The effects of grain supplements on liveweight change, staple strength and position of break for sheep grazing dry annual pastures

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SUMMARY

The effects of grain supplements on liveweight change, staple strength and position of break for adult wethers grazing dry pastures from November to April was examined. Treatments used were: nil supplement (control), lupins (lupins) or oats (oats) fed from pasture senescence (25 November) or lupins fed from 7 February (delayed lupins). Each supplement was fed at 100, 200, 300, 400 or 500 g/hd/d, with sheep in the lupins treatment also fed at 50 g/hd/d.

Supplements of lupins or oats generally reduced liveweight loss and increased staple strength compared to no supplement, except when lupins were given at 400 or 500 g/hd/d. While delayed lupins reduced liveweight loss after 7 February, there was no effect on staple strength compared to controls. Neither supplementation nor the time at which it began affected the position of break in the staple. These results are discussed in relation to their importance to farmers.

INTRODUCTION

During the summer/autumn period in Western Australia sheep graze dry feeds of low quality. The intake of these feeds is limited by low digestibility and crude protein content. Hence, sheep generally lose weight and condition and there are reductions in wool growth rate and fibre diameter.

Many farmers allow reductions in live weight (LW) before beginning to feed supplement, and then only supplement to achieve maintenance. The cost of the supplementary feed, and the fact that high levels of supplementation increase not only wool production, but also mean fibre diameter of the fleece are the main reasons farmers adopt this strategy. Rowe et al. (1989) found that feeding between 150 and 450 g/hd/d of lupins, oats or barley to weaners, increased mean fibre diameter in the fleece by only 0.5 to 0.9 microns. There was an associated increase in staple strength from 17 up to 26 N/kTex. Staple strength is expected to become a more important determinant of wool prices and, hence, farmers may have to revise their feeding strategies.

The experiment described here was designed to determine the effects of different levels of lupin and oat grain supplements and of time of commencement of supplementation on liveweight change (LWC), staple strength (SS) and position of break (POB) in the staple.

MATERIALS AND METHODS

The experiment was conducted at Mount Barker Research Station (Latitude 38° 38' S, longitude 177° 32'), where the climate is characteristically Mediterranean with an annual rainfall of 675 mm. There were 19 one hectare plots containing subterranean clover/annual ryegrass pasture, with between 2200 and 3300 kg dry matter (DM)/ha at senescence. This declined to an average of 1070 kg DM/ha in April, under grazing.

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One hundred and ninety Merino wethers (18 months of age, mean LW 51.3 ± 0.45 (s.e.) kg, mean condition score 3.2 ± 0.10) were randomly allocated to the treatments. The control treatment was replicated three times while the other treatments were not replicated. The treatments were: Control = no supplement; 6 rates of lupin feeding (50, 100, 200, 300, 400 and 500 g/hd/d) commenced at pasture senescence (25 November) (lupins); 5 rates of oat feeding (100, 200, 300, 400 and 500 g/hd/d) commenced at pasture senescence (oats); and 5 rates of lupin feeding (100, 200, 300, 400 and 500 g/hd/d) commenced on 7 February, when mean LW was 46.9 ± 0.73 kg (delayed lupins).

The lupins had a metabolisable energy content of 13.7 MJ/kg DM and a crude protein content of 331 g/kg DM compared to values for oats of 9.3 MJ/kg DM and 136 g/kg DM. During the experiment there were significant rainfall events (>5 mm) on 30 November, 7 and 24 December, 13 January and 25 March. The rain in March resulted in a good germination and green feed persisted through to 2 May when good follow up rains (110 mm in 5 days) occurred. Supplementary feeding ended on 17 April when the control groups maintained weight through three successive weighings, probably due to the availability of green feed. All sheep were grazed in common prior to and after the experiment. Oats were provided in troughs twice per week and lupins were manually broadcast across the plots once per week.

Live weight and condition score of all sheep were recorded every two weeks from pasture senescence until the end of supplementary feeding. Mid-side dyebands were applied monthly for determination of POB, and mid-side samples were taken from all sheep at shearing in October for determination of SS. POB was measured for 3 staples from each sheep. SS was measured for 10 staples from each sheep using an ATLAS machine.

Relationships between LWC or SS and level of supplementary feeding were fitted for lupins, oats and delayed lupins. With LWC, the delayed lupin group was treated separately since the supplementation period was shorter. The regression equation used was:

\[ Y = a + bX_L + cX_L^2 + dX_O + eX_O^2 + fX_DL + gX_DL^2 \]

where \( Y \) is LWC (g/hd/d) or SS (N/ktex); \( a, b, c, d, e, f, g \) are regression coefficients; \( X_L \) is the level of lupin feeding (g/hd/d); \( X_O \) is the level of oat feeding (g/hd/d); and \( X_DL \) is the level of delayed lupin feeding (g/hd/d). Differences in the response to level of feeding for the three supplement groups were compared. Quadratic terms were only included if significant (\( P < 0.05 \)).

**RESULTS**

*Effect of supplements on liveweight change*

Liveweight change and SS for different levels of lupins, oats and delayed lupins are summarised in table 1.
Table 1 The effect of level of supplement on liveweight change (LWC) during supplementation and staple strength (SS) during supplementation (143 days), LWC with increasing levels of lupins or oats were described by the following equations:

Lupins: \( Y = -13.0 + 0.427 \times (\pm 0.125)X - 0.0000973(\pm 0.0000269)X^2 \)  
Oats: \( Y = -13.0 + 0.0519(\pm 0.0356)X \)  

\( n = 9 \)  
\( P<0.05, \% \text{ variance accounted for is 45} \)

For the delayed lupins group, LWC during supplementation (69 days) with increasing levels of lupins was described by the following equation:

Delayed Lupins: \( Y = -27.0 + 0.191(\pm 0.0375)X \)  
\( n = 8 \)  
\( P<0.05, \% \text{ variance accounted for is 78} \)

The relationships between level of supplement and LWC during supplementation were different \( (P<0.05) \) for lupins and oats. The relationship for lupins was improved by fitting a quadratic function because of the adverse effects of 400 and 500 g/hd/d lupins (Table 1). The relationship for oats indicated a positive linear increase during supplementation (eq. 2), as did that for delayed lupins (eq. 3).

Effect of supplements on staple strength and position of break

Changes in SS with increasing levels of each supplement were described by the following equations:

Lupins: \( Y = 27.9 + 0.0867(\pm 0.0415)X - 0.000213(\pm 0.0000903)X^2 \)  
Oats: \( Y = 27.9 + 0.0249(\pm 0.0116)X \)  
Delayed Lupins: \( Y = 27.9 - 0.0146(\pm 0.0116)X \)  

\( n = 9 \)  
\( n = 8 \)  
\( n = 8 \)  
\( P<0.05, \% \text{ variance accounted for is 40} \)

For sheep on the delayed lupins treatment, SS was the same as that for the control sheep (Table 1). While there were no differences \( (P>0.05) \) in the relationships between level of supplement and SS for lupins (eq. 4) and oats (eq. 5), the relationship for lupins was improved by fitting a quadratic function. Again this was due to the adverse effects of 400 and 500 g/hd/d lupins (Table 1). Comparison of eq. 5 with 6 indicated that feeding oats early improved SS. While eq. 4 was not different to eq. 6, it is apparent that early feeding of lupins up to 300 g/hd/d also tended to increase SS.

On average, the POB in the staple was estimated to be on 18 February for the control sheep, 3 March for sheep on lupins, 23 February for sheep on oats and 19 February for sheep on delayed lupins.
DISCUSSION

The findings of this experiment indicate that delayed supplementation in this environment resulted in lower SS. With the increased importance of SS in the sale of wool by description, it is likely farmers may have to change their summer/autumn feeding policies.

Farmers seldom feed at levels in excess of 200–300 g/hd/d, unless paddock feed is extremely low. At these levels of supplementation there were no differences between oats and lupins for adult dry sheep. However, when fed at more than 300 g/hd/d, lupins resulted in LW loss and SS similar to that for sheep which received no supplement. At high levels of feeding, lupins given once weekly —may not only have substituted for the dry pasture at a greater rate than oats, but also to the extent that total digestible energy intake was reduced. These adverse effects of high lupin feeding were not apparent with delayed lupins, where sheep lost weight and condition prior to supplementary feeding. This indicates the effects may occur primarily with adult dry sheep in good condition whose demands for energy are low.

Despite differences in SS, supplementation had no effect on POB in the staple. In contrast, Rowe et al. (1989) found for November shorn weaner sheep that as SS increased, the POB in the staple moved closer to the tip. In south western Australia, the weakest part of the staple usually occurs near the break of season (Ralph unpublished). For the delayed lupin group, the break in the staple occurred on the 19 February, only 12 days after feeding commenced. The controls also broke at this time. Hence, there was insufficient time for the supplement to affect wool growth. The POB did not coincide with any rainfall event or drastic change in sheep management. However, in general, the POB in the staple corresponded to the time when fibre diameter was lowest (Curtis unpublished). It would seem the break occurred at this time as green feed became available in March, after which even the control sheep maintained weight.

This experiment indicated that significant gains in SS may result from feeding low levels of lupin or oat grain supplements from pasture senescence. While additional work is needed to confirm these findings, it would seem that to produce sound wool above the Australian Wool Corporation recommended minimum of 32 N/ktex, supplementation should not be delayed until after body condition falls.

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