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A comparison of six grasses for animal production

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Abstract

Farmers are aware of the increasing amount of information comparing alternative cultivars in dry environments in New Zealand. Animal production data in cool moist environments was unknown. To compare relative animal performance six different grasses were sown with Grasslands Tahora white clover (*Trifolium repens* L.) in 0.25 ha plots in two replicates in December 1988 at the Gore Research Centre in Southland. The six grasses were Grasslands Nui perennial ryegrass (*Lolium perenne* L.), Grasslands Roa tall fescue *(Festuca arundinacea* L)., Grasslands Kara cocksfoot *(Dactylis glomerata* L). Grasslands Matua prairie grass *(Bromus willdenowii* Kunth), Grasslands Hakari upland brome *(Bromus sitchensis),* and Grasslands Kahu timothy *(Phleum pratense* L). These pastures were rotationally grazed with goats through spring and summer of the following two years; 2-weekly liveweight gain of 10 goats was recorded. Stocking rate was estimated from the addition of extra goats each week to achieve a residual pasture height of 100 mm. Spring liveweight gains (mid Sept-late Nov) were greatest on timothy and least on prairie grass. Stocking rate in spring was highest on the upland brome and tall fescue pastures and lowest for prairie grass and timothy pastures. Prairie grass pastures produced less total liveweight gain per ha than the other pastures. During summer, goat liveweight gains were ranked similarly to spring. Stocking rates were greatest on upland brome, and lowest on tall fescue. Total liveweight gain per ha in summer was greatest on the timothy pastures and least on prairie grass pastures.

Keywords *Bromus sitchensis, Bromus willdenowii, Dactylis glomerata, Festuca arundinacea,* goats, *Lolium perenne.* liveweight gain, *Phleum pratense,* stocking rate, *Trifolium repens*

Introduction

Pastoral agriculture in Southland is conducted in a cool moist environment with moist summers and a low pasture pest status. Low endophyte ryegrass has been considered the appropriate choice of grass species in this environment (Stevens & Hickey 1989). Reports of improved animal liveweight gain from alternative grass species in summer-dry environments (Fraser 1985; McFarlane 1990; Wright *et* al. 1985) created a demand for knowledge about the suitability of these alternatives in Southland. Animal production from a range of pasture grasses was measured over spring and summer to assist farmers in choosing seed mixtures when sowing new pastures.

An increased farmer interest in goats and the general lack of knowledge of goat performance on pastures prompted their choice as the initial test animal. It was suggested that chevon meat production could be markedly improved through *improvements* in goat liveweight gains. The measurement of per animal liveweight gain and potential stocking rates meant per ha production could be calculated.

Materials and methods

Six pasture grasses were sown with 3 kg/ha Grasslands Tahora whiteclover (*Trifolium repens* L.) on 10 December 1988 in 2 replicates of 0.25 ha individually fenced plots at the Gore Research Centre in Southland. The grasses were Grasslands Nuiperermialryegrass (*Lolium perenne* L.). Grasslands Roa tall fescue *(Festuca arundinacea* L), Grasslands Kara cocksfoot (*Dactylis glomerata* L.), Grasslands Matua prairie grass *(Bromus wildenowii* Kunth). Grasslands Hakari upland brome (*Bromus sitchensis*), and Grasslands Kahu timothy (*Phleum pratense* L.) sown at 18, 20, 10, 30, 30, and 8 kg/ha respectively. Measurements began in late September 1989 and continued for the spring and summer of the following 2 years.

Goats were used to evaluate the animal production from these pastures. The goats were 70% and 20% G2 angora types in years 1 and 2 respectively with the remainder beiig G1 and purebred *angoras. These* were stratified for pedigree and initial liveweight and allocatii randomly to the treatments from each group. A core of 10 measurement goats werecontinuallyconfiied to each plot. Measurement goats were weighed every 2 weeks. All plots were mechanically topped during late November and December to remove reproductive stem remaining after grazing. Grazing management was set to achieve a post-grazing pasture height of 100 mm to the recommendation of McCall & Lambert (1987) to avoid intake suppression and ensure goat performance reflected pasture performance rather than the particular grazing management chosen. Extra goats were added weekly to each plot to ensure the 100 mm grazing height was achieved, and numbers recorded. Plots were subdivided into four with goats grazing for 7 days, allowing a 21-day regrowth period.

The goats were orally treated monthly for internal parasites with Ivermectin and supplemented with selenium every 8 weeks. Footrot and scald problems were controlled by standing all goats in a zinc sulphate footbath for 15 minutes every 2 weeks.

Pasture measurements of bothpre- and post-grazing herbage mass and botanical composition were recorded every 2 weeks. 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 and summer 25 November to 15 February.

Results

Timothy pastures gave thehighest individual liveweight gains throughout both spring and summer (Table 1). Perennial ryegrass. cocksfoot. upland brome, and tall fescue produced an intermediate group, and goats on prairie grass had the lowest liveweight gain throughout (Table 1). Liveweight increases were relatively constant and high until 24 November for all grasses. Goats on the timothy pastures continued to grow at this rate for another month until 22 December, The rate of liveweight gain was reduced for all grasses for the rest of the summer (Table 1).

Table 1 The amount ofherbage pm andpoet-grazing. and mean goat liveweight gain during spring and summer

A: Spring	Herbage mass(kgDM/ha) pre-grazing(	post-grazing	Goat growth rate (g/day)
Ryegrass	3510	2290	127
Tall fescue	3970	2670	107
Cocksfoot	3410	2290	114
Prairie grass	3510	2590	86
Upland brome	4070	2590	108
Timothy	3770	2270	139
lsd	356	418	19
B: Summer			
Ryegrass	3280	2550	55
Tall fescue	3590	2750	45
Cocksfoot	3210	2500	54
Prairie grass	3960	2820	34
Upland brome	3530	2730	43
Timothy	3250	2350	62
lsd	307	288	18

Tall fescue and upland brome pastures sustained higher stocking rates in spring than prairie grass and timothy pastures (Table 2). Perennial ryegrass and cocksfoot were intermediate.

The pm-grazing herbage masses (Table 1) in spring ranged between 3410 kg DM/ha for cocksfoot and4070 kg DM/ha for upland brome. Post-grazing herbagemass in spring was lowest for timothy pastures and highest in tall fescue pastures, ranging from 2270 to 2670 kg DM/ ha. During summer the pre-grazing herbage *mass was* highestonprairiegrasspasturesandlowestoncocksfoot pastures, ranging from 3210 to 3960 kg DM/ha. Post-grazing herbage masses were higher than spring, ranging from 2350 kg DM/ha for timothy to 2820 kg DM/ha for prairie grass pastures.

Sown grass contents of the pastures before grazing were lowest in tall fescue and timothy in both spring and summer (Table 3). Other pastures were higher and similar in spring. Cocksfoot had the greatest sown grass content in summer.

White clover content was greatest for timothy in both spring and summer (Table 3). In spring tall fescue was intermediate and the other grasses all lower. During summer prairie grass had intermediate white clover contents and others were lower.

Other species made a significantly greater contribution to tall fescue pastures in both spring and summer than other pasture (Table 3). Dead material (Table 3) was greatest in ryegrass and least in upland brome and timothy pastures in summer.

The digestibility of spring pasture in the grazing horizon (Table 3) was greatest in timothy, ryegrass and tall fescue pastures. During summer the digestibility of upland brome pastures was lower than other pastures.

Proteincontent was high in all swards in both spring and summer (Table 3). Timothy pastures had higher protein status than other swards. Prairie grass was generally lower.

Discussion

Perennial ryegrass showed its versatility and high performance in a cool moist environment with good goat liveweight gain and stocking rates in this evaluation. Though differences in the performance of lambs grazing high and low endophyte perennial ryegrass have been shown in Southland (Eerens *et al.* 1993). they are small compared with the differences found in drier, warmer environments (Fletcher 1986; McFarlane 1990). The consumption of herbage above 100 mm by the goats would have further minimised the effects of any endophyte present in the base of this ryegrass of moderate endophyte infection (45%).

Table 2 The stocking rate and total liveweight gain per ha of angora-type wether goats on six pasture types in spring and summer

	Spring		Summer	
	Stocking rate (goats/ha)	Total gain (kg/ha)	Stocking rate (goats/ha)	Total gain (kg/ha)
Ryegrass	54.5 eb	439 a	49.6 bc	231 ab
Tall fescue	59.6 a	405a	46.0 c	188 ab
Cocksfoot	56.5 ab	406 a	52.2 abc	236 ab
Prairie grass	51.1 b	279 b	54.0 ab	166 b
Upland brome	59.1 a	396 a	57.3 a	193 ab
Timothy	49.3 b	432 a	50.1 bc	254a
lsd	7.6	80	5.4	63

Timothy is a high quality pasture species (Langer 1990); this was confirmed here, though the high white clover content was a contributing factor. Deterioration of pasture quality at and after heading was later with timothy than the other species. Good animal growth continued for a month longer on timothy pastures in late spring than other pastures, a similar result to that of Davies & Morgan (1979). High clover content of these pastures was not the only factor involved as prairie grass pastures also had a good summer clover content but goat growth was much lower.

Goat performance from cocksfoot and upland brome was not significantly different from that from perennial ryegrass in spring or summer. Cocksfoot has generally been regarded as a grass of lower quality (Davis & Morgan 1979; Minson *et al.* 1964), though this was not so in this trial. Animal performance from upland brome pastures has not previously been tested in New Zealand. The results from this trial have shownuplandbrome and cocksfoot to be valuable additions to the range of pasture species in New Zealand. Control of upland brome during its extremely strong heading stage in late spring is critical to maintaining animal performance even though seedheads are palatable.

Tall fescue has been reported to have high animal performance (McFarlane 1990; Wright *et al.* 1985). especially in late summer. In the cool moist environment where grass growth is not affected by moisture stress tall fescue had no advantage over perennial ryegrass. The grazing management may have been detrimental to the quality of tall fescue, as farmer experience suggests that hard grazing is needed to maintain animal performance (Milne pers comm).

Goats grazing prairie grass had the lowest liveweight gains of the trial. Previous results from sheep grazing (Fraser 1985) in dryland conditions have shown an

Table 3 Botanical composition (mean of two years) and pasture digestibility and protein content above 100 mm (year 1 only) for spring and summer.

Botanical Composition (%)						
A: Spring	Sown Grass	White Clover	Other Spp	Dead Material	Digestibility (% DDM)	Protein (% DM)
Ryegrass	69	14	4	13	76.9	22.3
Tall fescue	41	22	26	9	77.3	29.9
Cocksfoot	66	16	3	15	71.9	27.2
Prairie grass	65	12	7	16	72.0	22.6
Upland brome	64	16	7	11	75.1	26.4
Timothy	47	35	6	10	76.1	32.6
lsd	7.0	7.0	5.4	4.1	3.5	4.1
B: Summer						
Ryegrass	55	19	3	23	73.0	23.0
Tall fescue	39	19	22	20	70.9	24.2
Cocksfoot	64	14	3	19	72.1	23.2
Prairie grass	51	23	5	21	72.5	20.9
Upland brome	56	21	5	18	66.6	21.0
Timothy	44	30	8	16	74.2	26.0
lsd	6.3	7.9'	3.1	3.7	3.9	4.3

improvement in animal performance. Results from moister environments (Cosgrove & Brougham 1988; Rugambwa et *al.* 1990) have shown lower animal performance from prairie grass despite higher pasture production. Results from this trial are consistent with those.

Variations in pre- and-post grazing herbage mass were a function of the pasture growth and animal intake. Themaximumdifferencebetweenpre- and post-grazing herbage mass occurred in the timothy pastures where goats grazed timothy closer to the ground than other pastures (Casey 1992).

Pasture quality was apparently high throughout the trial but *there* was still a characteristic reduction in animal Performance after pastures had gone to seed. Animal performance did not recover until February, and then not to the level of early spring. Pasture digestibility above 100 mm remained high in January, not significantly different from October levels but animal growth rates declined to 30-40% of those in October.

The traditional laboratory techniques of digestibility and protein content were not well related to the animal production differences measured in the field. White clover content, another predictor of pasture feeding value, was similar at 19.5 and 21.0 in spring and summer respectively. but animal performance still fell. When red clover was used with ryegrass (Stevens et *al.* 1992) legume content increased from 21 to 43% for spring and summer respectively, but again animal growth rates in summer fell, to be only 59% of those in spring. Exceptionally high clover contents in summer appear to be required in summer to maintain animal performance. These results indicate that 'summer ill thrift'. a feature often thought to be associated with low pasture quality. was still apparent in these high quality swards.

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