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Summer lamb finishing on forage crops

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Abstract

The objective of this study was to compare lamb growth and performance on three forages over summer in a large scale, replicated experiment. The three forage treatments were new spring-sown pasture (*cv.* Bealey perennial ryegrass and *cv.* Apex white clover), hybrid leafy turnip (*cv.* Hunter), and a predominant white clover sward. The study was conducted over 28 days, with 28 days preceding the study as the herbage adjustment period. Entire male lambs (n=270) were allocated to one of the three treatments, balanced for live weight at day -28 (D-28). Live weights and liveweight gains were measured at D-28, -14, 0, 14 and 28. Herbage heights were measured pre- and post-grazing to ensure lambs were receiving a herbage allowance of at least three times their potential intake. Herbage quality parameters were also measured post-grazing. Liveweight gains were different ($P<0.05$) between treatment groups, being 311±10.2, 222±10.1, and 160±10.2 g/day for clover, Hunter, and new pasture, respectively. The results showed that Hunter and clover produced superior lamb growth compared to new pasture over summer for the 28 day trial period.

Keywords: brassica crops; lamb growth rates; pasture; clover.

Introduction

Brassica forage crops are a widely used form of supplementary feed throughout New Zealand, with 300 000 ha sown each year. They are used for additional winter feed or as a summer feed in areas which experience drought conditions. Recently, hybrid leafy turnips have become popular, for lamb finishing over the summer/early autumn months (Millner, 1993). Examples of these leafy turnips include Pasja and Hunter that are New Zealand cultivars, and Tyfon, a Chinese cabbage hybrid originally from the USA (Reid *et al.*, 1994). They have a higher percentage of leaf than other brassica crops, with many growing points, and therefore have the ability to regrow and be grazed repeatedly within a single season (White & Hodgson, 1999).

The faster a lamb grows up to and following weaning, the sooner it can be slaughtered at a desired weight, and the more efficient it is at converting herbage to meat. This is due to a lower proportion of the total feed requirement being contributed to maintenance, and more to growth (Rattray *et al.*, 1976). The average daily growth rate for weaned lambs in New Zealand is approximately 150 g/day (Kerr, 2000). Anecdotal farmer evidence and overseas research on Tyfon suggest that lamb growth rates on leafy turnip crops can be variable and inconsistent (Rule *et al.*, 1991; Reid *et al.*, 1994). There is little New Zealand scientific data on lamb performance on either Pasja or Hunter. Conversely, it is well established that high growth rates on predominant clover swards can be achieved (Jagusch *et al.*, 1979a; Fraser & Rowarth, 1996; Knight *et al.*, 1996).

Therefore, a large-scale, replicated study was conducted in the summer of 2005/2006 to compare lamb growth rates on *ad libitum* allowances of leafy turnips, predominant clover, and a perennial ryegrass / white clover pasture.

Materials and Methods

Two hundred and seventy weaned, entire male lambs were utilised, comprising equal numbers of ½ Romney, ½ Poll Dorset (PDRom), and ½ Romney, ¼ East Friesian, ¼ Texel (TEFRom) lambs. The lambs were based at Pasture and Crop Research Unit, Massey University, Palmerston North. Lambs were allocated into one of three forage treatments; a newly established perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) pasture (*cv.* Bealey NEA2 perennial ryegrass sown at 28 kg/ha and *cv.* Apex white clover sown at 4 kg/ha), designated as new pasture (n=90); hybrid leafy turnip (*cv.* Hunter sown at 4 kg/ha), designated as Hunter (n=90); or predominant white clover (*Trifolium repens*) (mixed cultivars undersown with *cv.* Apex at 4 kg/ha), designated as Clover (n=90). All crops excluding the white clover sward were fully cultivated and roller drilled. The predominant white clover sward was sprayed with a selective herbicide Gallant NF, prior to undersowing. On each herbage treatment there were three replicates (n=30). The lambs were assigned to their treatments through stratification of live weight

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within breed, and then allocated to ensure even numbers of lambs from within each breed were within each replicate. Lambs allocated to the Hunter and new pasture treatments were grazed on their respective forage treatments for 28 days (D-28 to 0) prior to the study, to adjust to these feed types. Clover treatment lambs grazed an established pasture containing high levels of clover in the pre-study period. The main study period was for 28 days (D1-28), from mid January to mid February. During this period, there were 3 replicates of 30 animals within each forage treatment. Unfasted live weights were recorded on all lambs at D-28, -14, 0, 14, and 28.

Fifty sward stick measurements, to determine height of the herbage, were taken in each break pre- and post-grazing for all herbage treatments (Bircham, 1981). Pre-determined limits for the post-grazing herbage height were 4-5cm for pasture and clover treatments, and 10-12cm for Hunter to ensure lamb intake was not limited. Lambs were shifted weekly on to a new break, or sooner if sward height was to become too low. Breaks were rotationally grazed so lambs returned to their respective same break once during the study period.

A grazing exclusion cage was placed on each break prior to lambs grazing it, and left for the duration of the grazing. Post-grazing, a 'hand-plucked' sample (of approximately 100g fresh weight) was taken from each cage (Frame, 1993). Samples were freeze-dried then ground to fine granule size before analysis. This was carried out to determine forage characteristics including digestibility (and hence metabolisable energy) (Roughan & Holland, 1977), crude protein (CP) (total combustion method), and neutral detergent fibre (NDF) (Robertson & Van Soest, 1981).

Data were analysed using the Proc Glm procedure in SAS version 9.1 (SAS, 2006). The fixed effects were forage treatment (Pasture *vs.* Hunter *vs.* Clover) nested within replicate, and breed (PDRom *vs.* TEFRom). The relationships between treatment and breed and treatment and time period were also determined. Liveweight gains per fortnight were analysed using repeated measures analysis of variance (Gill & Hafs, 1971). Liveweight at D0 was used as a covariate to reduce errors caused by differences in liveweight during the adjustment period (D-28 to D0). Proc Genmod was used to analyse frequency of liveweight gains over 300 g/day. Tables will present least squares means ± standard error.

RESULTS

During D1-28, Clover had higher ($P<0.05$) crude protein concentrations, while Hunter had higher ($P<0.05$) metabolisable energy (ME) concentrations, and new pasture had higher ($P<0.05$) neutral detergent fibre (NDF) content. Over time, ME of new pasture decreased ($P<0.05$), but there was no other pattern emerging in any herbage quality parameters in any treatment by time interaction (Table 1).

Liveweights differed significantly at D28, with clover treatment lambs significantly ($P<0.05$) heavier than Hunter treatment lambs, which were significantly ($P<0.05$) heavier than new pasture treatment lambs (Table 2). Throughout the study PDRom lambs were significantly ($P<0.05$) heavier than TEFRom lambs by 2-3kg.

During D1-28, lambs grazing Clover grew significantly ($P<0.05$) faster (311±10.2 g/day) than lambs grazing Hunter (222.4±10.1 g/day), which grew significantly ($P<0.05$) faster than lambs grazing new pasture (160.1±10.2 g/day). During the same period there was no difference in growth rates between breeds (data not shown). Significantly ($P<0.05$) more Clover treatment lambs grew faster than 300g/day during D1-28 (logit 0.134±0.211; 53.3%), compared to both Hunter (logit -1.457±0.269; 18.9%) and new pasture treatment lambs (logit -4.489±1.006; 1.1%) (Figure 1).

Table 1: The effect of forage treatment (Pasture *vs.* Hunter *vs.* Clover) and time of study (D14 *vs.* D28) on sward heights (cm) (pre-grazing (Pre) and post-grazing (Post)), and herbage quality (digestibility (DOMD), metabolisable energy (ME, MJ ME/kg DM), crude protein (protein, % of dry matter), and neutral detergent fibre (NDF, % of dry matter)) (Least squares means±s.e.).

	Herbage heights and quality					
Treatment x Time	**Pre**	**Post**	**Digestibility**	**ME**	**Protein**	**NDF**
Pasture x D14	18.3±2.1	7.9±1.4	$65.5±1.3^{b}$	$10.7±0.2^{b}$	$16.8±1.3^{a}$	$39.3±1.7^{c}$
Pasture x D28	16.6±2.1	10.4±1.4	$60.2±1.3^{a}$	$9.8±0.2^{a}$	$15.5±1.3^{a}$	$47.7±1.7^{d}$
Hunter x D14	22.8±2.1	14.3±1.4	$84.0±1.3^{d}$	$13.7±0.2^{d}$	$15.6±1.3^{a}$	$21.1±1.7^{a}$
Hunter x D28	14.7±2.1	12.6±1.4	$81.7±1.2^{d}$	$13.3±0.2^{d}$	$17.4±1.2^{ac}$	$20.8±1.5^{a}$
Clover x D14	14.8±2.1	4.9±1.4	$73.2±1.3^{c}$	$11.9±0.2^{c}$	$20.9±1.3^{bc}$	$27.5±1.7^{b}$
Clover x D28	8.3±2.1	6.6±1.4	$71.6±1.2^{c}$	$11.7±0.2^{c}$	$27.6±1.2^{d}$	$26.3±1.5^{b}$

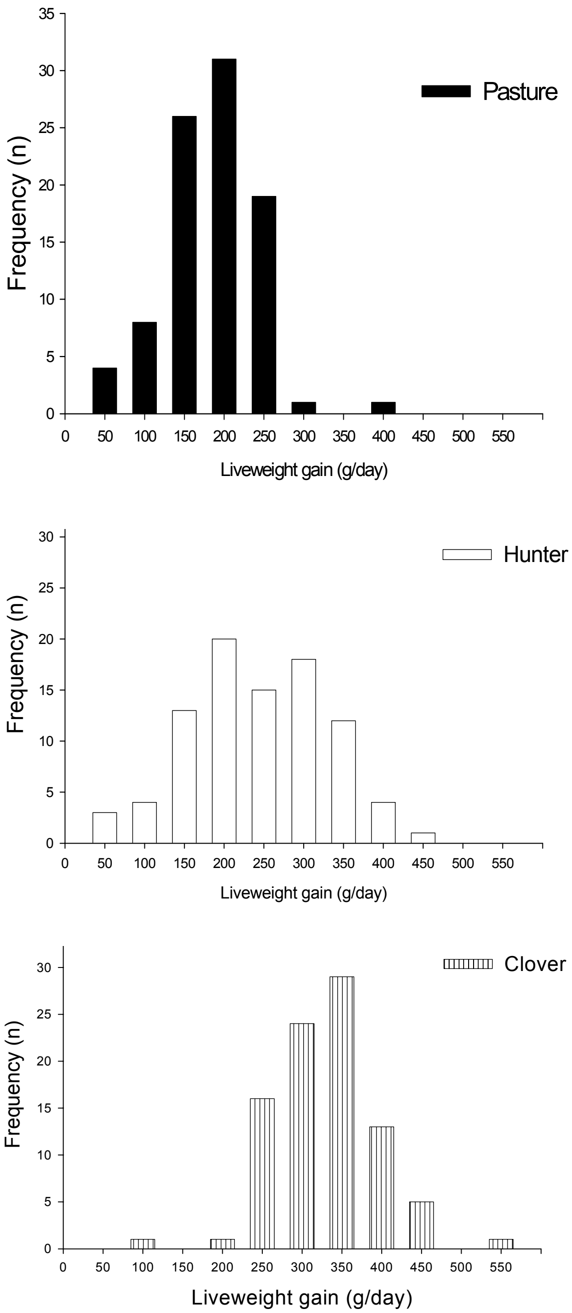
Means within columns with different superscripts are significantly different ($P<0.05$), excluding pre- and post-height.

Table 2: The effect of forage treatment (Pasture *vs*. Hunter *vs*. Clover) and lamb breed (Poll Dorset X Romney (PDRom) *vs*. Texel X East Friesian X Romney (TEFRom)) on lamb live weight (kg) at days 0 (D0), 14 (D14), and 28 (D28) (Least squares means±s.e.).

		Liveweight (kg)		
	n	**D0**	**D14**	**D28**
Forage Treatment				
Pasture	90	36.3±0.4[b]	39.1±0.4	40.8±0.2[a]
Hunter	90	35.6±0.4[ab]	39.2±0.4	41.8±0.2[b]
Clover	90	34.5±0.4[a]	39.1±0.4	43.2±0.2[c]
Breed				
PDRom	135	36.8±0.2[b]	40.6±0.2[b]	43.4±0.3[b]
TEFRom	135	34.1±0.2[a]	37.6±0.2[a]	40.4±0.3[a]

Means within treatment and breed and within columns with different superscripts are significantly different ($P<0.05$).

Figure 1: Frequency graphs of liveweight gains for the three forage treatments during D1-28. Values denote liveweight gains up to and including that value, *e.g*. 200 denotes 151-200 g/day.



DISCUSSION

Lambs grew fastest grazing on the predominant white clover sward, with over half growing faster than 300 g/day. Similarly, Jagusch *et al.* (1979b) and Fraser & Rowarth (1996) found white clover produced the highest live weight gain in lambs compared to a range of crops and legumes, probably due to high crude protein concentrations (Fraser & Rowarth, 1996; Knight *et al.*, 1996), and more rapid passage of the clover through the rumen, allowing greater intakes. However, clover is difficult to maintain as a pure sward and thus is not usually a practical crop to grow for lamb finishing purposes.

Lamb growth rates on Hunter were higher than on new pasture, and also than those previously recorded on similar crops (Thomas *et al.*, 1990; Rule *et al.*, 1991; Reid *et al.*, 1994; Dove & Milne, 2006). The higher liveweight gains in lambs grazing Hunter compared to pasture was most likely explained by the higher herbage quality (Hodgson, 1990). The ME values obtained for Hunter were also higher than those previously reported for Pasja by Millner (1993), which may suggest that *cv.* Hunter has a slightly higher ME value than that of *cv.* Pasja. The lower crude protein for Hunter compared to Clover may explain why lambs performed better on Clover than Hunter. At just above 15% CP for the majority of the trial, the content in Hunter was marginal for lamb finishing purposes in relation to recommendations by Hodgson & Brookes (1999). The NDF concentration in Hunter was similar to that of earlier reports on Tyfon (Wiedenhoeft & Barton, 1994; Penrose *et al.*, 1996) and bulb turnips (McFerran *et al.*, 1997).

Hunter treatment lambs appeared to have a wider distribution in liveweight gains compared with Pasture and Clover treatment lambs (Figure 1). This wider distribution may support the variable results observed from leafy turnips (Rule *et al.*, 1991; Reid *et al.*, 1994; Dove & Milne, 2006).

The relatively low lamb growth rates on Pasture were possibly due to a low clover content (results not shown), which has been shown to depress liveweights in previous studies (Munro *et al.*, 1992; Moss *et al.*, 2000; Papadopoulos *et al.*, 2001). Kerr (2000) suggested that an ME content of at least 11 MJ/kg DM is required to sustain high lamb growth rates. The low ME in the new pasture was probably a result of the declining clover content (although this is not known) as well as high neutral detergent fibre (NDF) concentrations. In the present study, new pasture NDF concentrations reached levels above 45% from D14, which probably explained why the new pasture treatment lambs had lower liveweight gains in the later part of the study (Hodgson & Brookes, 1999).

CONCLUSIONS

Lamb liveweight gains were greatest on Clover, followed by Hunter and were poorest on the new pasture. This was related to forage quality. This study showed that lamb growth has the capacity to be considerably higher on Hunter than a new pasture, if allowances and hence intakes, are maximum. Hunter also has the additional benefits of being able to be grazed a number of times within one summer season, and is a useful way to split the pasture rotation system while getting valuable use from the crop. The choice of crop to use for summer lamb finishing depends on an individual operation. However, there is now evidence to show that under unrestricted feeding conditions lambs can grow at high rates with Hunter.

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