

EFFECTS OF REPRODUCTION AND SUPPLEMENTARY FEEDING ON STAPLE STRENGTH AND OTHER WOOL CHARACTERISTICS OF GRAZING EWES

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SUMMARY

This experiment measured the effects of type of supplementary feed, lambing time and number of offspring reared on the wool grown by grazing ewes and weight of lambs at birth and weaning. Two groups of 95 winter-lambing ewes were compared: one group was fed a canola meal-based pellet for six weeks before the start of lambing and the first two weeks of lambing; the other was fed a similar amount of lupins over the same period. Feeding the canola meal pellets resulted in increased staple strength in the ewes that lambled during the first cycle, a later point of break in the wool but increased lamb mortality. The later lambing ewes had higher staple strength, broader fibre diameter and greater staple length. Lambs born later were heavier at birth but lighter at weaning. Ewes that reared one or two lambs produced less wool with shorter staples and lower clean wool yield than dry ewes. Ewes rearing two lambs had lower staple strengths than dry ewes or those rearing one lamb.

Keywords: wool, sheep, canola meal, reproduction, staple strength, lupins

INTRODUCTION

Wool growth is depressed in pregnancy and lactation resulting in lower fleece weight and fibre diameter (Corbett 1979). Depending on the time of lambing and feed supply, staple strength may also be reduced. For ewes lambing in autumn in a Mediterranean environment, late pregnancy and early lactation correspond to a period of low quality and availability of pasture. The effects of high nutrient requirements and low nutrient availability together result in a dramatic decrease in wool growth and fibre diameter thereby causing a weak point in the fibre and reduced staple strength. In the same environment, lambing in winter or spring will mean that the availability of pasture is more closely matched to the ewe's requirements. In comparisons between ewes lambing in May or in August, the August lambing ewes had consistently fewer fleeces with a staple strength below 30 N/ktex (Foot and Vizard 1993).

Other factors may also influence the effects of reproduction on staple strength. Croker *et al.* (1990) reported that rearing more than one lamb further decreased staple strength and Masters and Mata (1996) suggested that feeding protein that escapes degradation in the rumen in late pregnancy and early lactation increases wool growth and may improve staple strength. The experiment described here aimed to measure effects of number of lambs reared, type of supplement and lambing time on wool production and characteristics, and lamb weights, growth and survival in two groups of ewes lambing in early winter.

METHODS

This experiment was carried out at Yalanbee Research Station, approximately 65 km east of Perth (31° 45'S, 116° 28'E), Western Australia. A flock of 250 mixed age Merino ewes was used. On December 22, ewes were treated with intravaginal sponges (Repromap, Upjohn) to synchronise mating and lambing. After the sponges were removed (January 3), rams were introduced for eight weeks. Approximately 90 days after the first day of mating, all ewes were pregnancy tested by real-time ultrasound and two groups of 95 ewes were selected to continue in the experiment. Most of the ewes that had not conceived were excluded although 24 were retained to make up the 95 in each group. One group contained 11 dry, 47 single and 37 twin bearing ewes allocated according to the scanning results, the corresponding numbers in the second group were 12 dry, 47 single and 36 twin bearing ewes. The groups were held in adjoining paddocks and rotated between the paddocks each week until the commencement of lambing (June 2). There was little difference in feed availability or shelter between the paddocks. The two groups were retained in separate paddocks during the eight weeks of lambing and then brought together as one group until the lambs were weaned.

For approximately six weeks prior to the start of lambing and for two weeks after, one group of ewes was fed 230 g/head/day of a pellet containing canola meal/lupins/oats (65:25:10) and the second 230 g/head/day of lupins. The canola meal was produced by the expeller process and had therefore been heated during oil

extraction. The supplements were fed three times per week in troughs. Outside of the experimental period ewes in both groups were fed the same supplements as part of the normal farm routine.

Ewes were initially shorn and fleeces weighed in March, 65 days before the start of lambing and then again on November 3. At the second shearing, fleeces were weighed and midside samples of wool collected for measurement of fibre diameter, yield, staple strength and point of break. Yield and average fibre diameter were determined by the Australian Wool Testing Authority (AWTA Ltd) while staple strength and length were measured using standard procedures for an Agritest system (Agritest Pty Ltd, Sydney). The tip and base of each staple broken in the strength test were weighed and the weight of the tip as a proportion of the total staple weight was used to calculate the percentage point of break.

Each flock was inspected daily during lambing, newborn lambs were weighed and the mother identified. Dead lambs were counted daily and identified if they had been tagged on a previous day. Lambs were weighed again at weaning (September 28).

Results were analysed by ANOVA using Systat (Wilkinson *et al.* 1992). Greasy fleece weight in the previous year (March shorn) was used as a covariate in the analysis of clean fleece weight. Individual means were compared using Tukey's HSD test. Least squares means are shown in the tables. In the evaluation of the effects of cycle of birth, ewes lambing during the first 10 days were classified as first cycle, the next 12 days as second cycle and all others as third cycle. Only ewes that conceived and reared the same number of lambs were included in the analysis. Lamb mortalities were compared using Chi-squared analysis.

RESULTS

Feeding the canola meal/lupin/oats pellets resulted in higher staple strength in the ewes lambing during the first cycle (but not the second and third) and a move in the point of break to a later time compared with the ewes fed lupins only. The type of supplement did not affect clean fleece weight, fibre diameter or staple length (Table 1).

Ewes that lambed during the second and third cycles had wool with a higher staple strength, broader fibre diameter and longer staples than ewes lambing during the first cycle. The time of lambing did not affect clean fleece weight or point of break (Table 1).

The number of offspring conceived and reared influenced a number of raw wool characteristics. Ewes that produced one or two lambs had lower clean fleece weights, a later point of break and shorter staples than dry ewes. There were no differences between ewes that reared one or two lambs except for staple strength. The ewes rearing twins had a significantly lower staple strength than the ewes rearing single lambs (Table 2).

Birth weight, weaning weight and growth rates were not affected by type of supplement although there were significantly ($P < 0.05$) more lamb deaths before marking in the canola meal fed group (15.6%) than in the lupin fed group (5.5%). Birth status (whether single or twin), sex and cycle of birth all affected birth weight, weaning weight and growth rate from birth to weaning (Table 3). Lower birth weights were measured in lambs born as twins, females and lambs born in the first cycle. At weaning the twin born lambs and females were still lighter than the single born and male lambs, however, because of the longer time between birth and weaning, the early born lambs were heavier than later born lambs. Overall, weaning weights were 30.4 kg (s.e.m. 0.31 kg), 28.2 kg (s.e.m. 0.45 kg) and 24.9 kg (s.e.m. 0.68 kg) for the lambs born in the first, second and third cycles respectively. Growth rate was also affected by birth status, sex and cycle of birth. Single born lambs and males grew faster.

DISCUSSION

Feeding a pellet containing 65% canola meal for six weeks prior to the start of lambing and during the first two weeks of lambing increased staple strength in ewes lambing in the first but not later cycles. The increase in strength in the first cycle ewes was 7.4 N/ktex. Feeding the canola based pellet also resulted in a significantly different point of break in the fibre, indicating that the point of minimum wool growth and fibre diameter was later in these ewes, probably after supplementation with canola meal stopped. The type of supplement did not significantly influence clean fleece weight, average fibre diameter or staple length, although the trend towards higher clean fleece weights in the canola meal fed ewes is consistent with a short period of increased wool growth during the supplementation period. Lambing in this experiment started during a sustained period of rainfall and the availability of green feed was poor during the early part of lambing but improved during the lambing period.

Table 1. Effect of type of supplement (S) and cycle of lamb birth (C) on clean fleece weight (CFW), staple strength (SS), point of break (POB), fibre diameter (FD) and staple length (SL) in reproducing ewes

Supple- ment (S)	Cycle (C)	N ^A	CFW (kg)		SS (N/ktex)		POB (% from tip)		FD (µm)		SL (mm)	
			mean	s.e.m.	mean	s.e.m.	mean	s.e.m.	mean	s.e.m.	mean	s.e.m.
Canola	1	38	2.08	1.03	36.3	1.9	29.6	1.0	21.8	0.24	68.5	0.9
	2	22	2.19	0.08	39.6	1.9	32.7	1.3	22.3	0.30	68.0	1.1
	3	6	2.46	0.18	44.2	4.8	34.4	2.6	23.1	0.59	72.4	2.2
Lupins	1	38	2.12	0.06	28.9	1.7	28.2	1.0	22.0	0.23	67.2	0.8
	2	24	2.10	0.08	42.6	2.3	27.8	1.2	22.8	0.29	70.8	1.0
	3	10	2.18	0.12	43.1	3.7	26.8	2.0	23.0	0.46	70.1	1.7
Significance (P<0.05)			-		CxS ^B		S		C		C	

^A Mean number of ewes/cell. ^B When interaction significant, main effects are not identified separately.

Table 2. Effect of number of offspring conceived and reared on clean fleece weight (CFW), staple strength (SS), point of break (POB), fibre diameter (FD) and staple length (SL) in reproducing ewes

Lambs N ^A reared		CFW (kg)		SS (N/ktex)		POB (% from tip)		FD (µm)		SL (mm)		Yield (%)	
		mean	s.e.m.	mean	s.e.m.	mean	s.e.m.	mean	s.e.m.	mean	s.e.m.	mean	s.e.m.
0	8	2.81 ^a	0.15	46.8 ^a	4.3	20.8 ^a	2.3	22.4 ^a	0.5	75.3 ^a	1.9	78.7 ^a	1.6
1	82	2.17 ^b	0.05	39.1 ^a	1.3	29.0 ^b	0.7	22.3 ^a	0.2	69.2 ^b	0.6	73.9 ^b	0.5
2	53	2.05 ^b	0.06	33.1 ^b	1.6	30.1 ^b	0.9	22.2 ^a	0.2	68.0 ^b	0.7	74.2 ^b	0.6

^A Mean number of ewes/cell. Within columns, numbers with different superscripts are significantly different (P < 0.05).

Table 3. Effect of birth status, sex and cycle of birth on birth (BW) and weaning (WW) weights and growth rates to weaning (GR)

Birth status (BS)	Sex (S)	Cycle (C)	N ^A	BW (kg)		WW (kg)		GR (g/day)	
				mean	s.e.m.	mean	s.e.m.	mean	s.e.m.
Single	Male	1	22	6.13	0.20	33.6	0.74	244	7
		2	15	6.71	0.24	29.9	0.90	242	8
		3	5	6.76	0.42	31	1.55	293	14
	Female	1	25	5.56	0.19	31.5	0.69	230	6
		2	22	6.22	0.20	29.9	0.74	239	7
		3	8	6.35	0.33	26.4	1.23	248	11
Twin	Male	1	53	5.28	0.13	28.8	0.48	208	4
		2	11	5.64	0.28	28.0	1.05	234	9
		3	6	5.6	0.38	20.9	1.41	195	13
	Female	1	38	4.75	0.15	27.6	0.56	201	5
		2	15	4.92	0.24	24.7	0.90	203	8
		3	8	5.25	0.33	21.2	1.23	198	11
Significance (P < 0.05)				BS, S, C		BSxSxC ^B		BSxSxC	

^A Number of lambs/cell. ^B When interaction significant, main effects are not identified separately.

The cycle in which the ewes gave birth also influenced wool characteristics. The ewes lambing in the second and third cycles had higher staple strength, fibre diameter and staple length. Increases in staple strength have been shown when ewes lambing in late winter or spring are compared with ewes lambing in autumn (Foot and Vizard 1993), however, the current experiment shows that even a delay of two to four weeks may significantly improve staple strength. This observation was probably the result of increased pasture availability later in the lambing period. The higher average fibre diameter in the later lambing ewes is not consistent with previous observations. For example, Foot and Vizard (1993) reported slightly lower fibre diameters in later lambing ewes.

Ewes that produced and reared one or two lambs produced less wool with shorter staple length and lower clean wool yield than ewes producing no lambs. There were no differences in these characteristics between the groups producing one or two lambs, however, the ewes producing and rearing twins grew wool with a significantly lower staple strength than ewes producing either one or no lambs. Production of sound wool from ewes rearing twins may therefore require additional or different feeding strategies, particularly if lambing is in autumn.

Later born, male and single born lambs were all heavier at birth than lambs born in the first cycle, females or twins respectively. The higher birth weights of the males and single born lambs were maintained through to weaning. However, because of the longer period between birth and weaning the early born lambs were significantly heavier than later born lambs at weaning. At the extremes, the twin lambs born in the third cycle were approximately 12 kg lighter than the single lambs born in the first cycle. For this class of sheep, the lower weaning weights of 21 kg are well below the desirable weights to ensure survival through summer and these weaners would require special management during the rest of spring and summer. Many producers are now lambing later than early winter and the results from this experiment indicate weaning weights are likely to be low. Additional standing feed or supplementary feed would be needed for the production of lambs for sale or their retention as flock replacements.

The type of supplement fed to the ewes had no effect on lamb birth weights or growth but feeding the canola meal pellet was associated with increased lamb mortality. Masters and Mata (1996) reported that feeding canola meal to ewes resulted in depression in lamb birth weight and early growth and suggested this may have been caused by the residual glucosinolates in the meal. The metabolic products of glucosinolates inhibit the use of iodine by the thyroid gland. This would reduce the ability of the lamb to withstand cold stress and could account for the increased mortality observed. This observation requires confirmation as the groups lambed in separate paddocks and, although there were no obvious differences in feed supply or shelter between the paddocks, differences in lamb mortality may be a result of paddock factors.

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