Lamb and hogget growth on different white clover and ryegrass cultivar mixtures in southern New Zealand

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ABSTRACT

Lamb and hogget liveweight gains from five different white clover/ryegrass mixtures were compared at AgResearch, Gore from 1992-1995. The mixtures involved comparisons between white clover cultivars (Huia and Demand), ryegrass endophyte types (endophyte-free and 187BB which produces no lolitrem B) and ryegrass species (Marsden and Greenstone hybrid ryegrasses and Pacific perennial ryegrass). Averaged over 3 years, Marsden/Demand produced significantly greater lamb growth rates and final carcass weights (15.0 cf. 14.1 kg) compared with Marsden/Huia pastures. The advantage in lamb production from Demand based pastures was directly linked to the higher yields of white clover. The 187BB endophyte had no advantage over endophyte-free ryegrass pastures which produced similar herbage yields, lamb carcass weights and hogget liveweights as 187BB ryegrass without any associated animal health problems. Lamb carcass weights (14.9 cf. 14.4 kg) and final hogget liveweights (66 cf. 63 kg) were superior from the

Marsden and Greenstone hybrid compared with Pacific perennial ryegrass pastures respectively. The hybrids produced a greater proportion of leaf to stem than perennial ryegrass in spring/early summer and are favoured for use in animal finishing pastures in southern New Zealand.

Keywords: endophyte; herbage yield; hybrid ryegrass; lamb carcass weight; perennial ryegrass; white clover.

INTRODUCTION

Otago-Southland is an intensive pastoral farming region where high animal productivity can be achieved on perennial ryegrass (*Lolium perenne* L.) and white clover (*Trifolium repens* L.) pastures. However, post weaning lamb growth rates of 120 g/day are common resulting in regional average carcass weights of 13.5 kg in March-April (Brown, 1990). The meat industry favours heavier weight carcasses and a financial incentive is offered to farmers producing lamb carcasses in the 15-17 kg weight range. The current low lamb growth rates during the summer has been attributed to poor clover growth (Hay & Baxter,1984), grazing of high endophyte (*Neotyphodium lolii*) ryegrass (Eerens *et al.*, 1992) and inadequate soil fertility to maintain ryegrass/white clover pastures allowing inferior grass species to invade and produce pastures of low nutritional value (Hook, 1979).

Pastures containing the white clover cultivar, Grasslands Demand have produced significantly greater herbage yields than the standard Grasslands Huia during spring/summer in Southland (Widdup *et al.*, 1989) providing the potential to improve clover yields and lamb production. The detrimental effect of ryegrass endophyte on sheep production has been demonstrated in Canterbury (Fletcher *et al.*, 1990) and to a lesser degree in the cool moist environment of Southland (Eerens *et al.*, 1992). The endophyte provides resistance to Argentine stem weevil, a pasture pest that reduces ryegrass persistence in summer dry regions but has caused little damage to ryegrass in the moist Southland region (Eerens *et al.*, 1992). The overall evidence suggests that high endophyte ryegrass does not benefit pasture and animal production in southern regions. However, recently the selected endophyte 187BB which does not produce the neurotoxin lolitrem B responsible for ryegrass staggers (Gallagher *et al.*, 1982) but still confers persistence to ryegrass (Fletcher and Sutherland, 1993) offers an alternative to high endophyte and endophyte free ryegrasses. In addition, the species of ryegrass can influence animal production. Perennial ryegrasses demonstrate high herbage yields and persistence but are often criticised by farmers for their poor animal acceptability. In contrast, hybrid ryegrasses (*Lolium hybridum* L.) have higher feed value (Lancashire and Ulyatt, 1975) and provide better animal liveweight gains (Harris and Johnstone, 1973) than perennial ryegrass.

This paper investigates the impact of white clover cultivar, endophyte free or 187BB endophyte ryegrass and perennial or hybrid ryegrass on lamb and hogget growth in Southland.

MATERIALS AND METHODS

A grazing experiment evaluating lamb and hogget growth on five different white clover/ryegrass pasture mixtures was carried out at the AgResearch Gore Research Centre, Southland from 1992-1995. The five pasture mixtures were compared in a randomised complete block design with three replicates. The mixtures were Grasslands Marsden endophyte free hybrid ryegrass with either Grasslands Huia or Grasslands Demand white clover; Grasslands Pacific endophyte free or Pacific 187BB peren-

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nial ryegrass with Demand white clover and Grasslands Greenstone 187BB tetraploid hybrid ryegrass with Demand white clover. The Marsden and Pacific ryegrass cultivars were sown at 18 kg/ha and the Greenstone at 25 kg/ha with the clover cultivars sown at 3 kg/ha. The mixtures were sown in November 1991 with 350 kg/ha of molybdic potassic superphosphate (0-6-14-8) and annual maintenance dressings with 350 kg/ha of superphosphate (0-9-0-10). Each pasture treatment was 0.25 ha and was further sub-divided by electric fencing into 6 paddocks to enable rotational grazing.

From December to March each year pastures were stocked with a core group of 5-7 Coopworth lambs. Weaned lambs were initially weighed and allocated to treatments so that all 15 mobs had a mean initial liveweight of 21 kg in year 1, 25.6 kg in year 2 and 19.5 kg in year 3. Lambs were shifted weekly or when 50% of the feed on offer had been eaten. Extra lambs were added to treatments to maintain similar feeding allowances on each pasture. Residual herbage was grazed by follow-up ewes down to 800 kg DM/ha. Pre and post-grazing herbage mass and pasture composition were measured at fortnightly intervals by cutting four 0.28m^2 quadrats per plot to a 3cm stubble. Lambs were weighed unfasted at 3 weekly intervals and slaughtered for carcass weight after 100 days in years 1 and 2 and 84 days in year 3.

Seven-month old Coopworth hoggets grazed the treatments at 20 hoggets/ha from May to December in year 1 and year 2. The hoggets were allocated to treatments such that each of the 15 mobs had a similar mean hogget liveweight of 29.5 kg in year 1 and 35.5 kg in year 2. A 7-10 week grazing rotation was used during winter and 18-24 day rotation during spring. Extra hoggets were added in the spring to ensure a 1000 kg DM/ha residue after each grazing. Pasture measurements were the same as for the lamb experiment and hogget liveweight gain was determined by monthly unfasted weighings.

The lamb and hogget growth rates, final lamb carcass weights and herbage yields were analysed by ANOVA using the Genstat statistical package. Pairwise comparisons were used to determine the main effects of white clover cultivar, ryegrass endophyte type and ryegrass species. The white clover cultivar comparison tested the difference between Huia and Demand white clover both in mixtures with Marsden hybrid ryegrass. The ryegrass endophyte comparison tested the endophyte-free Pacific with 187BB Pacific perennial ryegrass. The ryegrass species comparison tested the hybrids Marsden and Greenstone with the two Pacific perennial ryegrass cultivars.

TABLE 1: Mean daily growth rate and final carcass weight of lambs grazing different white clover cultivars, endophyte types and ryegrass species over three years (1992-1995)

	Daily growth rate (g/day)			Carcass weight (kg)		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
White clover effect						
Marsden/Huia	178	137	168	15.2	14.5	12.7
Marsden/Demand	179	155	186	15.3	16.2	13.6
Endophyte effect						
Pacific endophyte-free	190	138	170	16.1	15.4	12.4
Pacific 187BB	163	140	168	14.7	15.1	12.7
Ryegrass species effect						
Marsden endophyte-free	179	155	186	15.3	16.2	13.6
Pacific endophyte-free	190	138	170	16.1	15.4	12.4
Greenstone 187BB	182	141	174	15.6	15.8	13.2
Pacific 187BB	163	140	168	14.7	15.1	12.7
LSD (P<0.10)	24	10	18	0.9	0.7	0.7
LSD (P<0.05)	29	12	23	1.2	0.9	0.9

TABLE 2 : The summer ryegrass and white clover herbage yields from different white clover/ryegrass mixtures over three years (1992-1995)

	Ryegrass yield (kgDM/ha)			White clover yield (kgDM/ha)		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
White clover effect						
Marsden/Huia	3420	5700	3210	1950	1200	430
Marsden/Demand	3650	6060	3740	1940	1700	1330
Endophyte effect						
Pacific endophyte-free	3750	6000	3700	1900	1600	1180
Pacific 187BB	3680	6500	3700	1950	1570	1340
Ryegrass species effect						
Marsden endophyte-free	3650	6060	3740	1940	1700	1330
Pacific endophyte-free	3750	6000	3700	1900	1600	1180
Greenstone 187BB	3550	6300	4100	1850	1870	1230
Pacific 187BB	3680	6500	3700	1950	1570	1340
LSD (P<0.10)	320	800	490	310	360	175
LSD (P<0.05)	400	990	610	380	450	220

RESULTS AND DISCUSSION

White clover effect

Marsden/Demand pastures produced higher (P<0.05) mean daily lamb liveweight gain and final carcass weight in years 2 and 3 compared with Marsden/Huia pastures (Table 1). The greatest advantage was in year 2 when the Demand pastures produced lamb carcasses that were 1.7 kg heavier than Huia pastures. The lower carcass weights produced on all treatments in year 3 were due to a prolonged dry spell during February that necessitated early killing of lambs as feed supplies dwindled. During the winter-spring period, hogget liveweight gain and final liveweights were similar on the Demand and Huia based pastures (Table 3). The advantage in lamb production from Demand compared with Huia based pastures was directly linked to the quantity of white clover produced in each pasture (Table 2). The ryegrass yields were similar for both Demand and Huia pastures during summer-early autumn but Demand produced significantly greater (P<0.05) clover yields in the second and third years. The

TABLE 3: The mean daily hogget growth rate, final hogget liveweight, total (August-December) herbage yield and % ryegrass leaf from the white clover/ryegrass mixtures averaged over two years (1992-1994)

	Daily growth rate (g/day)	Liveweight (kg)	Total yield (kgDM/ha)	% ryegrass leaf :stem Sep.	Oct.	Nov.
White clover effect						
Marsden/Huia	198	66	6100	75	66	53
Marsden/Demand	204	66	5800	72	65	52
Endophyte effect						
Pacific endophyte-free	188	63	6500	71	56	34
Pacific 187BB	180	63	6400	73	58	39
Ryegrass species effect						
Marsden endophyte-free	204	66	5800	72	65	52
Pacific endophyte-free	188	63	6500	71	56	34
Greenstone 187BB	205	67	6000	75	66	56
Pacific 187BB	180	63	6400	73	58	39
LSD (P<0.10)	18	1.9	530	3.8	8.0	12.2
LSD (P<0.05)	22	2.3	660	4.7	9.9	15.2

legume content of the locally bred, Demand white clover was maintained at 20-25% in the pastures into the third and fourth years from sowing but for Huia this declined to 13% and 7% by the fourth year. The competitive advantage shown by Demand was probably from the active spring-summer growth adaptation and greater stolon development compared with Huia (Widdup *et al.*, 1989). In addition to using the most appropriate clover cultivar, management factors such as soil fertility, rotational grazing and pasture renewal that increase the clover performance in a pasture are likely to enhance animal productivity.

Endophyte effect

In year 1, lamb daily growth rate and final carcass weight were higher (P<0.05) from the endophyte-free compared to the 187BB Pacific pastures but were similar in years 2 and 3 (Table 1). Fletcher and Sutherland (1993) reported that 187BB endophyte in Nui and Ruanui ryegrasses produced lower lamb liveweight gains than endophyte-free ryegrass pastures in the drier Canterbury environment. Even though the alkaloid lolitrem B responsible for ryegrass staggers was absent from 187BB endophyte, there were other endophyte/ryegrass toxins such as ergovaline present that affected animal performance. The 187BB endophyte ryegrass pastures in the current experiment produced lower lamb liveweight gains than endophyte-free ryegrass pastures in the first year but similar lamb growth subsequently. Reduced ryegrass damage by Argentine stem weevil was a possible advantage of 187BB endophyte ryegrass but there was little detrimental effect of the weevil on the pastures in the cool, moist Southland environment. The endophyte-free ryegrass produced similar herbage yields and plant persistence to the 187BB ryegrass pastures (Table 2) resulting in high animal productivity without associated animal health problems.

Ryegrass species effect

The lamb carcass weights were higher (P<0.10) in most years on the hybrid Marsden and Greenstone ryegrasses compared with the perennial Pacific ryegrass pastures (Table 1). The difference in lamb carcass weights was not associated with any improved ryegrass or clover herbage yield from either the hybrid or perennial ryegrass pastures over summer (Table 2). For the hoggets, higher (P<0.10) daily growth rates during the spring period resulted in a 3-4 kg liveweight advantage (P<0.05) on Marsden and Greenstone hybrid ryegrass compared with Pacific perennial ryegrass pastures (Table 3). Even though the Marsden hybrid ryegrass herbage yields were lower (P<0.05) than Pacific perennial ryegrass in spring, both the Marsden and Greenstone hybrid ryegrasses had a higher (P<0.05) percentage of ryegrass leaf as opposed to stem (Table 3). The greater amount of leaf probably increased the acceptibility (Stone, 1994) of the hybrids compared with the perennial ryegrass and thus resulted in a higher voluntary intake. In addition, hybrids contain an annual ryegrass component and the cultivar Greenstone is a tetraploid ryegrass. Both annual and tetraploid ryegrasses have higher soluble carbohydrate and digestibility levels than perennial ryegrass (Lancashire and Ulyatt, 1975) that result in increased voluntary intakes. Further evaluation would be needed to test long term persistence but in the current experiment, the hybrids produced comparable herbage yields with perennial ryegrass after four years and are therefore recommended as suitable forages for use in animal finishing pastures in southern New Zealand.

CONCLUSIONS

Pastures based on Demand white clover produced higher lamb growth rates and final carcass weights compared with Huia based pastures.

Endophyte-free ryegrass pastures are recommended in Southland because the low incidence of Argentine stem weevil allow pastures to maintain herbage yields and animal productivity.

Pastures containing the hybrid ryegrasses Marsden and Greenstone, produced higher lamb carcasses and hogget liveweights compared with perennial Pacific ryegrass pastures.

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