Angora goat production from different legumes mixed with ryegrass

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ABSTRACT

The live weight gain, carrying capacity and total animal production from different pastures grazed by year old angora type wether goats were assessed during the spring, summer and autumn of two years. 'Grasslands Nui' perennial ryegrass (*Lolium perenne* L.) was sown with 'Grasslands Tahora' white clover (*Trifolium repens* L.), 'Grasslands Pawera' red clover (*Trifolium pratense* L.), or 'Grasslands Maku' lotus (*Lotus pedunculatus* Cav.) in December 1988 and measurements began in September 1989. Goat liveweight gain in spring was similar on all treatments averaging 130g/hd/day. Summer liveweight gain on red clover was 76g/hd/day, greater than the average of 56g/hd/day for white clover and lotus pastures. Autumn liveweight gains were not significantly different averaging 44g/hd/day. Carrying capacity was lowest on lotus pastures in all seasons. White clover pastures had the highest carrying capacity in all seasons though only significantly greater than red clover in autumn. No differences in total animal production per hectare were found in spring. Red clover, however, had 45% more animal production in summer than white clover or lotus pastures. This increased production was attributed to a greater consumption of legume due to both the dominance of red clover in the upper sward horizons and an active selection of red clover by the goats.

Keywords White clover, red clover, lotus, ryegrass, liveweight gain, carrying capacity, total animal production, pasture parameters.

INTRODUCTION

Improvements in the white clover content of pastures grazed by goats has been commented on in much of the goat research in New Zealand (Clark *et al.*, 1982; Clark *et al.*, 1984; Lambert *et al.*, 1987). Initial conclusions from this increase of white clover production were that goats ate little clover and this was reinforced by oesophageal samples from adult feral goats in hill country (Clark *et al.*, 1982).

Research which evolved from this has examined the use of this clover by sheep with little regard for the goat (Radcliffe & Francis 1988; Townsend & Radcliffe 1990). Subsequent work, however, has failed to find marked differences in the amount of clover eaten by young sheep or goats (Hughes *et al.*, 1984; Nicol & Collins 1990), suggesting that clover may be equally important for the performance of both.

Further research has revealed that goats perform well on high quality pastures when offered adequate amounts (McCall & Lambert 1987; Brown *et al.*, 1989), with goats ingesting a diet 20% greater in protein than the sward average (Masson *et al.*, 1991). Goat liveweight gain is also increased by increases in dietary protein (Hadjipanayiotou *et al.*, 1991). Goats should therefore perform better if the appropriate high producing legumes are present in the goats diet.

The use of other legumes for goats has not been reported in New Zealand and the performance of fibre goats on alternative lowland pastures is not well defined. This study reports the performance of angora goats from white clover, red clover, or *Lotus pedunculatus* pastures all with a ryegrass base. Detailed sward measurements were made to aid the interpretation of any performance differences encountered due to the different legumes.

MATERIALS AND METHODS

Nui perennial ryegrass (*Lolium perenne* L.) was sown with either Tahora white clover (*Trifolium repens* L.), Pawera red clover (*Trifolium pratense* L.) or Maku lotus (*Lotus pedunculatus* Cav.) as the legume component. The trial was sown on 10 December 1988 in two replicates of 0.25ha individually fenced plots. Measurements began in late September 1989 and continued for the spring, summer and autumn of the following two years. This was part of a larger trial comparing a range of pasture species.

The goats used were 70 and 20% G2 angora types in years 1 and 2 respectively with the remainder being G1 and purebred angoras. These were stratified for pedigree and initial liveweight and allocated randomly to the treatments from each group. A core of 10 measurement goats were confined to each plot for spring and summer, and 5 goats in autumn. The grazing management achieved a post-grazing pasture height of 10cm to the recommendation of McCall & Lambert (1987) to avoid intake suppression and ensure goat performance was the result of the pastures rather than the grazing management. Extra goats were added to each plot on a weekly basis to ensure the 10cm grazing height was achieved. Goat numbers were recorded weekly. Pastures were rotationally grazed with goats grazing for 7 days with 21 day regrowth periods. Measurement goats were weighed every two weeks.

The goats were orally treated for internal parasites with Ivermectin at monthly intervals and supplemented with selenium every eight weeks. Footrot and scald problems were controlled by putting all goats through a zinc sulphate footbath every two weeks.

Pasture measurements of pre and post-grazing herbage mass and botanical composition were recorded every 2 weeks. Stratified sampling of the pasture occurred just prior to grazing once in each season of year one only. A 1m x 20mm sample was removed in 4 layers, comprising 0-5, 5-10, 10-15, and 15-25cm, from each plot and dissected into its botanical parts.

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Both pasture and animal measurements were allocated to seasons based on the nearest weighing date to the end of each season. Spring became 26 September to 24 November, summer was 25 November to 15 February, and autumn became 16 February to 16 May. Autumn liveweight gain was only measured in year 2 and then from 5 April to 16 May once goats had grown sufficient fibre after February shearing to tolerate unsheltered weather conditions.

RESULTS AND DISCUSSION

Goat liveweight gain in spring was similar on all three legume based pastures (Table 1). Carrying capacity was highest on white clover, intermediate on red clover and least on lotus (Table 1). When converted into liveweight gain per hectare there were no significant differences between the legumes in spring though they were ranked similarly to their carrying capacities (Table 1).

TABLE 1 Angora wether goat production in spring, summer and autumn from white clover, red clover or lotus based ryegrass pastures.

Companion Legume	Liveweight gain (g/hd/day)			Carrying Capacity (goats/ha)			Total Gain (kg/ha)	
	Spr	Sum	Aut	Spr	Sum	Aut	Spr	Sum
White clover	126	54	38	54	50	38	440	230
Red clover	131	77	51	49	51	34	410	320
Lotus	129	60	41	45	42	30	370	210
lsd (0.05)	19	16	41	8	5	3	80	83

Summer liveweight gain (Table 1) was 41% greater for red clover than white clover pastures. Lotus pastures were not significantly different from white clover. Carrying capacity in summer (Table 1) was similar for both red and white clover, both being significantly higher than lotus pastures. The summer liveweight gain per hectare (Table 1) was significantly greater for red clover being on average 45% higher than white clover and lotus pastures.

Liveweight gains in autumn (Table 1) were only recorded in year 2. These showed no significant differences between the three legumes. Carrying capacity, recorded in both years, was greatest for white clover pastures, significantly higher than red clover which were in turn significantly greater than lotus pastures.

Though there were minor differences in the pre and post grazing herbage mass, these were not great. Spring, summer and autumn pre-grazing herbage mass averaged 3600, 3300, and 2900 kgDM/ha respectively while post-grazing herbage mass averaged 2400, 2600, and 2200 kgDM/ha.

Pre-grazing legume content was greatest in red clover pastures in all seasons (Table 2), though only had a significant effect on goat performance in summer. Lotus pastures had a significantly lower legume content than both white or red clover pastures in all seasons (Table 2) but had similar liveweight gains to white clover pastures.

In all seasons post-grazing legume content (Table 2) was similar to the pre-grazing legume content in both white clover and lotus pastures. Red clover pastures, however, had much less legume left after grazing than was on offer.

It would appear that red clover was actively selected by the goats, whereas other legumes were consumed in the same proportions as they occurred in the sward. The use of stratified sampling to study where each sward component was used to study this further.

TABLE 2 Pre- and Post-grazing legume content of white clover, red clover and lotus based ryegrass pastures grazed by goats (Two year mean).

Companion Legume	Spring		Summer		Autumn	
	Pre	Post	Pre	Post	Pre	Post
White clover	14.2	14.0	19.3	18.0	11.2	11.0
Red clover	21.2	14.3	42.5	28.9	33.9	27.0
Lotus	5.7	4.1	7.5	9.4	5.8	5.0
lsd (0.05)	9.4	10.0	2.7	8.5	5.3	9.4

The legume profiles (Figure 1a,b,c) show the predominance of red clover above the 10cm residual grazing height, especially in summer when it made up over 50% of the grazing horizons.

FIGURE 1 Legume distribution throughout white clover, red clover and lotus based ryegrass pastures in spring, summer and autumn (Year 1 only).

Figure 1a

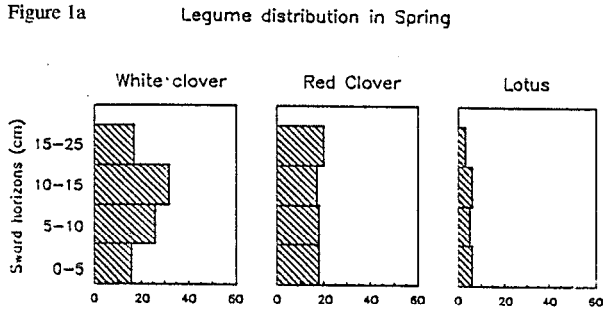


Figure 1b

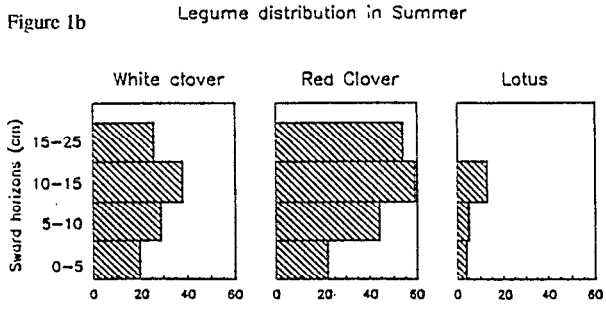
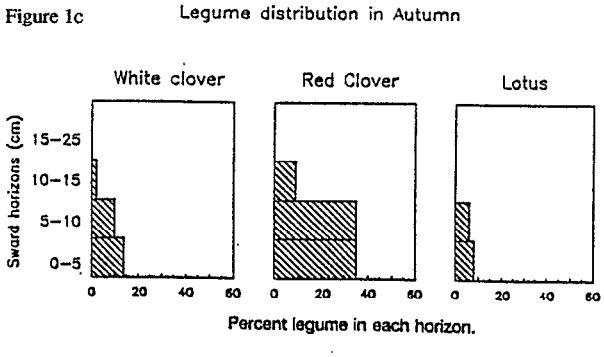


Figure 1c



When coupled with observations of the very uniform "top down" grazing pattern of goats (McCall & Fitzgerald 1987; Nicol *et al.*, 1987) it appears evident that the goats diet will consist of larger

amounts of legume when grazing red clover pastures. This was most obvious in summer when red clover dominance was at its maximum, and was also when the difference between pre- and post-grazing legume content was greatest. By contrast, the white clover was more dominant in the middle and lower horizons, and therefore much of it was below the post-grazing pasture height.

The actual residual legume content was then compared with a predicted residual legume content using the stratified sampling legume content below 10cm in spring and summer, and below 5cm in autumn as the predictor (Table 3). This showed no differences between actual and predicted legume content in white clover pastures, indicating no evidence of active selection or rejection of white clover. Red clover, however, was always less in the actual residual sample than was predicted by horizon sampling therefore indicating an active selection for red clover. Both actual and predicted legume content was variable in lotus pastures and the magnitude of the amount of lotus was too small to draw any conclusions.

TABLE 3 Actual and predicted post-grazing legume content in year 1 only.

Companion Legume	Spring		Summer		Autumn	
	Actual	Pred.	Actual	Pred.	Actual	Pred.
White clover	23.9	20.1	23.1	23.2	14.2	13.5
Red clover	9.9	17.8	20.1	28.5	24.7	35.0
Lotus	4.4	5.3	11.2	4.0	4.1	7.8
lsd	9.1	9.4	8.6	9.1	6.4	9.1

Red clover in spring and autumn occurred lower in the sward profile but its apparent selection was of a similar magnitude although the effect of higher dietary legume content on goat liveweight gain was much less. This lack of liveweight gain response to changes in spring legume content has also been reported for sheep when both ryegrass and white clover have produced similar liveweight gains.

The data from this trial concurs with the studies of Hughes *et al.*, (1984) and Nicol & Collins (1990). Both found that selection against white clover did not exist when it was a part of the goats grazing horizon. The apparent selection of a high protein diet reported by Masson *et al.*, (1991) may have partly been due to the grazing habit of the goat as the diet consumed on all of these pastures was much higher than the sward average. By removing only the herbage from the top of the sward (Collins & Nicol 1986; Nicol *et al.*, 1987) goats ensure that they consume the highest quality parts of the plant, leaving the lower quality stem, pseudostem and dead material which are most abundant at the bottom of the sward (M.J. Casey in prep). The apparent selection of red clover in this study improved the diet of the goat and was due to grazing habit as well as active selection.

Lotus was only a minor feature of the swards. Although the lotus pastures were maintained at a lower pH than the others the lotus still did not compete well with the vigorous ryegrass growth. Lotus did however exhibit a similar distribution through the sward to red clover, being more prevalent in the upper horizons, especially in summer. In environments of lower fertility more suited to lotus growth, lotus will be a valuable legume for use by goats. Lower carrying capacity on the lotus pastures was the result of lower pasture height, possibly due to the poorer nitrogen nutrition of the ryegrass.

White clover/ryegrass pastures in this study provided angora goat liveweight gains higher than the 54-92 and 49 g/hd/day found by Brown *et al.*, (1989) and Townsend & Radcliffe (1990) respectively. Red clover/ryegrass pastures also provided good goat production and gave an improvement of 45% over white clover pastures in summer only. This appears to have been due both to the increase of legume in the upper horizons of the pasture and active selection by the goats. Observations after four years suggest that red clover will be long lived under goat grazing to 10cm.

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