Lamb growth rates on pasture: assessing options for finishing lambs in spring

Shawn McGrath[1,4], Graeme Sandral[2,4], Michael Friend[3,4]

[1] School of Animal and Veterinary Sciences, Boorooma St, Wagga Wagga, NSW 2650, shmcgrath@csu.edu.au
[2] NSW Department of Primary Industries**,** Pine Gully Road, Wagga Wagga, NSW 2650, graeme.sandral@dpi.nsw.gov.au
[3] School of Animal and Veterinary Sciences, Boorooma St, Wagga Wagga, NSW 2650, mfriend@csu.edu.au
[4] Graham Centre for Agricultural Innovation, Pugsley Place, Wagga Wagga, NSW 2650

Pastures that allow high lamb growth rates in late-spring and early summer are likely to facilitate an increase in production for meat-based livestock systems. This study compared the growth rates and final weights of White Dorper and crossbred lambs grazing six novel pastures over the mid to late-spring period.

Pasture treatments (0.4ha plots) were sown in April 2014 in a replicated complete block design. Pasture treatments included French serradella, bladder clover, forage brassica, lucerne, lucerne + phalaris and arrowleaf clover + chicory with the latter two treatments sown in 1:1 alternate sowing row (tyne) arrangement. Each plot was grazed by 13 lambs (mean starting weight 32.2 kg; five White Dorper (Dorper), five White Suffolk x Merino (WSM) and three White Suffolk x White Dorper (WSD); between 15 October and 2 December. Lambs were weighed weekly after an overnight curfew. Pasture pluck samples were taken weekly and nutritive value tested by NIR. Pastures were managed to ensure the amount of above-ground biomass did not limit intake of lambs.

Lambs grazing the lucerne + phalaris and French serradella pastures reached maximum liveweight on 18 November, lambs grazing bladder clover reached maximum weight on 26 November and lambs grazing forage brassica, chicory + arrowleaf clover and lucerne were still gaining weight at the conclusion of the experiment (2 December). Final liveweights were highest for lambs grazing the arrowleaf clover + chicory pasture (Dorper 43.7 kg, WSD 45.2 kg and WSM 44.0 kg).

Key words
Novel legumes, digestibility, crude protein, lambs

Introduction

Historically pastures containing lucerne (*Medicago sativa*) grazed by crossbred lambs have provided a benchmark for pasture and livestock performance respectively in south-Eastern Australia (Humphries 2012). A range of new pasture species, cultivars and livestock breeds have been introduced into Australian grazing systems (Kilminster and Greeff 2011; Nichols et al. 2012). This study compared growth rates and final weights of weaned White Dorper and crossbred lambs on a range pastures including novel species over the mid to late-spring period.

Methods

Pasture establishment

The experimental site located on Charles Sturt University (CSU) farm at Wagga Wagga, NSW was sown into good moisture on 8-10 April 2014. The experiment included six treatments replicated three times providing 18 plots each 0.4 ha. Treatments were *Ornithopus sativus* cv. Margurita (French serradella), *Trifolium spumosum* cv. Bartolo (bladder clover), *Brassica napus* cv. Stego (forage brassica), *Medicago sativa* cv. SARDI 10 (lucerne), lucerne + *Phalaris aquatica* cv. Advanced AT (phalaris) and *Trifolium vesiculosum* cv. Arrowtas (arrowleaf clover) + *Cichorium intybus* cv. Choice (chicory) with the latter two treatments sown in 1:1 alternate sowing row (tyne) arrangement. All plots were sown at a rate of 35 kg/ha, with the exception of the brassica which was sown at a rate of 9 kg/ha. Phosphorus was applied at sowing to achieve 30 mg/kg Colwell P for all treatments.

Higher than average rainfall was received for autumn 2014 (167 mm cf. 120mm long-term average) and consequently the site (with the exception of the lucerne + phalaris plots) was grazed in early winter with Merino wethers to reduce the pasture biomass. Rainfall July-November totalled 140.4 mm compared to the long term average of 236.8 mm (BOM 2015); consequently all treatments were irrigated between 25 September to 6 October and 29 October to 9 November 2014. During each watering period 50 mm was applied in two irrigation events. This was undertaken to avoid premature pasture senescence in the annual treatments and ensure the experiment could be completed.

Feed on offer was assessed weekly during the grazing period (15 October to 2 December 2014) and remained above 2000 kg DM/ha in all treatments. Pasture pluck samples were collected weekly to simulate the likely diet quality of lambs. Samples were dried at 70 ºC for 48 hours and digestible organic matter in dry matter (DOMD) and crude protein (CP) tested in a commercial laboratory using near infrared spectroscopy with 10% of samples from each treatment tested by wet chemistry.

Sheep management

Weaned lambs were sourced from the CSU flock and local commercial flocks. Lambs were weighed on 7 October 2014 (allocation weight) and drenched (Hatrick, Ancare), vaccinated (5-in-1; Pfizer Animal Health) and treated to prevent fly-strike (Vetrazin spray-on; Novartis Animal Health). Lambs were yarded at 4pm on 14 October 2014, and drafted the following morning into pre-allocated groups, weighed and transported to plots. Allocation to plots within each replicate was based on genotype, source of lambs, sex and weight. Five Dorper, five WSM and three WSD were allocated to each plot, giving a stocking rate of 32.5 lambs/ha. Lambs were subsequently weighed each week after an overnight fast (curfew weight) throughout the experimental period. Lamb weights from 11 November were discarded due to errors experienced with the scales at that time. Of the annual pastures French serradella commenced senescence earlier than other treatments and consequently the lambs grazing this treatment lost a significant amount of weight in the weekly measurement period ending 26 November and were subsequently removed from the experiment. Final weighing date for all other treatments was 2 December 2014.

Statistical analysis

Forage quality and lamb weights were analysed using linear mixed models in Genstat16th edition (VSNi). The random model for lamb weight was replicate/plot/lamb/date. Sex, genotype, treatment, date and their interactions were tested as terms in the fixed model, and start weight was tested as a co-variate and included.

Results

Forage quality: The interaction of treatment and date was significant (P<0.001) for DOMD and CP content of pluck samples (Table 1). At the first measurement (13 Oct) the DOMD of chicory + arrowleaf clover, lucerne and forage brassica treatments were high compared with the other treatments (Table 1). DOMD was lower by the end of the experiment (2 December) in all treatments; however the temporal pattern of DOMD changes differed between treatments (Table 1). CP was highest in the lucerne and chicory + arrowleaf clover treatments at the commencement of the experiment and lucerne had the highest at the conclusion. The CP concentration in forage brassica and serradella was lower than other treatments at the end of the experiment.

Table 1. Mean digestible organic matter digestibility (DOMD) and crude protein content of pluck samples. LSD values allow for both pasture type and time interval comparisons.

date	chicory/ arrowleaf clover	lucerne	bladder clover	French serradella	lucerne/ phalaris	Forage brassica
Digestible Organic Matter in Dry Matter (DOMD)						
13-Oct	74	74	62	63	63	72
24-Oct	77	76	65	65	62	75
29-Oct	76	73	63	64	61	74
5-Nov	77	73	60	58	56	69
13-Nov	70	67	54	47	55	59
21-Nov	71	63	51	39	52	56
26-Nov	65	72	49	38	54	59
2-Dec	65	64	49	38	53	47
DOMD average l.s.d. = 4						
Crude protein (CP)						
13-Oct	29.4	32.3	20.5	23.7	23.2	23.6
24-Oct	30.3	27.9	19.3	20.2	19.0	22.0
29-Oct	28.5	24.9	14.2	19.4	14.7	23.1
5-Nov	24.8	25.8	14.8	15.3	10.4	17.7
13-Nov	17.7	23.3	13.6	10.7	13.0	16.4
21-Nov	19.8	19.5	12.0	7.8	10.0	16.7
26-Nov	13.9	24.4	12.9	8.5	14.1	13.9
2-Dec	15.3	21.9	14.9	9.7	18.1	10.1
CP average l.s.d. = 4.1						

Lamb weights: The interaction of genotype and sex was significant (P<0.01) for lamb liveweight. The interaction between date, pasture treatment and genotype was also significant (P=0.020; Table 2). Finishing

liveweight of lambs was highest for the chicory + arrowleaf clover and lowest for French serradella and lucerne + phalaris across all lamb genotypes (Table 2).

Table 2. Mean curfew weight of White Suffolk × White Dorper, White Dorper x White Dorper and White Suffolk × Merino lambs grazing pastures from 15 October to 2 December 2014 (l.s.d. = 0.9; l.s.d. values allow for pasture type, lamb genotype and time interval comparisons)

date	chicory/ arrowleaf clover	lucerne	bladder clover	French serradella	lucerne/ phalaris	Forage brassica
	White Suffolk x White Dorper					
15-Oct	32.4	32.4	32.4	32.4	32.4	32.4
21-Oct	33.4	33.1	33.1	33.6	33.9	32.9
28-Oct	35.3	35.1	35.5	35.8	35.6	34.3
4-Nov	37.7	37.1	37.1	37.4	37.4	35.7
18-Nov	41.1	38.8	39.6	38.9	39.0	38.6
26-Nov	43.5	41.2	40.8	37.3	38.1	40.0
2-Dec	45.2	42.6	41.0	*	37.9	41.2
	White Dorper x White Dorper					
15-Oct	32.2	32.2	32.2	32.2	32.2	32.2
21-Oct	32.9	32.6	33.2	33.7	33.6	32.8
28-Oct	35.0	34.9	35.7	35.9	35.5	34.2
4-Nov	37.2	36.5	37.5	37.3	37.3	35.8
18-Nov	40.3	38.5	40.2	39.9	39.0	38.8
26-Nov	42.5	40.6	41.4	38.6	38.7	40.3
2-Dec	43.7	41.7	41.4	*	38.8	41.1
	White Suffolk x Merino					
15-Oct	32.3	32.3	32.3	32.3	32.3	32.3
21-Oct	33.3	32.6	33.4	33.9	33.5	32.9
28-Oct	35.0	34.7	35.2	35.6	35.3	34.2
4-Nov	37.4	36.1	37.3	37.5	37.3	35.7
18-Nov	40.8	38.1	38.7	38.4	37.6	38.5
26-Nov	42.9	40.1	40.0	36.2	37.4	39.8
2-Dec	44.0	41.4	39.6	*	37.6	40.5

Discussion

The results from this research indicate that where pasture availability does not limit livestock intakes, using a high quality late maturing pasture should facilitate high growth rates longer into the growing season and ensure increased lamb slaughter weights. Diet digestibility of lambs grazing chicory + arrowleaf clover or lucerne was high throughout the experiment, and lambs on these treatments continued to gain weight. Lambs grazing bladder clover performed better than expected from DOMD results and lucerne + phalaris worse than expected. Pluck samples from the lucerne + phalaris treatment may have been unintentionally biased by over representation of lucerne and consequently DOMD could have been overestimated, however there is no apparent explanation for lamb growth rates being higher than expected on bladder clover.

The legume and herb mixture of arrowleaf clover + chicory, which was dominated by arrowleaf clover for much of the experiment, produced the highest lamb growth rates and heaviest final weights. Other studies comparing lamb production from arrowleaf clover with subterranean clover or ryegrass have shown that arrowleaf clover can extend the growing season by maintaining higher digestibility later in the season, thus increasing lamb production (Thompson et al. 2010). Lucerne often responds to out of season rainfall and when it does it can provide high quality feed (Humphries 2012) while arrowleaf clover, being an annual, will eventually senesce and decline in quality (Thompson et al. 2010). The advantage of lucerne over arrowleaf clover + chicory therefore is most likely to be expressed later in the summer period than was tested in this study, although interestingly lamb growth rates were lower for lucerne compared to arrowleaf clover + chicory in spring.

Mean liveweights of WSD and WSM lambs grazing French serradella or bladder clover did not differ significantly to lambs grazing arrowleaf clover + chicory after the first 20 days of grazing, thereafter liveweights on bladder clover and French serradella were significantly lower as digestibility reduced and crude protein concentrations declined to a level that could restrict growth rates (Dabiri and Thonney 2004). Liveweights of Dorper lambs did not differ significantly between bladder clover and arrowleaf clover + chicory until much later in the trial (i.e. after 42 days of grazing). It is unclear whether this genotype difference relates to differences in diet selection, metabolism or both. DOMD and CP declined more slowly in bladder clover compared to French serradella allowing lambs to continue to gain weight for longer when grazing bladder clover.

Growth rates on the lucerne + phalaris mixture were initially high, and mean lamb liveweights did not differ significantly from lambs grazing arrowleaf clover + chicory after grazing pasture for 20 days. Growth rates on lucerne + phalaris declined from mid-November with diet quality as the lucerne content of pasture also declined (data not shown) and phalaris was in the stem elongation phase. Although the lucerne in this mixture responded to available moisture late in the trial, growth rates of lambs had not increased by the conclusion of grazing.

Mean liveweight of lambs grazing brassica was significantly lower than other treatments except lucerne after 13 days of grazing (Table 2), despite high digestibility and crude protein content. This, corresponded corresponding to the period when leaf availability was highest. An initial period of slow growth when lambs are introduced to brassica species is was a feature of many other studies (Barry 2013). Despite this initial lag in growth, lambs grazing the brassica gained liveweight throughout the experiment and the diet of lambs grazing brassica transitioned from predominantly leaf to include seed pod and inflorescence.

The experiment highlights the opportunity to exploit hybrid vigour by using a terminal sire in Dorper systems. The WSD lambs had higher finishing weights than other genotypes on the higher value grazing treatments (i.e. arrowleaf clover + chicory and lucerne). The high nutritive values in arrowleaf clover + chicory and lucerne treatments may have allowed this genotype to express the full potential of hybrid vigour and therefore higher growth rates.

Conclusions

Perennial pasture alone does not ensure high late spring and early summer lamb growth rates, vis-a-vis lucerne + phalaris, although early preferential grazing of lucerne and stem elongation in phalaris could have disadvantaged this treatment. The late maturing annual legume Arrowtas (Arrowleaf clover) and Choice (Chicory) performed exceptionally well, outperforming lucerne as measured by final lamb finishing liveweights. Lamb growth rates on forage brassica were disappointing over the 15 Oct to 5 Nov period when compared with French serradella and bladder clover despite higher estimates of dietary DOMD. Reasons for DOMD not always being a reliable predictor of liveweight gain require further investigation.

References

Barry, TN (2013) The feeding value of forage brassica plants for grazing ruminant livestock. *Animal Feed Science and Technology* **181**, 15-25.

BOM (2015) 'Climate data online.' Available at http://www.bom.gov.au/climate/data/ [Accessed 24 April, 2015].

Dabiri, N, Thonney, ML (2004) Source and level of supplemental protein for growing lambs. *Journal of Animal Science* **82**, 3237-3244.

Humphries, AW (2012) Future applications of lucerne for efficient livestock production in southern Australia. *Crop and Pasture Science* **63**, 909-917.

Kilminster, TF, Greeff, JC (2011) A note on the reproductive performance of Damara, Dorper and Merino sheep under optimum management and nutrition for Merino ewes in the eastern wheatbelt of Western Australia. *Tropical Animal Health and Production* **43**, 1459-64.

Nichols, PGH, Revell, CK, Humphries, AW, Howie, JH, Hall, EJ, Sandral, GA, Ghamkhar, K, Harris, CA (2012) Temperate pasture legumes in Australia—their history, current use, and future prospects. *Crop and Pasture Science* **63**, 691-725.

Thompson, AN, Kennedy, AJ, Holmes, J, Kearney, G (2010) Arrowleaf clover improves lamb growth rates in late spring and early summer compared with subterranean clover pastures in south-west Victoria. *Animal Production Science* **50**, 807-816.

Acknowledgements

This research was funded by Meat and Livestock Australia. Technical assistance provided by S. Hildebrand, C. Fuller, A. Price, P. Sutton, B. Sutton, T. Williams, K. Schirmer, I. James and E. Knight.