LIVEWEIGHT CHANGES DURING SPRING IN RELATION TO FEED ON OFFER, AND EFFECTS ON WOOL PRODUCTION OF ADULT MERINO WETHERS

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SUMMARY

The effects of 5 stocking rates (8, 16, 24, 32 and 40 sheep/ha) during spring (August to December) were related to liveweight changes, clean fleece weight and mean fibre diameter of the fleece for adult Merino wethers. Each stocking rate was replicated 3 times in a randomised block design. Stocking rates were used to generate different amounts of green feed on offer to the sheep.

Sheep which maintained their liveweight between August and December produced fleeces which weighed less (about 0.73 kg clean) and were about 1.9 microns finer than for sheep which gained liveweight at about 75 g/day. Sheep from the highest stocking rate entered summer at lower liveweight (70 v. 76 kg) and condition (score 3 v. 4) compared with those of sheep grazed at lower stocking rates which are closer to current management practices. There was considerable variation in the relationships between feed on offer and liveweight change at different times during spring indicating the difficulties in predicting liveweight change from feed on offer over periods when pasture quantity and quality are different. The potential uses of grazing pressure during spring to produce finer wool are discussed.

Keywords: sheep, grazing management, feed on offer, pasture quality, fibre diameter.

INTRODUCTION

Higher prices paid for Merino fleece wools as mean fibre diameter (FD) decreases have led to an interest among wool growers in reducing the FD of their wool clip. This can be achieved by breeding or by managing the nutrient intake of the sheep. For example, the rate of wool growth (WGR) and FD can be reduced by feeding lower levels of supplements in the summer-autumn, but the effects on mean FD of the fleece are small because WGR's are low at this time of the year (Rowe *et al.* 1989). Furthermore, under-feeding at this time can have detrimental effects on the staple strength (Thompson and Curtis 1990). Under continuous grazing, it is well recognised that mean FD can be reduced by increasing stocking rate (SR) (Curtis *et al.* 1989). However, increased SR under continuous grazing also results in increased variation in FD along the staple, and may reduce the staple strength.

High pasture growth rates in spring increase the availability of feed to levels where sheep liveweight increases, WGRs are high and FD increases (Purser and Southey 1984). These workers found that in the medium to high rainfall areas of W.A., 50% or more of the fleece may be grown in the 4 months of August to December . Our experiment examined the effects of nutritional management during spring on characteristics of the fleece. We tested the hypothesis that managing grazing sheep to maintain liveweight during spring could significantly reduce mean FD of the fleece.

MATERIALS AND METHODS

The experiment was conducted at Mount Barker Research Station (latitude 38°38'S., longitude 117°32'E.) during 1989. The climate is characteristically Mediterranean with an average annual rainfall of 700 mm and a growing season from May to November. Total rainfall in 1989 was 676 mm. Sheep were continuously stocked during spring at rates of 8, 16, 24, 32 and 40 sheep/ha. The average SR for this district is around 9 sheep/ha. Different SR's were used to generate different amounts of green feed on offer (GFO), and each treatment was replicated 3 times in a randomised block design. All plots were 1 ha.

Pastures

The experimental site had been a subterranean clover-annual ryegrass pasture for 10 years. The botanical composition of the pasture in July was 53% clover, 35% grasses and 12% broad-leaf plants, mainly capeweed. Plots were grazed by non-experimental sheep in winter. Treatment sheep were introduced to the plots on July 10 and treatments started on August 8 when GFO (± s.e.) was 1500 ± 40 kg dry matter (DM)/ha and finished on 8 December when GFO had declined to about 1000 kg DM/ha on some plots. GFO was assessed weekly by visual estimation (30 quadrats per plot x 3 observers) calibrated against 15 quadrat cuts. Quadrats were harvested by cutting at ground level using a scalpel. This harvesting method was adopted on the assumption that sheep have the ability to prehend any pasture material above ground. Pasture samples were washed in water to remove soil, dried at 70°C for 3 days and weighed to determine dry weights.

GFO data for 2 phases (phase 1, 8 August to 2 November; phase 2, 2 November to 8 December) are presented. The end of phase 1 coincided with peak GFO for a SR of 8 sheep/ha when most grasses had set seed and subterranean clover had passed peak flowering. The average GFO within each phase has been calculated as the average of the weekly GFO estimates.

Sheep

One hundred and twenty Merino wethers (5 years of age), were selected from flocks and stratified on the basis of liveweight (LW) for allocation to plots ($n = 8$). Extra sheep, which were not monitored, were used to achieve the desired SRs. All sheep were grazed in common prior to July 10 and after the experiment. They were drenched prior to entering the plots and faecal grab samples taken every 4-6 weeks during the grazing period indicated low levels of internal parasites. The LW and condition score (CS) were recorded every 3 weeks during the experimental period. LW change (LWC) was estimated by regression analysis. LW, CS and LWC were examined for the 2 pasture phases described above. Mid-side fleece samples were taken 1 week prior to the annual shearing in March to determine yield and mean FD. Greasy wool weights were recorded at shearing; this included locks and skirtings, but not bellies and crutchings.

Statistics

Treatment means for GFO, LW and CS at each recording date were compared by analysis of variance using plot means. Relationships between average GFO, and LWC, CFW or mean FD of the fleece were examined by regression analysis.

RESULTS

Effects of stocking rate on feed on offer

There were no differences in GFO between treatments at the commencement of grazing (Table 1). Average GFO during both pasture phases declined linearly ($P < 0.05$) with increasing SR. There were differences ($P < 0.05$) in the average GFO during both phases. GFO tended to increase during phase 1 and decrease during phase 2, although these changes in GFO were similar for SRs greater than 24 sheep/ha.

Table 1. Initial, average and final feed on offer (GFO, kg dry matter/ha) under different stocking rates from 8 August to 2 November (Phase 1) and from 2 November to 8 December (Phase 2) during 1989

Feed on offer	Spring stocking rate (sheep/ha)					s.e.d.
	8	16	24	32	40	
			Phase 1			
Initial	1580	1470	1450	1450	1520	61
Average	3750	2870	1980	1670	1680	242
			Phase 2			
Initial	7650	5740	3200	2140	2060	608
Average	7140	5360	3210	2230	1940	488
Final	4490	2950	2000	1530	1370	483
			Overall			
Average	4660	3540	2320	1830	1740	307

Effects of feed on offer on changes in sheep liveweight and condition score

There were no differences in LW, uncorrected for wool, and CS between treatments at the commencement of grazing, except that sheep stocked at 24/ha were lighter ($P < 0.05$) than sheep stocked at 8/ha, and in a lower ($P < 0.05$) condition score than sheep stocked at 8, 16 and 32/ha (Table 2). These differences were generated between 10 July and when the experiment commenced on 8 August.

During phase 1 there was a linear decline ($P < 0.05$) in LWC with increasing SR (Table 2), and LWC was positively ($P < 0.05$) related to GFO. During phase 2, the situation was reversed and

Table 2. Liveweight (LW, kg), condition score (CS) and liveweight change (LWC, g/day) for adult Merino wethers grazed at different stocking rates from 8 August to 2 November (Phase 1), and from 2 November to 8 December (Phase 2) during 1989

	Spring stocking rate (sheep/ha)					s.e.d
	8	16	24	32	40	
			Phase 1			
Initial LW	67.2	66.5	65.2	66.1	66.7	0.83
Initial CS	4.2	4.3	3.8	4.2	4.1	0.17
LWC	77	60	21	3	–69	44.5
			Phase 2			
Initial LW	72.9	70.7	66.6	66.4	63.9	2.97
Initial CS	4.6	4.6	3.3	3.6	3.4	0.54
LWC	76	123	151	147	161	27.4
			Overall			
LWC	73	73	69	51	29	20.0
Final LW	75.8	75.4	72.3	72.0	70.1	2.54
Final CS	4.4	4.3	3.8	3.8	3.3	0.48

greater *(P* < 0.05) gains in LW were recorded at higher SR treatments, and the LW response was negatively *(P* < 0.05) related to GFO. However, over the whole grazing period, gains in LW were greater *(P* < 0.05) at low SRs, and there was a positive *(P* < 0.05) quadratic relationship between LWC and GFO. At the conclusion of grazing LW and CS declined linearly *(P* < 0.05) with increasing SR.

Effects of liveweight change on clean fleece weight and mean fibre diameter

There were positive *(P* < 0.01) linear relationships between LWC over the whole grazing period and CFW or mean FD of the fleece (Table 3). CFW and mean FD for sheep that maintained LW between 8 August and 8 December were calculated to be about 0.73 kg and 1.9 microns less than for sheep which gained about 75 g/day.

Table 3. Linear relationships between liveweight change (g/day) during the experimental period and the clean fleece weight (kg) (for 11 months, April-March), or the mean fibre diameter (micron) of the fleece (*n* = 15)

	Intercept ± s.e.	Slope ± s.e.	r^2	Signif. of regression
Clean fleece weight	3.90 ± 0.170	0.00976 ± 0.00265	0.47	***
Mean fibre diameter	22.2 ± 0.476	0.026 ± 0.007	0.45	***

*** *P* < 0.01

DISCUSSION

During spring, different SRs under continuous grazing were used to generate a range of GFO available to sheep and in the LWC of the animals. The results support the hypothesis that grazing sheep to maintain LW during spring can significantly reduce the mean FD of the fleece. The extent to which mean FD is reduced will depend on the period of LW maintenance. The grazing treatments in this experiment lasted for 122 days in a relatively long growing season environment.

The change from phase 1 to phase 2 corresponded with seed production in the grasses, and the passing of peak flowering in subterranean clover. Total DM/ha declined from this point onwards for all SRs, and especially in plots grazed at low SRs where GFO was greatest. This is consistent with the results of Willoughby (1959). Digestibility also falls from flowering and as pastures mature (Radcliffe and Cochrane 1970). It is believed that declines in pasture quality contributed to the variation between phases 1 and 2 in the relationship between GFO and LWC, and indicate the difficulties in predicting LWC in adult sheep from GFO alone at different times during spring.

Pastures at low SRs matured about 1 month earlier that those at higher SRs. Collins and Aitken (1970) have shown that flowering in undefoliated pastures occurred 30 days earlier than in pastures under a severe defoliation regime. Continued gains in LW during phase 2 at low SRs may therefore have been due to increases in gut fill, since the amount of digesta in the rumen increases for forages of lower digestibility (Weston 1989). This suggestion is supported by the fact that sheep at low SRs were on average in condition score 4.6 at the beginning of phase 2, and presumably their demands for energy were low and their drive to consume feed of declining quality was depressed. The gains in LW at high SRs may also have been due to an increase in gut fill, although this was unlikely to account for all of the 5 to 6 kg increase in LW. High SR delayed maturation of the pastures and they responded more to rains in November, when they grew at about 100 kg DM/ha day (A. N. Thompson, unpublished data). Brown (1977) reported that pasture growth rates between October and the end of the season for annual pastures stocked at 17.5 sheep/ha were more than twice that for pastures stocked at 7.5 sheep/ha (75 v. 32 kg DM/ha.day). Thus, the increase in LW during phase 2 for sheep at high SRs may also have been due to increased intake of green pasture.

When adopting intensive grazing in spring, producers need to make decisions about how to manage ungrazed areas. A number of options exist including leaving the ungrazed pasture as dry standing feed, mechanically topping the pasture and windrowing, conserving excess feed as silage or hay, or chemically treating the pasture. All of these options have implications for the production and composition of pastures in subsequent years, and what is best in one situation may not be in others. In today's market, intensive grazing in spring is most profitable for sheep flocks which produce wool of less than 22 microns, and that are in environments with long periods of excess green feed. The changes in wool production need to be balanced against the effects of sheep going into summer-autumn at lower LW and condition. They will need to be monitored closely, and are likely to require supplements earlier than those which are grazed at more conservative SRs.

It is concluded that there is a need to more clearly define pasture conditions that are required to achieve predetermined levels of animal performance at different times in the pasture growing season for different classes of stock. Pasture quality obviously has an important effect on the relationship between GFO and LWC which indicates that using GFO as a management aid to achieve predetermined levels of animal performance may be of limited use from flowering onwards.

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