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Nutritional value of ‘Grasslands Maku’ lotus grown on low fertility soils

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ABSTRACT
Weaned lambs grazed areas of native tussock oversown with either lotus or a mixture of white and red clover for 2 consecutive 4-week periods in each of 2 years. The lambs selectively grazed introduced legume in the clover plots but not in the lotus plots. At herbage allowances at or below 2 kg DM/animal/d, there were no differences in live-weight gain (LWG) between lambs grazing areas oversown with either lotus or clover. At high allowances, LWG tended to be lower during the initial 4 weeks of grazing lotus (60 to 114 g/d) and to then increase to comparable values for lambs grazing areas oversown with clovers (140 g/d). Any depression of LWG could be minimised by “conditioning” lambs to lotus, and by management of companion grasses to keep them in the vegetative state. It was concluded that the initial period of lower LWG on lotus would not be a drawback if lotus was used as a maintenance-type feed for ewes in summer/autumn.

Keywords Lotus pedunculatus; native tussock; lamb growth; tannin levels; white clover; red clover.

INTRODUCTION

Lotus pedunculatus Cav. is a perennial legume common in low fertility hill country pastures particularly under wet or shady conditions (Levy, 1970). Its ability to outyield white clover on acid (pH<5.2), low fertility soils (Scott and Mills, 1981) has encouraged runholders to oversow ‘Grasslands Maku’ lotus in the tussock grasslands. In feeding value studies carried out at Palmerston North the daily live-weight gain (LWG) of sheep grazing Maku lotus was 87% of that of sheep grazing white clover (John and Lancashire, 1981). Under these high fertility conditions the level of condensed tannins in the foliage DM was 1 to 3%. In contrast, condensed tannin levels were much higher in Maku lotus growing in the Otago tussock grasslands, attaining concentrations of 8 to 10% DM when grown under typical low fertiliser application rates (Barry, and Forss, 1983). At such high concentrations condensed tannins depressed voluntary intake (Barry and Duncan, 1984) and depressed LWG of sheep grazing relatively pure lotus by about 50 g/d (Barry, 1985).

The aim of the present experiment was to compare LWG of lambs grazing mixed grass/legume swards typical of those obtained when Maku lotus or clovers are oversown into tussock grassland.

MATERIALS AND METHODS

Pastures
Areas of acid, low fertility tussock grassland 400 to 520 m above sea level on the Waiora Hill Farm adjacent to the Invermay Centre were oversown with either ‘Grasslands Maku’ lotus or a mixture of ‘Grasslands Huia’ white clover and ‘Grasslands Pawera’ red clover in the spring of 1979. Grasses consisted predominantly of browntop, sweet vernal and some Yorkshire fog.

Pasture measurements were carried out by the “calibrated eye appraisal” method of Haydock and Shaw (1975), allowing a large number of appraisals to be taken in each paddock. Actual dry matter (DM) production was determined by cutting a set of reference quadrats to ground level and weighing the sample after dissection out and rejection of unpalatable tussock, weed and dead matter. Tannin levels were determined in lotus foliage at each grazing.

The amount of available DM (i.e. introduced legume + inter-tussock grasses, but excluding tussock) in each paddock was determined, and the number of lambs required to give the nominated allowance (kg DM/lamb/d) was calculated. Grazing then proceeded by set stocking for 2 consecutive periods of 17 to 31 d in both Experiment 1 (1982-83) and Experiment 2 (1983-84). In both experiments, all groups of lambs were changed to new paddocks at the start of period 2. Because of variation in establishment and the amounts of bare ground, tussock and scrub in each paddock, residual DM could not be measured with any degree of accuracy and hence values for percentage utilisation of the swards have not been calculated.

Stock
Romney wether lambs weaned in December were used in both experiments. Mean live weight at the start of period 1 was 25.9 kg in Experiment 1 (mid-
December) and 21.3 kg in Experiment 2 (early January). Lambs were drenched with an anthelmintic + 2 mg selenium prior to each grazing. All lambs were weighed after a 24-h fast at the beginning of each experiment, and at the end of periods 1 and 2.

**Design**

In Experiment 1 lambs were grazed at a range of allowances from 1 to 4 kg DM/animal/d (Fig. 1) and the response in live-weight gain (LWG; y) to the amount of pasture on offer (allowance; x) was examined by regression analyses on the means of each mob, using the hyperbolic relationship.

\[ y = \frac{a - b}{x} \]

In this analysis 'a' refers to the maximum potential LWG achieved by an infinite allowance, and 'b' is defined as the change in LWG in response to increasing allowance from 1 kg DM/animal/d to infinity. This method of analysis was considered to be the most appropriate for the present data, as with only 6 pairs of observations per data set, models such as Mitscherlich curves could not be fitted with any degree of precision.

In Experiment 2 lambs were grazed at either 2 or 4 DM/animal/d with 4 replicate mobs at each allowance (Table 1).

**TABLE 1** Live-weight gain (g/animal/d) of lambs grazing areas of native tussock oversown with Maku lotus or a mixture of white and red clover. Data refer to 2 consecutive periods (days 1 to 31 and 32 to 58) in Experiment 2.

<table>
<thead>
<tr>
<th>Allowance (kg DM/animal/d)</th>
<th>Period 1</th>
<th>Period 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lotus</td>
<td>Clover</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>98</td>
</tr>
<tr>
<td>4</td>
<td>114</td>
<td>131</td>
</tr>
<tr>
<td>SEM</td>
<td>11.5</td>
<td>14.2</td>
</tr>
</tbody>
</table>

**RESULTS**

**Tannin Levels**

Tannin levels in foliage at the start of grazing ranged from 8.4 to 9.1% in Experiment 1 and 8.6 to 9.5% in Experiment 2.

**Grazing Behaviour**

A comparison of the legume contents of the swards in Experiment 1, before and after grazing illustrates that lambs were selectively grazing legume in the clover paddocks but not in the lotus paddocks. Selective grazing reduced the clover content from 42% down to 6%. In contrast, the lotus content remained constant at 74 to 76% indicating that lambs were grazing grass and lotus.

Visual observations of the lotus swards indicated a change in grazing behaviour with time. When lambs were first introduced to lotus they grazed patches of lotus to ground level and left the majority of lotus ungrazed. With time the grazing behaviour changed and lambs grazed uniformly over the paddock with leafy foliage being eaten first. This was observed in both years and was not accounted for by changes in stage of growth of the lotus or of condensed tannin levels.

**FIG. 1** Response of lamb live-weight gain to allowance of oversown pasture (introduced grasses and legume but excluding tussock) on offer in each of the 2 consecutive grazing periods in Experiment 1. (○, areas oversown with Maku lotus; ♦, areas oversown with a white clover/red clover mixture; (a) days 1 to 28; (b) days 29-47).

**Live-weight Gain**

In period 1 the LWG of lambs on clover swards in Experiment 1 increased curvilinearly with the amount of feed on offer (Fig. 1). In contrast the regression was not significant with lotus and the actual LWG's recorded on lotus were lower and unchanged over pasture allowances ranging from 1.5 to 4.0 kg DM/animal/d. In period 2 there were significant curvilinear relationships between LWG and the amount of pasture on offer with both clover and lotus, and gains in excess of 100 g/d were recorded on both swards.
In Experiment 2 there were no significant differences in LWG between clover and lotus over either grazing period (Table 1). However, although not significant there was a trend for LWG on lotus to improve relative to clover during the second grazing period in sheep offered the high allowance.

**DISCUSSION**

Results from the present grazing experiments show that low rates of LWG can occur in lambs grazing swards of oversown Maku lotus. This agrees with results from pen feeding and from grazing pure swards of Maku lotus with both lambs and wethers (Barry and Duncan, 1984; Barry, 1985) and is attributable to high levels of condensed tannins reducing voluntary intake. Maku lotus has been recommended for low cost development of tussock grasslands and is being used to provide feed for stock over the summer/autumn period so that pastures at lower altitudes can be spell for ewe flushing and wintering (Scott and Mills, 1981). In this context the lowest gains recorded in the grazing experiments (40 to 60 g/d) are acceptable, and hence high levels of condensed tannin in the foliage are unlikely to be a limiting factor in the use of Grasslands Maku lotus in management systems where ewes are grazed over the summer/autumn period. Because of the severe effects of early frosts on Maku lotus foliage the accumulation of a “bank” of forage for flushing during April is not recommended (Wedderburn and Lowther, 1985).

An area where the effect of condensed tannins in reducing voluntary intake is likely to be a limitation is with ewe hoggets or weaned lambs where high rates of LWG are required. The present results indicate that rates of LWG on Maku lotus may be only half those on clover. However this low LWG occurred only in the first month and then increased to over 150 g/d, suggesting that sheep can be ‘conditioned’ to grazing Maku lotus, as also observed by Barry (1985). Further support for this suggestion comes from visual observations of changes in grazing behaviour with time.

One major difference between experiments was the pre-experimental grazing of the swards. In Experiment 1 paddocks were grazed in late-winter and feed was allowed to accumulate until grazing commenced in mid-December. By then, the low fertility grasses were of low palatability with stalk and seed heads present. In Experiment 2 swards were grazed during spring so that at the beginning of experimental grazing, lambs were introduced onto vegetative grasses of high palatability (Lancashire and Ulyatt, 1974). Higher digestibility of the companion grasses could therefore be a factor in the greater LWG obtained in lambs grazing areas oversown with lotus in Experiment 2 than in Experiment 1.

Although rotational grazing is recommended for Maku lotus (Sheath, 1981), few farmers at present have sufficient areas of Maku lotus to warrant subdivision to allow continuous rotation grazing of their lambs or ewe hoggets. In addition Wedderburn and Lowther (1985) have demonstrated the importance of spelling over the late summer/early autumn in promoting the spread of Maku lotus by rhizomes in newly established swards.

In conclusion, runholders must be aware of the potential for low LWG when lambs or ewe hoggets are first introduced onto Maku lotus. However, the present results suggest that high levels of condensed tannin are not a limitation to the use of Maku lotus as a maintenance-type feed by ewes over the summer/autumn period.

**REFERENCES**


