GRAZING SHEEP ON REVEGETATED SALINE PASTURES: EFFECTS OF SEASON AND GRAZING ON MORPHOLOGY AND NUTRITIVE VALUE OF SALTBUSH

Atiq-ur-Rehman[1], J.B. Mackintosh[2], B.E. Warren[3] and D.R. Lindsay[2]
[1]Arid Zone Research Institute, Pakistan Agricultural Research Council, P.O. 63, Quetta, Pakistan
[2]Faculty of Agriculture (Animal Science Group), The University of Western Australia, WA 6907
[3]Sheep Industries Branch, Dept of Agriculture, 120 Albany Hwy, Albany, Western Australia 6330

ABSTRACT

This experiment was designed to determine the thickness of saltbush (*Atriplex amnicola*) stem grazed by sheep, grazing pressure on saltbush in the presence of understorey and the effect of season on the nutritive value of saltbush. Four 0.9 ha plots of *Atriplex amnicola* were grazed by a group of 10 Merino wethers each. The results indicated that the maximum diameter of stem selected by sheep under extreme conditions was only 1.5 mm. The number of stems chewed per 0.1m^2 quadrat were 0.8, 9.6, 20.1 and 18.0 ($P<0.05$) after 2, 4, 6 and 8 wk. From January to June the nitrogen content (14 to 30 gkg^{-1}) and DMD (0.65 to 0.72) of saltbush leaves remained high. These results suggest that in the presence of understorey the grazing pressure on saltbush was least and increases when the feed from understorey was exhausted. The nutritional value of saltbush did not deteriorate severely during the summer and autumn period.

KEY WORDS

Atriplex amnicola (saltbush), sheep, grazing pressure, grazing pattern

INTRODUCTION

In revegetation programs of saline soils of Western Australia, saltbush (*Atriplex amnicola*) is regarded as valuable because of its high crude protein (12 -18%) during summer and autumn and tolerance to both drought and salinity (Malcolm and Swaan, 1989). Different assumptions were made regarding the diameter of saltbush stem considered ingestible by sheep and varied from 5 mm to 10 mm (Warren *et al*. 1990; Pol, 1980). The coarse stem component was included when calculating the grazable biomass available from saltbush pastures and variable estimates up to 15000 kg DMha^{-1}year^{-1} have been reported (Miyamoto *et al*., 1994; Le Houerou, 1986). The results of agronomic and animal production studies carried out on the basis of these assumptions has led to debate on the suitability of saltbush as an animal feed. It was imperative that the thickness of saltbush stem grazed by sheep be tested under field conditions. The hypothesis tested in this study was that sheep while grazing saltbush pastures select very fine material from the plants, which can be a good source of feed during dry summer/autumn periods.

MATERIALS AND METHODS

The study was conducted at Great Southern Agricultural Research Institute, Katanning, Western Australia. Four plots of 0.9 ha with 700 plants of *Atriplex amnicola* in each plot and inter-row vegetation of dead barley grass (*Hordeum geniculatum*) were used in the study. Shrubs in each plot were visually scored from 1 to 5 on the basis of leafiness to define the variation between shrubs. Shrubs with score 1 had the least and with score 5 the largest amount of leaf. The seasonal change in leaf:stem ratio and chemical composition were determined by placing a fence around three randomly chosen shrubs of each score in each plot from 13 January to 1 June, 1994 to exclude grazing. The samples from each shrub consisted of at least eight pieces of fine stem harvested 10 cm back from the tip fortnightly. The pooled samples of three shrubs for each score within a plot were divided into two portions. One portion was further fractioned into leaf and stem and the remainder was retained as whole plant.

Ten Merino wethers were grazed from 12 April to 18 May, 1994 on each plot at a stocking rate of about 11 ha^{-1}. The selectivity of sheep grazing *A. amnicola* was determined by harvesting at least four branches of four shrubs of each score at random. The pooled samples for each score within a plot were divided as for fenced shrub samples. All samples were freeze dried prior to further analysis. The samples were analysed for nitrogen and in vitro dry matter digestibility (DMD).

The consumption pattern of the saltbush by sheep was estimated at fortnightly intervals commencing from 20 April, by counting the number of chewed/eaten stems within two 0.1 m^2 windows on the surface of three randomly chosen shrubs of each score in each plot. The tip diameter of all stems in each window that had been eaten was measured with sliding vernier callipers.

RESULTS AND DISCUSSION

There was no difference in sheep selectivity, consumption pattern during grazing, leaf:stem ratio, nitrogen or DMD between saltbush with different scores. Results presented in Table 1 and 2 are therefore, from the pooled data of different scores.

The results of this study suggest that sheep grazing saltbush select predominantly leaf material and very fine stem. For the first week of grazing, sheep ate saltbush sparingly and refused saltbush stem with a thickness of more than 0.14 mm (Table 1). However, as grazing proceeded, the grazing pressure on the saltbush plants also increased from 0.8 to 18 stems chewed/0.1 m^2 leading to consumption of thicker stems (Table 1). Under extreme conditions the diameter of the stem consumed reached its maximum mean thickness of 1.5 mm. At this time, only a few individual measurements of refused stem exceeded 2 mm. This suggests that grazing of stems thicker than 1.5 mm by sheep cannot be regarded as voluntary. The selection of very fine stem by sheep from shrubs was also reported by du Toit (1993). He reported that the diameter for the non-grazable fraction of stem by sheep for *Pentzia spinescens* at different stocking rates was 1.14 mm for the lowest and 1.68 mm for the highest stocking rate. These results illustrate that sheep can be very selective in the material they browse from forage bushes and that the stem selected from saltbush plants is much finer than generally assumed in previous studies.

The findings that sheep grazing saltbush select very fine stem material also suggests that the grazable fraction from saltbush plantations is much lower than generally reported. The edible biomass production can vary considerably, depending upon the ecological conditions and management of the shrubs, but the yields up to 15000 kg DMha^{-1}year^{-1} could be misleading for saltbush plantations when the stem diameters used in the calculations are not reported. The weight of pure leaf was only 760 g in 1900 kg DMha^{-1} biomass of A. amnicola when it constituted leaf and less than 5 mm thick stem (Stephen Vlahos, Pers. comm., 1994). Therefore, stocking rates calculated on the basis of biomass estimates containing stem up to 10 mm thick are probably excessive. The leaf:stem ratio of the grazed plants in this study also support this premise. When sheep were grazed at a stocking rate of 11/ha, the leaf:stem ratio of the plants dropped from 1.4 on 20th April to 0.2 on 18th May, while the leaf:stem ratio in ungrazed plants remained at about 2.0. After 5 wk of grazing the edible material had been largely removed and then sheep rapidly lost live weight. In this instance it can be calculated that the edible material (from understorey and saltbush) consumed during 5 wk while the animals maintained body weight was about 280 - 385 kg DM/ha, assuming an intake of 0.8 to 1.1 kg DM/day or about 350 sheep grazing days/ ha.

The DMD of whole plant residue from grazed bushes on 1 June after 6 wk of grazing was only 0.25 compared to 0.52 for ungrazed samples. The DMD of grazed whole plant samples was lower than the DMD of saltbush stem alone (0.29; Table 2). The grazing pattern indicated by the DMD is supported by the low concentration of nitrogen in whole plant residues from grazed bushes. The nitrogen concentration of the whole plant residues was similar to the nitrogen concentration of stem samples (6 gkg^{-1}; P>0.05). These results emphasise the importance of limited nutrients available to the sheep grazing saltbush stem.

In conclusion, it is evident that grazing sheep prefer to select only leaf and very fine stem material (up to 1.5 mm) from saltbush. The edible biomass available from saltbush can be far less than generally assumed and I caution the interpretation of the results of animal production studies in which stem 5 to 10 mm thick is assumed to be edible. It is also clear that the nutritional value of saltbush material itself did not deteriorate during the dry summer/autumn period, the nitrogen content (14 - 30 gkg^{-1}) and the DMD (0.65 - 0.72) remained high during this period. Therefore, saltbush may have a useful place in Mediterranean environments and maximum benefits can be achieved by strategic grazing of these shrubs, when there is shortage of alternatives and it can partially replace costly grain supplements.

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Table 1
Grazing pressure, expressed as number of stems chewed/0.1m^2 quadrat and the thickness of saltbush stem selected by sheep during grazing

	20 Apr	3 May	18 May	1 June	SED
Av. diameter of stem refused (mm)	0.14^{a}	1.26^{b}	1.41^{c}	1.49^{c}	0.056
No. of stems chewed/0.1 m^2 quadrate	0.77^{a}	9.64^{b}	20.14^{c}	18.03^{c}	0.966

- values with different superscripts are significantly different (P<0.05)

Table 2
Effect of season and grazing on the co-efficient of dry matter digestibility (DMD), nitrogen contents (g/kg) and leaf:stem ratio of saltbush samples

	13 Jan	23 Feb	23 Mar	20 Apr	3 May	18 May	1 June
DMD							
Leaf	0.70^{acd}	0.68^{a}	0.65^{b}	0.69^{acd}	0.72^{cd}	0.72^{cd}	0.70^{d}
Stem	0.38^{a}	0.39^{a}	0.35^{ab}	0.36^{ab}	0.34^{ab}	0.31^{bc}	0.29^{c}
Whole plant	0.66^{a}	0.66^{a}	0.55^{bc}	0.57^{b}	0.58^{b}	0.59^{b}	0.52^{c}
Whole plant (grazed)	-	-	0.53^{a}	0.44^{b}	0.29^{c}	0.25^{c}	
Nitrogen							
Leaf	14^{a}	15^{a}	16^{ab}	17^{b}	16^{ab}	20^{c}	30^{d}
Stem	7^{acd}	7^{acd}	6^{bcf}	7^{cdf}	7^{d}	8^{e}	6^{f}
Whole plant	10^{ac}	13^{bde}	11^{cd}	13^{de}	12^{de}	14^{e}	18^{f}
Whole plant (grazed)	-	-	11^{a}	7^{b}	5^{c}	8^{d}	
Leaf:stem ratio							
Ungrazed	2.06^{ae}	2.00^{abde}	1.67^{bcdef}	1.62^{cdef}	1.65^{def}	1.88^{e}	1.36^{f}
Grazed	-	-	-	1.37^{a}	0.66^{b}	0.15^{c}	0.12^{c}

- values with different superscripts are significantly different (P<0.05)