION

Escalating problems of resistance to both anthelmintics (McKenna *et al.*, 1995) and dips (Wilson & Heath, 1994) and residue levels in exported products (Wakelin, 1994) are likely to result in pressure to reduce pesticide inputs in the management of dags, and both internal and external parasites. At the same time, consumer awareness of animal welfare issues seems likely to increase, requiring increasingly high levels of parasite control (Williams, 1993). Clearly, viable non-chemical alternatives to the use of pesticides will be required.

Lambs grazed on pasture species which contain condensed tannins (e.g., *Lotus corniculatus* (lotus)), suffer less from the detrimental effects of internal parasites, accumulate fewer dags and are less susceptible to flystrike than lambs grazed on ryegrass/white clover (Niezen *et al.*, 1994; Leathwick & Atkinson, 1995). Such forages therefore have considerable potential for the management of dags and parasitism, and for reducing reliance on pesticides. The above trials compared the performance of animals grazed continuously on one pasture or another. As lotus does not persist well under continuous grazing (Chapman *et al.*, 1990), and being a poor competitor is unlikely to be grown in mixed swards, then the most likely scenario for utilising lotus "on farm" is that it be grown as a speciality crop which is rotationally grazed. To date, no information exists on how often or for how long lambs need to be grazed on lotus in order to realise significant benefits. The aim of this trial was to firstly confirm the results of a previous study (Leathwick & Atkinson, 1995) on the benefits of grazing lambs on lotus on dags and flystrike, and secondly, establish for how many days each fortnight lambs need to be grazed on lotus in order to realise significant benefits.

MATERIALS AND METHODS

Adjacent swards of pure *Lotus corniculatus* (var Goldie) and mixed ryegrass (var Nui)/white clover (var Tahora) were established on a dry sandy soil at the Flock House Agricultural Centre, near Bulls. Two paddocks of each pasture type were established which enabled two replicates of the 5 treatment groups to be run simultaneously. Treatments consisted of groups of 26 lambs, which were rotationally grazed over the two pasture types, spending either 14, 10, 7, 4, or 0 continuous days each fortnight grazing lotus (Treatments 1-5 respectively). Lambs were restrictively randomised to treatment such that mean live-weight, faecal nematode egg count (FEC) and dag score were approximately equal in all groups at the start of the trial.

The trial was conducted over two time periods - from 25th October to 20th December 1994 (56 days) and from 17th January to 6th March 1995 (48 days). Three times each week all lambs were examined for the presence of maggots. After samples had been collected for fly identification all areas of strike were spot-treated with a 0.25% solution of cypermethrin (Cypor: Young's Animal Health (NZ) Ltd). At the end of the trial all animals were crutched and crutchings were oven dried and weighed. Wool growth was assessed by harvesting wool from midside patches. All animals were weighed and faecal sampled for FEC at approximately 2 weekly intervals. Faecal samples were weighed wet and dry to determine faecal dry matter content. In the second time-period the presence/absence of tapeworm proglottids and/or eggs was recorded whenever faecal sampling, checking for flystrike or carrying out FECs. Eight West Australian fly traps, 2 in each of the 4 paddocks, were used to monitor strike-fly abundance. Traps were baited with sheep's liver and sodium sulphide and

were replaced weekly. Herbage mass (kg DM/ha) was measured every 2-3 weeks by electronic pasture metre calibrated for each pasture type and pasture plucks were taken fortnightly to estimate parasite larval infestations.

Data on the incidence of flystrike was analysed by χ^2 test. All other results were analysed by ANOVA using a model of 5 treatments by 2 replicates by 2 times. Least Squares means were compared by *t*-test. FECs were transformed by $\text{Log}_{10}(x+1)$ before analysis.

RESULTS

Flies and Flystrike:

There was more flystrike recorded over the second time-period (98 lambs struck) than over the first (14 lambs struck - Table 1). This difference reflected the abundance of flies as the West Australian traps indicated low fly numbers over the initial trial period with large numbers being caught only toward the end of the first time-period and throughout the second. The difference did not reflect the dagginess of the lambs as there was no difference in final dag weights between the two times (means of 99.5 g and 105.4 g).

TABLE 1: Percentage flystrike occurring in groups of lambs (N=52) grazed on *Lotus corniculatus* or ryegrass/white clover for different numbers of days each fortnight.

Time-period	Days each fortnight grazing lotus				
	14	10	7	4	0
Oct.25 - Dec.20	2.0	2.1	3.8	5.8	14.0
Jan.17 - Mar.6	12.2	19.6	49.0	54.0	58.0

Treatments differed significantly in the amount of flystrike (χ^2 test: $P < 0.001$: Table 2) but the amount of lotus required in the diet to have an impact on flystrike appears to have differed between times. When fly pressure was low (Time 1), a reduction in flystrike was apparent when the lambs spent only 4 days each fortnight grazing lotus. But, when fly pressure was high (Time 2) 10 days lotus/fortnight was required to reduce the incidence of flystrike (Table 1).

Dags, Flystrike and Internal Parasites:

Lambs grazed on lotus for 7 or more days/fortnight (treatments 1-3) had significantly fewer dags at the end of the trial than lambs which grazed lotus for either 0 or 4 days/fortnight (treatments 4-5, $P < 0.01$, Table 2).

There was a significant link between dags and flystrike. The mean weight of dags for struck and unstruck lambs was 185 vs 105g respectively ($P < 0.01$). When the proportion of lambs struck was regressed against mean dag weight for each of the 20 treatment groups within the trial the goodness of fit was poor ($R^2 = 0.34$). However, when the same data was plotted for time-periods 1 & 2 separately, the goodness of fit remained low for period 1 ($R^2 = 0.34$) but was high for period 2 ($R^2 = 0.68$). It should be noted that without exception all strikes were in the breech

area and despite high fly numbers (up to 90 strike flies/trap/day) no cases of body strike were recorded and lambs without dags were seldom struck.

While animals grazed on lotus acquired fewer dags there was no treatment effect on FEC (Table 2) nor was there any correlation between dag weight and FEC, either overall or within treatments. Also, there was no difference in faecal dry matter content between treatments (Table 2) or any correlation between dag weight and faecal dry matter content, either overall or within treatments. Larval nematode infestations on pasture were high initially (500 L3/kg DM), were zero on all paddocks from November to February and climbed toward the end of the trial (350 L3/kg DM).

TABLE 2: Mean percentage struck, weight of dags, live-weight gain, wool growth, faecal dry matter content and faecal nematode egg count of lambs grazed on *Lotus corniculatus* or ryegrass/white clover for different numbers of days each fortnight.

	Days each fortnight grazing lotus				
	14	10	7	4	0
% of lambs struck	7	11	26	29	36*
Weight of dags (g)	86 _A	111 _A	113 _A	149 _B	154 _B
Live-weight gain (g/day)	160 _a	120 _{ab}	104 _{bc}	100 _{bcd}	73 _d
Wool growth (mg/cm ² /day)	2.05	2.10	2.06	2.03	1.93
Faecal dry matter (%)	19.4	21.9	19.4	18.1	17.1
Faecal egg count at trial end	787	737	822	849	857

* means significantly different - χ^2 test, $P < 0.001$.

means in the same row having letters in common are not statistically different, _{A-B}, $P < 0.01$; _{a-d}, $P < 0.05$.

Live-weight gain and wool growth:

Lambs which grazed lotus for 7 or more days/fortnight (treatments 1-3) grew significantly faster than lambs grazed solely on ryegrass/white clover (treatment 5). Also, lambs which grazed only lotus (treatment 1) grew significantly faster than those which grazed lotus for 7 or less days/fortnight (treatments 3-5). These differences did not reflect feed availability as pasture mass was consistent across all paddocks throughout, being initially 4-5,000 kg DM/ha and remaining at or about this level until the end of January before declining to approximately 2,000 kg DM/ha in all paddocks by the end of the trial.

There was no significant effect of treatment on wool growth (Table 2).

Flystrike and Tapeworms:

The data on the presence of tapeworms were used to investigate the association between infection with tapeworms and susceptibility to flystrike. Of the 81 lambs recorded as having tapeworms 36 (44%) were struck while of the 172 in which tapeworms were not recorded 62 (36%) were struck - these proportions were not significantly different ($\chi^2 = 1.64$).

DISCUSSION

These results confirm previous findings (Leathwick & Atkinson 1995) that lambs grazed on lotus acquire fewer dags and suffer less from flystrike than lambs grazed on ryegrass/white clover. There was a consistent trend for lotus in the diet to improve animal performance (reduced dags and flystrike, increased live-weight gain) with the more time spent grazing lotus the greater the benefits. As with previous work (Morley *et al.*, 1976; Fletcher & Sutherland, 1993; Leathwick & Atkinson, 1995) the data show a strong relationship between dags and flystrike indicating that the management of dags must be a key component of any flystrike control programme. However, the mechanism by which dag formation is reduced in lambs grazed on lotus is unclear. Morley *et al.* (1976) and Leathwick & Atkinson (1995) both recorded a significant reduction in dags and flystrike associated with helminth parasite control. Morley *et al.*, (1976) showed a significant association between dags and worm burden and helminth larval availability on pasture and yet they and others (Fletcher & Sutherland, 1993; Larsen *et al.*, 1994; Leathwick & Atkinson, 1995) have failed to show a correlation between dags and FEC. Larsen *et al.*, (1994) suggested that dag formation is due to the host's immune response to the ingestion of parasite larvae off pasture. However, in this experiment neither worm burden, as indicated by FEC, nor larval infestation on pasture differed between treatments and so the observed differences in dag formation cannot relate to differences in helminth infection.

Fletcher & Sutherland (1993) demonstrated an effect of endophyte in ryegrass on dags and flystrike. The ryegrass used in this experiment was an endophyte containing variety so the possibility exists that the observed reduction in dags on the lotus is due to the absence of endophyte in this pasture species. However, Niezen *et al.*, (1995) demonstrated a significant reduction in dag formation on sulla (*Hedysarum coronarium*) compared with lucerne, and concluded that this was probably due to the presence of condensed tannins in the sulla. In addition, based on this and other experiments (Niezen *et al.*, 1995; Robertson *et al.*, 1995), reduction in dag formation in lambs grazed on pastures containing condensed tannins does not appear to be associated with increased faecal dry matter content. This is in contrast to work on the influence of endophyte (Fletcher *et al.*, 1990; Fletcher & Sutherland, 1993) where increased dag formation on endophyte contaminated pastures is invariably associated with scouring and low faecal dry matter content. The differences in dag accumulation observed in this experiment may therefore be due to the absence of endophyte, and/or the presence of condensed tannins, in the lotus. To date, no experiments have attempted to compare directly the influence of endophyte and condensed tannins on dag formation but such an experiment would seem desirable both in terms of understanding the underlying mechanisms and in making recommendations to farmers.

Many farmers drench lambs to remove tapeworms despite the absence of evidence of any resulting production benefit (Elliott, 1984). There is also speculation that

lambs infected with tapeworms suffer more from flystrike (Leathwick, *pers. obs.*). The data on tapeworms and flystrike in this experiment must be interpreted with caution as it was not possible to show that tapeworms were absent, only that they were not recorded. However, as each lamb was checked at least eight times for the presence of proglottids and/or tapeworm eggs then it seems reasonable that most of those animals classed as "no tapeworms" were in fact not infected. While such data will never be entirely conclusive it does suggest that if there is a link between infection with tapeworms and susceptibility to flystrike then it is not an obvious one.

Pastures such as lotus appear to have considerable potential as a tool in the management of helminth parasites, dags and flystrike. The fact that lambs grazed on such pastures can grow well despite parasite burdens which would normally cause significant production losses (Niezen *et al.*, 1994; Robertson *et al.*, 1995) suggests that reliance on anthelmintics to maintain growth rates may decline. In addition, the reduced accumulation of dags and associated levels of flystrike seem likely to result in lower labour input and reduced reliance on dipping. Successful integration of such pastures into sheep grazing systems should therefore reduce pesticide input while maintaining, if not improving, current productivity and quality. However, based on these results, lambs would need to graze lotus for 7 or more days each fortnight in order to ensure a significant increase in performance compared with ryegrass/white clover. Further work will be required to demonstrate the extent to which pesticide use can be reduced and whether significant economic benefits will result from investing in such a forage crop.

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