Lamb growth rate on annual and perennial ryegrasses

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Abstract

In autumn of 3 consecutive years, tetraploid annual and diploid perennial ryegrasses were sown, and over 6 weeks in each spring the growth rates of 11 month old Romney cross lambs grazing the different ryegrasses were compared. Lamb liveweight gains on annual ryegrasses (364 g/day) were lower ($P<0.05$) than on perennial ryegrasses (407 g/day). However, because growth rates of annual ryegrasses were greater than for perennials, they supported a higher stocking rate and produced an extra 95 kg of liveweight/ha over the grazing period. In Year 1, groups of lambs on separate areas of annual and perennial ryegrasses were supplemented with kibbled maize (240 g/head/day) and meadow hay *ad libitum* to determine if additional energy or fibre could increase lamb liveweight gain. Supplements had no significant impact on lamb growth rates, suggesting that in this experiment, neither the energy or fibre contents of the diets were limiting lamb growth.

Keywords: annual ryegrass, perennial ryegrass, maize supplementation, lamb growth rates

Introduction

Previous agronomic studies (P.D. Muir unpublished data) have shown that under "winter-warm" growing conditions in Hawkes Bay the advantage of annual ryegrasses over perennial ryegrasses is small in terms of total annual production. However, annual ryegrasses are believed to have higher growth rates over autumn and winter and some farmers have continually re-sown with annuals to obtain this perceived benefit. Moreover, the seed industry suggests that there are additional economic benefits to sowing tetraploid annual ryegrasses with feed quality attributes that lead to better animal performance. Yet there are few data to support this statement.

There have been suggestions that the high crude protein content of spring pasture may limit animal performance (Edwards *et al.* 2007). Removal of surplus dietary protein requires energy (Waghorn & Wolfe 1984), therefore, improving the ratio of energy to protein in high quality spring pastures by adding additional energy, could improve animal performance (Miller *et al.* 2001).

This work was initiated to compare lamb liveweight gains and lamb production per hectare on newly sown annual and newly sown perennial ryegrasses. In addition, the effect of energy and fibre supplementation on lamb performance on newly sown ryegrasses was examined.

Materials and Methods

Experimental design and treatments

The experiment started in autumn 2006 when separate 1.5 ha paddocks of annual ryegrass and perennial ryegrass were sown on a Matapiro silt loam soil (Yellow Grey Earth; pH=6, Olsen P=20 µg/ml). In autumn 2007, and again in autumn 2008, these areas were re-sown with the same species.

The treatment areas were arranged in a randomised block design with 3 replicates. In 2006, an extra 3 replicates (1.5 ha paddocks) of both annual and perennial ryegrasses were established at the same time to enable the feeding of supplements (kibbled maize + meadow hay) to the animals on these areas, providing a 2 x 2 factorial for testing the effects of adding supplements to the diet (Table 1).

The annual ryegrasses were all tetraploids and were an equal mix of 'Archie', 'Andy' and 'Grasslands Moata' sown at 28 kg/ha. The perennial ryegrasses were all diploids and were an equal mix of 'Grasslands Impact', 'Bronsyn' and 'Alto' (all with AR1endophyte) sown at 19 kg/ha. A mix of cultivars was used to avoid the debate about the merits of individual cultivars. Clover was not included so comparisons of animal production off both ryegrasses were not confounded by different clover contents affecting pasture quality. Seed was direct-drilled in autumn once there was sufficient moisture for plant establishment. Before drilling, existing vegetation was killed by spraying with glyphosate at 1.23 kg a. i. /ha. Seed was drilled with Cropmaster 20 (200 kg/ha) and Mesurol (2 kg/ha) for slug control. Pastures were given a quick graze with a large mob of lambs 3–4 weeks before the experiment started to encourage tillering and provide similar pasture covers across all treatments at the start. The aim was to run the experiment over 6 weeks between late July and early September when pasture quality was unlikely to be compromised by seed head emergence. However, the difficult growing conditions in the 2007 drought year meant the experiment could not start until the 24th August (Table 1). In 2007, 56 mm of rain fell between the beginning of March and the end of May –

Table 1 Sowing and grazing dates over 3 years.

	Year					
	2006		2007		2008	
	Annual	Perennial	Annual	Perennial	Annual	Perennial
No. of paddocks	3+3*	3+3*	3	3	3	3
Sowing date	18 April		18 April		23 April	
Grazing duration (d)	41		53		42	
Start grazing date	19 July		24 August		8 August	
Finish grazing date	29 August		15 October		19 September	
Average cover (kg DM/ha)	1932	1801	1336	1263	2320	2380

*additional paddocks where the animals were also fed supplements

this was 31% of the average rainfall for this period and followed a dry summer where 77% of the mean rainfall occurred. A regional drought was declared.

Eleven month old Romney cross lambs were randomly allocated to treatments when pasture covers were around 1600 kg DM/ha. The aim was to maintain pasture covers between 1600 and 2200 kg DM/ha using a core number of lambs with access to additional lambs on a "put and take" basis depending on whether the average pasture cover on a paddock had dropped or risen since the previous measurement. Lambs were set stocked on each paddock. All lambs were drenched with Matrix Hi-mineral (Ancare) before entering the experimental blocks. Lambs were weighed directly off pasture at the beginning, middle and end of each experimental period using Tru-test scales (model MP600). Lambs that were added or removed were weighed on and off the treatments and their weight changes and number of days they were on the experiment were recorded. Stocking rate was calculated as the average number of lambs per hectare for each paddock over each experimental period. The total weight produced per hectare included both the liveweight gain of the core lambs and the "put and take" lambs that were included for pasture control. The "put and take" lambs were managed under similar conditions to those on the experiment when not grazing the treatment areas. In 2006, supplemented lambs received 240 g/head/day of kibbled maize and meadow hay *ad libitum*. Lambs were pre-allocated to treatment groups and those allocated to the supplement were adjusted to the kibbled maize ration for 3 weeks before the experiment commenced. Maize was fed daily in half round troughs with sufficient space for all lambs to have simultaneous access. Meadow hay was offered in hay racks during the experiment but intakes were difficult to measure because of high wastage rates. Observations suggested intakes of meadow hay were low.

A pasture cage (3 by 1.5 m) was set up in a randomly selected site in each paddock after sowing and mowed at monthly intervals to determine pasture growth rates from sowing through until the grazing experiment finished. A 2.77 m^2 area in each cage was mown to 5 cm at 3-weekly intervals during the experimental period. The pasture collected was weighed and a 400 g sub-sample dried at 85°C. Another sub-sample was dried at 45°C and then ground for chemical analysis using Near Infra Red Spectroscopy (NIRS). To determine the number of lambs to be added or removed from the farmlets, pasture covers were measured twice weekly with a calibrated rising plate meter.

Data analysis was carried out using the Generalised Linear Model programme in Minitab for Windows with replicate used as a block and year included as a variate.

Results and Discussion

Annuals versus perennials

On average, annual ryegrasses produced 5046 and perennial ryegrasses 3290 kg DM/ha (a difference of 1756 kg DM/ha) between establishment and the end of the experimental period.

The lamb liveweight gains (average 389 g/day over 3 years) achieved in this study were extremely high compared to published data. Most other reports of liveweight gains of lambs or hoggets of this age are around 100-200 g/d (Brown 1990; Ryan & Widdup 1997). Some of the weight gains in the present study may have been due to gut-fill effects or compensatory growth as a result of previous nutritional history. Lamb liveweight gains were consistently higher on the perennial ryegrasses (average 407 g/d) than on the annual ryegrasses (364 g/d) and these differences were significant in 2006 and 2008 (Table 2), although there were no differences in the energy (about 11.6 MJ ME/kg DM) and crude protein contents (about 23%) of the annual and perennial ryegrasses, when averaged over the 3 years. The higher stocking rate that was possible on the annual ryegrass, using the 'put and take' management system, is a reflection on the higher average pasture growth rates on annuals (65 kg DM/ha/day) than on perennials (41 kg DM/ha/day) ($P<0.01$).

Table 2 Lamb performance on annual and perennial ryegrass pastures.

Year	2006		2007		2008			
Pasture type	Annual	Perennial	Annual	Perennial	Annual	Perennial	SE	P_{cult}
Core lambs								
No of lambs	238	181	83	21	90	60		
Start liveweight (kg)	37.9	37.8	34.0	34.1	31.6	31.1	0.4	0.32
Final liveweight* (kg)	52.3[a]	53.8[b]	51.2	52.2	47.1	47.8	0.5	0.005
Liveweight gain* (g/d)	350[a]	390[b]	334	359	431[a]	471[b]	11	0.001
All lambs								
Average SR[§] (lambs/ha)	26.4	20.1	19.0	7.5	27	19	0.7	0.001
Total liveweight produced (kg/ha)	383	322	336	211	441	340	1.8	0.001

* different superscripts indicates significant differences (P<0.05) within years; [§] SR= Stocking rate.

Table 3 Effect of supplementing with hay and maize on growth rates of lambs grazing perennial and annual ryegrasses.

	Treatment			
	Control	Supplemented	SE	P
Number	210	209		
Initial liveweight (kg)	37.0	38.8	0.48	0.001
Final liveweight* (kg)	53.5	52.6	0.39	0.02
Liveweight gain (g/d)	380	360	97	0.14
Total liveweight (kg /ha)	365	348	0.30	0.15

*covariate initial liveweight fitted.

This resulted in higher average total liveweight gain on annual ryegrass (386 kg/ha) than on perennial (291 kg/ha). The animals on each ryegrass were offered similar amounts of pasture in each of the 3 years (average 1840 kg DM/ha), although in the drought year (2007) this fell to 1300 kg DM/ha, which was below the ideal range of 1600-2200 kg DM/ha.

An interesting observation was that the dry matter content of the annuals (14%) was consistently below that of the perennial ryegrasses (17.1%), indicating the potential for overestimation of pasture covers by as much as 18% when visual appraisal is used.

Supplementing with hay and grain

In 2006, lambs were supplemented with both meadow hay (*ad libitum*) and kibbled maize at 240 g/head/day. There was no evidence that feeding these supplements improved lamb liveweight gain or production per hectare (Table 3) when lambs were grazed on annual or perennial ryegrasses, suggesting energy and fibre levels were not limiting lamb growth rates in this experiment. Given the high liveweight gains already being achieved in 2006 (mean 370 g/day) it is likely that the maize simply substituted for pasture. In 2006, when the maize substitution was undertaken, crude protein levels in pasture were a modest 21.4%. At these levels, the excretion of surplus nitrogen may not have placed a burden on the lambs. It is possible that an effect of energy supplementation might have been present if crude protein contents had been as high as the 30% measured on nitrogen boosted pastures (P. D. Muir, unpublished data).

Conclusions

There is no evidence to support the contention that lamb liveweight gains are higher on newly sown tetraploid annual ryegrasses than on newly sown diploid perennial ryegrasses. However, further work needs to be undertaken to determine the extent to which lamb growth rates are affected when grazing established diploid perennial ryegrass swards in subsequent years.

Whilst annual ryegrasses may produce extra winter dry matter (in these experiments annuals grew 1756 kg DM/ha more than the perennial ryegrasses between sowing and the end of the experimental period) this may not generate sufficient extra return to justify the sowing cost. For example, at 1756 kg DM/ha and assuming a utilisation of 75% and a return on winter and early spring pasture of 20 c/kg DM, the additional returns from sowing annuals instead of perennials is $263/ha. This is less than the cost of establishing a pasture and suggests that in Hawkes Bay, the extra winter/early spring dry matter produced by re-sowing annual ryegrasses the previous autumn may not justify the cost. Instead, sowing perennial ryegrass (which might last several years) may be of greater value.

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