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LUPIN GRAIN BUT NOT BARLEY STRAW SUPPLEMENTS ALLOW CASHMERE BUCK KIDS TO GROW RAPIDLY DURING WINTER

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SUMMARY

This paper reports an experiment aimed to determine if *ad libitum* feeding of low or high digestibility supplements improved weight gain and cashmere production of cashmere buck kids (mean ± se, liveweight 24.8 ± 0.5 kg) grazing winter pastures. The design was 3 feeding treatments: Control (C) - grazing with no supplement; Straw (S) - grazing with *ad libitum* barley straw; Lupin (L) - grazing with *ad libitum* whole lupin grain (*Lupinus angustifolius)* x 3 replicates each of 4 goats. Feeding began on June 26 and finished on August 18. From August 19 to November 17 all goats grazed together with green pasture availabilities > 2500 kg DM/ha. Intake of straw in S was 412 ± 59 g DM/head/day and intake of lupins in L was 723 ± 24 g DM/head/day. Animals in S wasted 57% of the straw fed in the hay racks. L resulted in substitution of lupins for pasture. Feeding of lupins significantly increased liveweight at the end of winter and spring, and increased pasture availability and body condition at the end of winter. Supplements of low digestible straw provided no benefits in liveweight gain. Results indicate that to obtain liveweight gain during winter cashmere goats require green pasture availabilities significantly >850 kg DM/ha. Supplementation did not affect cashmere production (mean ± se, total fleece weight 353 ± 15 g, cashmere weight 126 ± 9 g and cashmere fibre diameter 15.2 ± 0.1 µm). Weaner cashmere bucks exhibited only partial compensatory liveweight gain during spring. In conclusion cashmere bucks can grow rapidly during winter if provided with adequate highly digestible feedstuffs while provision of low digestible forages will provide little or no benefits.
Keywords: nutrition, supplementation, growth, cashmere, management

INTRODUCTION

During cold wet winters in regions of Victoria, Tasmania, south western Australia and the tablelands of New South Wales the availability of pasture is limited and grazing goats grow slowly or only maintain liveweight (McGregor 1990a). Both McGregor (1984) and Walkden-Brown *et al.* (1994) have suggested that short day length or associated physiological changes may be implicated in low body growth rates of feral/cashmere goats from May to July. There is also a widespread belief that goats must be provided with high fibre, high roughage diets and consequently weaner cashmere goats have commonly been supplied poor quality, low digestibility hay during dry autumns and winters (McGregor 1990a). The aim of this experiment was to determine if *ad libitum* feeding of low or high digestibility supplements improved liveweight gain and cashmere production of grazing cashmere buck kids.

MATERIALS AND METHODS

Design and diets

The design was 3 feeding treatments x 3 replicates each of 4 goats. Treatments were: **Control (C)** - grazing with no supplement; **Straw (S)** - grazing with *ad libitum* barley straw; **Lupin (L)** - grazing with *ad libitum* whole lupin grain (*Lupinus angustifolius). Ad libitum* feeding was at 20% above intake. Following stratification on liveweight goats were randomly allocated to treatment. Replicates were randomly allocated to plots (0.4 ha) of annual temperate pasture. Feeding began on June 26 and finished on August 18. From August 19 until November 17 all goats grazed together with green pasture availabilities > 2500 kg DM/ha.

Animals, their management and measurement

Goats used in this experiment were provided by a commercial cashmere breeder who was experiencing difficulty in obtaining growth of weaner cashmere buck kids. Buck kids were born in August, weaned in January, fed low quality hay during autumn and taken to the Institute at Werribee (37°54'S., 144°41'E., elevation 46 m), Vic. in May. Buck kids were used as they are the most valuable animals in a flock and they have the greatest potential to grow quickly. On arrival these goats were foot parred, vaccinated against *Clostridium spp*., and treated with anthelmintic. After 4 weeks they were weighed (mean ± se, liveweight 24.8 ± 0.5 kg), placed onto plots which had green pasture availability of 1250 kg DM/ha. Fences were 1.1 m mesh with electric outriggers. Every 14 days goats were weighed and from August 27 moved to new pasture. Body condition (CS) was scored on June 26, August 18 and November 17 (McGregor 1983, 1990). At the same time fasted liveweight was measured following a 24 hour fast. Goats were shorn on August 8, fleeces weighed, grid sampled and tested (McGregor 1988). "Sarlon" shade cloth was erected on the southern fence line as an effective wind break. Faecal strongyl egg counts (FEC) were measured at the end of supplementary feeding. Goats were visually assessed for fleece growth on November 18.

Weighed amounts of supplements were fed daily. S was fed in hay racks at ground level, providing rack space of 2 m/goat. Each week S residues were raked up, weighed, subsampled and samples dried at 100° C to determine dry matter intake. L was fed in metal troughs (McGregor 1984) providing trough space of 2 m/goat. During the last 3 weeks of feeding crushed limestone was added to the lupins at 1.5% and L goats were exercised twice daily for 5 minutes. Pasture availability was measured at the start, after 3 and 7 weeks and in each paddock grazed in spring (McIntyre 1952). S and L were sampled weekly to determine DM, dry matter digestibility (DMD), nitrogen (N), and acid detergent fibre (ADF) using standard methods (McGregor 1988).

Statistical analysis

The mean value of each replicate was the experimental unit. Analysis of variance was used to estimate treatment effects. Standard errors of difference between means (sed) and the variance ratio to calculate the probability of significant differences between means were obtained using Genstat (1983) release 5.3.1.. FEC were analysed as log(1+ FEC). Data were pooled for linear regression analyses.

RESULTS

Nutrient composition, intake of ration and effect of treatments on pasture availability

Composition of the feeds (g DM/kg) were 4.5 N and 407 ADF for straw and 45.9 N and 232 ADF for lupins. DMD was 54.5% and 83.1% for straw and lupins respectively.

Intake of straw (mean ± se) was 412 ± 59 g DM/head/day. Intake of lupins was 723 ± 24 g DM/head/day. Animals in S wasted 57% or 537 g DM/head/day of the straw fed in hay racks.

Pasture availability at 3 and 7 weeks is shown in Table 1. After 7 weeks L had more pasture available than other treatments ($P < 0.05$).

Table 1. The effect of *ad libitum* supplementary feeding of barley straw or lupins on the availability of annual pastures grazed by weaner cashmere bucks at 10 animals/ha during winter (kg DM/ha)

Treatment	After 3 weeks		After 7 weeks		Change week 3 to 7
	Green	Total	Green	Total	in total kg DM/ha
Control	720	1030	850	1160	+ 130
Barley straw	710	1130	1110	1410	+ 280
Lupins	1280	1670	2170	2800	+1130
sed		243		302	

Effect of treatments on liveweight and body condition score

Liveweight Within 2 weeks of supplementary feeding there were significant differences in mean liveweight between treatments ($P < 0.01$, Figure 1). After 8 weeks kids in L had a mean liveweight 7 kg greater than those in S ($P < 0.001$). Within 1 week of the end of supplementary feeding there was no difference in liveweight between S and C ($P > 0.05$). L goats remained heavier than the other treatments until the end of the experiment ($P < 0.05$). The apparent decline in liveweight in mid September was related to very heavy rainfall in the 2 days prior to weighing. C gained more than S and L in the first 3 weeks of common grazing ($P < 0.05$). By November 17, 3 L goats exceeded 51 kg having gained 23.7 kg since the experiment began.

Mean fasted liveweight gain was 35% greater for L than C during the experiment ($P < 0.05$), but during common grazing C gained 38% or 4.1 kg more than L ($P < 0.05$). Regression equations between liveweight and fasted liveweight were affected by supplementary feeding and grazing spring pasture. The regression coefficient of L was greater than S and C in August (0.977 vs 0.926, $P < 0.05$) and the regression coefficient at the end of spring was smaller than that for the start of the experiment in winter (0.920 vs 0.974, $P < 0.05$).

Condition Score Condition scores at the start averaged 2. At the end of supplementary feeding CS of S and C were 2- but L was 3- ($P < 0.01$). At the end CS of S and C were 3- and L was 3 (NS).

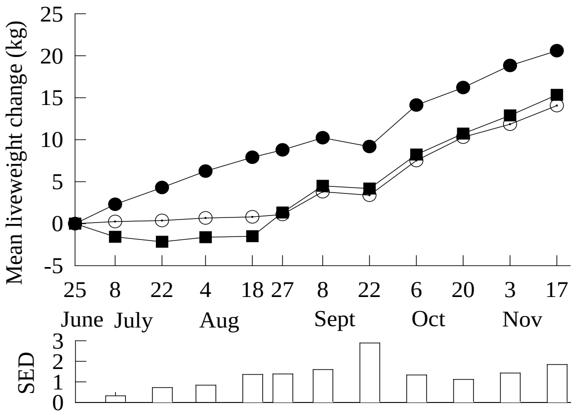

Figure 1. Mean liveweight change of cashmere buck kids grazing pasture (■), and supplemented with either *ad libitum* barley straw (❍) or lupin grain (●) from June 25 until August 18 and then grazed together on adequate spring pasture in southern Victoria

Cashmere production, cashmere quality and visual assessment

There were no treatment effects on cashmere production or quality (Table 2). There were obvious visual differences of the fleeces of the goats on November 18. L goats had clean skin with long shiny hair fleeces. C and S goats had scurfy skin with shorter and duller hair fleeces.

Table 2. The effect on cashmere production and cashmere quality of feeding weaner cashmere buck kids grazing winter pasture *ad libitum* supplements of barley straw or whole lupin grain

Treatment	Control	Barley straw	Lupins	SED
Greasy fleece weight (g)	363	340	364	30
Cashmere yield (%w/w)	33.3	35.0	36.5	6.5
Cashmere weight (g)	126	116	134	29
Cashmere diameter (μm)	15.4	14.9	15.2	0.5

Animal health

Mean FEC at the end of supplementary feeding were: C 530 (range 420-780); S 595 (60-1080) and L 310 (120-600). The difference between L and S was significant at P = 0.07. After 5 weeks of supplementary feeding L goats began to show signs of lameness. The distal end of the radius was swollen but no signs of arthritis were observed. All L goats were observed to spend a large proportion of each day at rest. All signs of lameness had disappeared within 1 week of cessation of supplementary feeding.

DISCUSSION

The most important finding is that weaner cashmere bucks can grow through the winter period if they are fed properly, contradicting views that slow growth rate during winter is linked to day length (McGregor 1984, Walkden-Brown *et al.* 1994). Feeding of lupins resulted in rapid growth, providing a new benchmark of 140 g/day for liveweight gain during winter (such liveweight gains have normally only been seen in goats during spring McGregor 1985), whereas C fed goats grazing winter pasture without supplements lost 30 g/day. Cashmere wether goats which have experienced energy restrictions during summer and early autumn are also able to grow rapidly in late autumn and early winter when fed highly digestible forage diets (McGregor 1988).

Ad libitum feeding of lupins resulted in significant substitution of lupins for pasture, as indicated by the doubling in pasture availability in plots where lupins were fed, while pasture availability on other treatment plots remained almost constant. L fed goats hardly grazed spenting most of their time resting. It is most likely that the lupins overcame restricted energy intake as the green pasture consumed would have provided adequate nitrogen for the growth of these goats (Gurung *et al.* 1994). This suggests that to obtain liveweight gain during winter cashmere goats require green pasture availabilities significantly >850 kg DM/ha (the amount available in August to C). *Ad libitum* feeding of lupins also resulted in osteodystrophia, resulting in inflamed knees and lameness in some goats. Supplementation of lupins with Ca was required to supply the requirement of 4 gCa/day of these rapidly growing goats, as the Ca content of lupins is ≈2.4 g/kg (AFIC 1987).

The provision of low quality roughage offered no benefits other than short term gains in liveweight in late winter compared to the control, differences which disappeared within 9 days of grazing adequate spring pasture. This along with the observation of similar fasted liveweights, suggests that differences in liveweight between S and C were most likely due to changes in gut fill. In assessing the performance of straw fed goats account must be taken of the large wastage as 33% more straw was wasted than eaten, increasing the costs of handling and purchase of such feedstuff. Fehr and Sauvant (1980) concluded that the cost of production will be higher if goats are fed lower quality supplements compared to more digestible supplements.

Control and straw fed goats exhibited only partial liveweight compensation during spring and remained significantly lighter than lupin fed goats at the end of spring. This response is different to sheep which can fully compensate during spring for liveweight deficits induced during winter (Allden 1968). Some of the benefits available to commercial and stud farmers from feeding lupins during winter demonstrated in this study include increased liveweight, increased body condition score and a more desirable visual appearance. These benefits will increase the value of bucks sold as sires or for meat production (McGregor 1990b). The increase in liveweight at the end of spring is likely to increase cashmere production during the following cashmere growing season (McGregor 1992), by up to 4.6 g/kg increase in liveweight.

In conclusion cashmere goats can grow rapidly in winter. Feeding of lupins during winter significantly increased liveweight at the end of winter and spring. Supplements of low digestible straw provided no benefits in liveweight gain during winter compared to grazing pasture alone. Weaner cashmere bucks exhibited only partial compensatory liveweight gain during spring.

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REFERENCES
AFIC (1987). Aust. Feed Composition Tables. Ed. H.T. Ostrowski-Meissner. (CSIRO: Sydney).
Allden, W.G. (1968). *Aust. J. Agric. Res.* **19:** 997-1007.
Fehr, P.M. and Sauvant, D. (1980). *J. Dairy Sci.* **63:** 1671-80.
Genstat (1983). Genstat Manual. Numeric Algorithms Group, Rothamsted Experimental Station (Oxford: England).
Gurung, N.K., Jallow, O.A., McGregor, B.A., Watson, M.J., McIlroy, B.K.M.H., Holmes, J.H.G. (1994). *Small Rumin. Res.* **14:** 185-92.
McGregor, B.A. (1983). *Mohair Aust*. **13(1):** 26-7.
McGregor, B.A. (1984). *Aust. J. Exp. Agric*. **24:** 77-82.
McGregor, B.A. (1985). In "Goat Production and Research in the Tropics" pp 82-90. Ed J.W.Copeland. (AGPS: Canberra).
McGregor, B.A. (1988). *Aust. J. Exp. Agric*. **28:** 459-67.
McGregor, B.A. (1990a). University of Sydney Post-Graduate Foundation in Veterinary Science Proceedings **134:** 347-75.
McGregor, B.A. (1990b) *Small Rumin. Res.* **3:** 465-73.
McGregor, B.A. (1992). *Small Rumin. Res.* **8:** 107-19.
McIntyre, G.A. (1952). *Aust. J. Agric. Res.* **3:** 385-90.
Walkden-Brown, S.W., Norton, B.J. and Restall, B.J. (1994). *Aust. J. Agric. R.* **45:** 355-66.