SHORT TERM, HIGH DENSITY GRAZING OF A SALTBUSH PLANTATION REDUCED WOOL STAPLE STRENGTH IN MERINO WETHERS

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SUMMARY

Wool staple strength and liveweight change were measured in Merino wethers grazed at 15, 20, 25 and 30 sheep/ha on a mixed species plantation of saltbush for 28 to 42 days in autumn 1992. These sheep grazed communally on other pastures for the remainder of the period between annual shearings. The carrying capacity of the saltbush plantation was about 700 sheep grazing days/ha with average daily intake of dry matter estimated at 0.9 kg/day. During the period on saltbush, liveweight was maintained until most of the edible plant material had been consumed. Tensile strength of wool staples from sheep stocked at 25 and 30 sheep/ha were weaker, 17.2 and 24.9 N/ktex, compared with staples from sheep stocked at lower rates, 27.1 N/ktex, or from sheep grazing a wheat stubble, 30.0 N/ktex ($P < 0.05$). Reducing stocking rate, together with removal of sheep before all leaf material is eaten, will improve staple strength.

Keywords: wool strength, saltbush, stocking rate.

INTRODUCTION

Over 440,000 ha of once arable land in Western Australia is now salt-affected (George 1990). Revegetating this land with perennial, salt tolerant forage species to provide a grazing resource for sheep may be a profitable option (Bathgate *et al. 1992).* This could be achieved by either controlling grazing and allowing natural revegetation or, on potentially productive sites, sowing a mixed species stand of saltbush (Barrett-Lennard *et al.* 1991). Grazing the saltbush in late autumn and early winter, when paddock feed is in shortest supply, may allow for an increased, year-round, carrying capacity of the whole farm with less grain supplementation (Barrett-Lennard *et al. 1992).* It is hypothesised that the maximum economic benefit from revegetating salt land will come from strategic grazing of the saltbush at high stocking rates for a limited period of time in autumn. However, this strategy entails considerable fluctuation in nutrient intake by grazing sheep with potential detrimental effects on strength of wool fibre grown throughout the whole year.

MATERIALS AND METHODS

Plant material

Water logged, salt-affected land 250 km north-east of Perth (30°23'S, 116°45'E), on which salt tolerant forage shrubs were sown in 1987, was selected and the most dense, uniformly vegetated areas fenced into 12 plots in autumn 1990. The species of salt-tolerant shrubs present in these plots were *Atriplex amnicola* (River Saltbush), *Maireana brevifolia* (Small-leafed Bluebush), *A. undulata* (Wavy-leaf Saltbush) and *A. Zentiformis* (Quailbrush). Annual grasses were removed from the saltbush plots in September of 1991 by burning.

The visual estimation method of Andrew *et al.* (1979), using standard portions of bushes of the different species, was used to measure available dry matter (DM) for every bush on 2 x 5 m transects in each plot on 5 and 6 March 1992. Visual scores were converted to kg DM/ha by cutting standard portions from the different species, separating into leaf and stem, drying and weighing. Representative, dried samples of saltbush collected from this site prior to grazing in April 1990 and 1991 were analysed by standard techniques for *in vitro* digestibility (IVD), nitrogen (N), mineral and oxalate concentrations. As there was little difference between the 2 previous years results nutritional quality was not assessed in autumn 1992, and results for the 1991 analyses only are presented.

The harvested residue of a wheat crop grown on adjacent, non-saline land was fenced into 3 plots of 0.7 ha and 3 plots of 1.4 ha. The quantity of stubble and summer germinated plants (weeds, grasses, medics and sub-clovers) present in these plots was assessed at the commencement of grazing by cutting 10 x 0.25 m^2 quadrats in each plot, drying and weighing.

Experimental animals

Eighty four, 3-year old Merino wethers, were weighed and allocated to 12 groups of 7 from liveweight strata. Dye-bands were placed in the wool and each group of sheep then allocated at random to 1 of the

12 saltbush paddocks. The paddocks were either 0.47, 0.35, 0.28 or 0.23 ha in area giving 4 stocking rates, 15, 20, 25 and 30 sheep/ha, each replicated 3 times. Grazing commenced 12 March 1992. Twenty four wethers, prepared in the same way, were grazed in groups of 4 on 6 wheat stubble plots at either 2.85 or 5.7 sheep/ha (stocking rates consistent with district practice) for 42 days from 12 March.

The sheep were weighed at weekly intervals until each treatment was removed from the saltbush because either no feed remained in 1 of the plots in that treatment or 1 of the groups of sheep within the treatment had lost an average of 15% of peak liveweight. Following removal from the plots, wool was again dye-banded and the sheep were then grazed communally on clover-based pasture until the annual shearing in October. Prior to shearing, the banded wool was removed and the length of wool between the bands measured. At shearing fleeces were weighed and mid-side samples of wool were collected for measurement of yield, fibre diameter, staple length and strength and the position of greatest weakness in the staple.

RESULTS

Sheep grazing the saltbush had access to 650 ± 230 kg DM/ha (mean ± sd) of saltbush, of which about half was leaf and half stem. The percentage that each species contributed to the total DM was *A. undulata* 46%, *A. Zentiformis* 34%, *M. brevifoli,* 12% and *A. amnicola,* 8%. A composite sample of leaf had an IVD of 66.6% and a N content of 1.33%, while stem had 37.2% IVD and 0.66% N. About 20% of leaf and 4% of stem was ash giving IVD for organic matter of leaf and stem of about 83% and 39% respectively. Leaf DM was 6% sodium (Na) and stem DM 0.4% Na. Bluebush leaf contained less than half the sodium chloride of the other species. Oxalate concentration in bluebush was 3.3% DM and in the other saltbush species, 1% or less. At the commencement of grazing the plant material on the harvested wheat crop comprised 820 kg DM/ha crop residue and 950 kg DM/ha summer germinated plants. Little summer germinated plant material was observed in the saltbush plots.

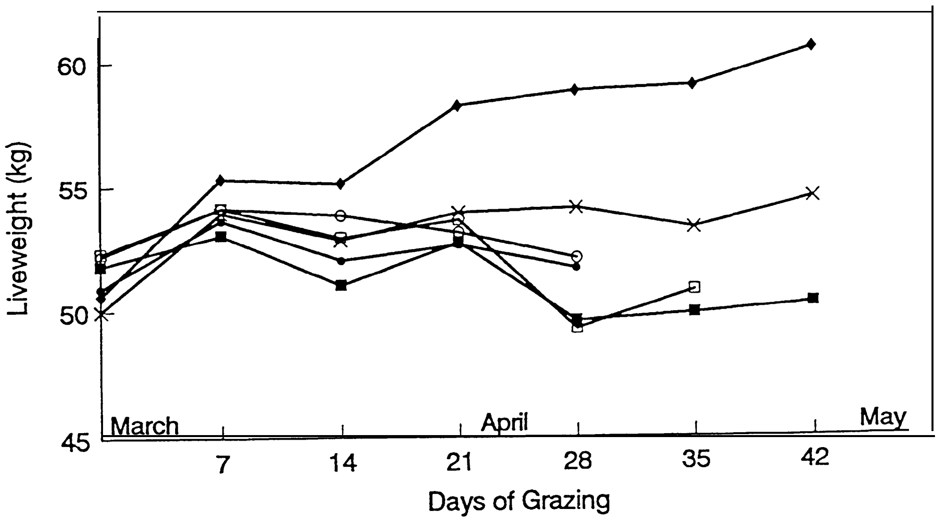

Figure 1. Change in liveweight of wethers grazing saltbush at stocking rates of 15 (closed squares), 20 (open squares), 25 (open circles) or 30 (closed circles) sheep/ha or wheat stubble at 2.85 (closed diamonds) and 5.7 (crosses) sheep/ha

The change in liveweight of the wethers grazing saltbush and wheat stubble at different stocking rates is presented in Figure 1. The sheep grazing saltbush at 25 and 30 sheep/ha were removed to pasture 28 days after the start of saltbush grazing. At this time mean liveweights were similar to that at the commencement of grazing, however, condition score had declined and there was little or no feed left in the plots. The sheep grazing saltbush at 15 and 20 sheep/ha had lost some weight after 28 days of grazing, however, because edible material remained, grazing was continued for another 7 to 14 days. At the termination of grazing, these sheep were about 1.5 kg below average starting weight.

Annual clean fleece weight, fibre diameter, staple length and strength and position of greatest weakness along the staple from sheep grazed on either saltbush or wheat stubble are presented in Table 1. The average daily increase in length of staple during the period sheep were on saltbush or stubble is also presented in this table. There were no differences in washing yield (mean 76.2%, 5% lsd 2.5%), fibre diameter (21.5 μm, 5% lsd 1.0 μm) or clean fleece weight ($P > 0.05$) between treatment groups, probably because production during the experiment contributed to only a small part of the total, annual production. The tensile strength of wool from sheep grazing saltbush at 25 and 30 sheep/ha (Table 1) was less compared with wool from sheep grazing at 15 and 20 sheep/ha and, in turn, this was less than the strength of staples from sheep grazed on the wheat stubble ($P < 0.05$). The weakest point in the staple in wool from sheep grazed on wheat stubble occurred after the trial was terminated, while the weakest point in staples from sheep grazed on the saltbush occurred during the trial period.

Table 1. Measurements of wool quality and production from wethers grazing saltbush or wheat stubble at different stocking rates

Stocking rate (sheep/ha)	Growth of staple during trial period (mm/day)	Clean fleece weight (kg)	Fibre diameter (μm)	Staple length (mm)	Staple strength (N/ktex)	POB (% staple from tip)
Saltbush						
15	0.255^{a}	4.37	20.9	92.0^{ab}	27.1^{bc}	47^{bc}
20	0.263^{ab}	4.21	21.7	88.6^{a}	27.1^{bc}	44^{b}
25	0.300^{c}	4.33	21.4	95.2^{b}	24.9^{b}	45^{b}
30	0.295^{bc}	4.46	21.3	94.0^{b}	17.2^{a}	51^{c}
Stubble						
2.9	0.333^{cd}	4.62	22.3	95.7^{b}	31.6^{d}	32^{a}
5.7	0.367^{d}	4.55	21.6	95.6^{b}	30.0^{cd}	33^{a}
lsd ($P < 0.05$)	0.034	n.s.	n.s.	5.14	3.84	5

Means within a column followed by different superscripts differ, $P < 0.05$.

DISCUSSION

Grazing saltbush in autumn extended the period of liveweight maintenance at a critical time of the year when paddock feed may be in short supply. In our studies, with 650 kg DM/ha of saltbush stocked at 15 to 30 sheep/ha, this period was between 28 to 42 days. Grazing at these relatively high stocking rates and only removing the sheep when little edible material remained on the plots resulted in a reduction in wool staple strength, particularly in those sheep grazing at the higher densities. As this weaker staple resulted primarily from feed deprivation, it may have been avoided by a more conservative approach to grazing in which sheep were removed while edible material still remained. However, reducing the stocking density will extend the period of saltbush grazing until it overlaps with periods of adequate paddock feed. This will reduce the economic value of the saltbush as a substitute for grain, and may reduce wool growth relative to that in animals grazing alternative pasture. In our study, unseasonable rain provided the sheep on wheat stubble with a diet of higher nutritive value than would normally be available at this time of year. This was not the case in the saltbush plots, probably because of the highly saline nature of the surface soils at this time of year and the high grazing pressure in these plots.

The number of sheep grazing days per ha supported by the saltbush plantation, when examined across all stocking rates, was about 700. We estimate, from the approximate amount of saltbush consumed, that mean intake was about 0.9 kg DM/day. This provided, initially, for liveweight maintenance suggesting saltbush leaf would have an equivalent ME value to wheaten hay (Oddy 1978). The use of energy from saltbush by grazing animals is low compared to non-halophyte species because of the high mineral, generally sodium and potassium chloride, content (Arieli *et* al. 1989). The concentrations of oxalate, especially in the *Atriplex* spp., were well below that which cause clinical signs of toxicity in sheep (Blood *et al.* 1979).

Saltbush leaf does not deteriorate nutritionally from one year to the next although ungrazed shrubs may become woody and develop a lower leaf : stem ratio. Because of this, cutting which increases leaf production, provides a higher quality, more palatable browse feed (Le Houerou 1986). However, it would significantly increase costs. To maximise economic benefit from saltbush plantations, grazing could be restricted to only those periods when there is a shortage of alternative, less costly paddock feed ie. as a "drought reserve" replacing costly grain supplements. The annual grasses which grow on the well drained and less saline areas in late winter and spring, such as barley grass, may contribute substantially to the total plant material in a saltbush stand. However, by next autumn this is of low nutritive value (Purser 1981). In our study this had been removed by burning in late spring.

Sheep grazed on saltbush for short periods in autumn at high stocking densities, compared with sheep grazing at lower density or on stubbles with a green "pick", had lower strength in wool staples produced throughout the year. While such a grazing strategy does not damage the shrubs and provides a substitute for expensive grain supplements, it reduces the value of the annual wool production from these animals and the economic return from planting saltbush. Stocking at 20 sheep/ha or less and removing the sheep from the plantation before all the leaf material is eaten should avoid this.

ACKNOWLEDGMENTS

We acknowledge the contributions from Mr M. Mills, of Pithara, who provided land and facilities, and Mr J. Ferguson, Manager Research Station, Wongan Hills who provided livestock and facilities. This work was funded by the Wool Research and Development Corporation.

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