Proc. Aust. Soc. Anim. Prod. 1996 Vol. 21

A PRELIMINARY STUDY OF SHEEP PRODUCTION FROM PASTURES ON WATERLOGGED AND MODERATELY SALINE LAND

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SUMMARY

Adult and weaner Merino wethers were grazed on pastures established on waterlogged and/or moderately saline land over 8 weeks in summer. The 4 pastures examined were (I) unimproved salt-land pasture consisting mainly of barley grass, (ii) Balansa clover/Concord Ryegrass, (iii) Puccinellia and (iv) tall wheat grass. Sheep grazing Balansa clover/Concord ryegrass and Puccinellia maintained liveweight over the 8 week experimental period and grew more wool, 10-12g/day (adults) or 7-8g/day (weaners) compared with 7-8g/day or 5-6 g/day for adults and weaners respectively on the control and tall wheat grass pastures.

There were differences in pasture mass and quality but these do not explain the significantly better sheep performance on the Balansa/Concord and Puccinellia pastures. These findings are being pursued as there may be opportunities for alternative pasture species on waterlogged, moderately saline land to increase the efficiency of sheep production, particularly as there is a move to spring lambing and early summer weaning in Mediterranean climates.

Keywords: sheep, liveweight, wool growth, pastures, waterlogged, salt-land, Merino wethers

INTRODUCTION

There are over 1 million ha of severely saline agricultural land in Western Australia (WA) and perhaps 2.5 million ha throughout Australia (Barrett-Lennard and Malcolm 1995). As well as this, there may be 4 times as much land that is winter-waterlogged and moderately saline, and which will not support traditional pastures or crops.

To address some of these problems the National Program on Productive Use and Rehabilitation of Saline Land aims to encourage land-holders to revegetate salt-land for livestock production. There is considerable work throughout Australia examining the use of halophyte species, particularly saltbushes *(Atriplex spp.)*, as forages. However, in a recent 4-year grazing study on revegetated salt-land, Warren *et al.* (1995) showed that the value of the different species of saltbush for sheep production is little better than the dry pasture species they replace. These findings are not encouraging for the economic revegetation of severely saline land.

Surrounding severely saline sites there are usually less saline areas with variable characteristics due to topography and soil type. This land has low productivity and supports poor quality grasses, such as barley *grass (Hordeum spp.)* and silver *grass (Vulpia spp.)*, but may have the potential to grow well-adapted, non-halophyte forage species. Evans (1993) has shown that there are a number of legume species that can grow on this land and there are also several grasses which will grow and persist in specific moderately saline environments (Barrett-Lennard and Malcolm 1995). These alternative pastures have not been extensively examined for sheep production.

Because of the limited adaptability of these pasture species and local interest in their use in a total salt-land management system, this experiment examined the grazing value for sheep of pastures on waterlogged and/or moderately saline land.

METHODS AND MATERIALS

The experimental site was a barley grass dominant area bordering a severely saline site sown to saltbush in a 50 ha paddock at Katanning WA (33.41°S,117.33°E). The soil group is a shallow, sandy duplex with from 50 to 200 mm of sand or sandy loam over a grey sodic clay sub-soil. The annual rainfall is about 485 mm, of which 75% falls between May and October.

Total areas of about 1.5 ha of *Puccinellia stricta* (Puccinellia), and about 3 ha each *Thinopyrum elongatum* (tall wheat grass), a mixture of *Trifolium balansae* cv. Paradana and *Lolium multiflorum cv.* Concord (Balansa/Concord) and unimproved, predominantly barley *grass (Hordeum spp.)* pasture (Control), were each subdivided into 3 equal size plots. The Puccinellia was a volunteer stand in a low, winter-waterlogged severely saline flat adjoining a drainage line, the Balansa/Concord on moderately saline, shallow duplex soil inundated for several weeks in winter, and tall wheat grass on a deeper duplex, mild to

moderate saline soil and not waterlogged for extended periods. The control plots were within the area bounded by the other salt-tolerant species on duplex soils with winter waterlogging.

Merino wethers were selected on 14 December 1993 from 2 mobs, 1 about 5-6 months of age and the other 2 years of age. A dyeband was placed in the midside wool and the sheep weighed at the same time. Sheep were again weighed and a second dyeband applied on 10 January 1994. Both groups of sheep were then stratified on liveweight and allocated to the experimental plots to give equal mean group weights. Five adult and 5 weaner sheep were placed in the BalansaKoncord and the tall wheat grass plots, 4 adults and 5 weaners in each control plot and 4 of each in the Puccinellia plots. The experiment thus consisted of 4 pastures, 3 replicates and 8, 9 or 10 sheep per replicate.

Prior to grazing available dry matter (DM) was estimated (t'Mannetje and Haydock 1963) and above ground material from randomly cast quadrats analysed for in *vitro* DM digestibility, ash, N, Na and K. Sheep were allowed free access to water and intake for each plot was measured weekly using small, in-line water meters adjusted for evaporation.

Sheep were weighed weekly and a dyeband placed in the wool at 4, 8 and 14 weeks. The experiment concluded when mean liveweight declined by more than 5 kg/head (Controls, tall wheat grass) or the available DM was less than 800 kg/ha (BalansaKoncord), the erosion risk level for the soil type.

Fleeces were weighed at shearing and a 50g midside sample taken for yield estimations. Wool growth during the grazing period was calculated by cutting staples at the base of each dyeband, scouring the sections, weighing and using the section weights to partition clean fleece weight.

RESULTS

At the beginning of the grazing experiment all annual plant species had senesced except for Concord ryegrass which remained green for a further two weeks, and the perennial tall wheat grass which retained green material throughout the experiment: Pasture available to the sheep and some quality measures at the start of grazing (10 January 1994) are shown in Table 1 below.

There were differences (P<0.05) in available DM (kgDM/ha) and *in vitro* DM digestibility and in N, Na and K content of the pastures (Table 1). From available DM and IVDMD the digestible DM for each kg of sheep liveweight (DDM/kgLwt) was calculated to give an index of pasture availability.

Table 1. Available DM (kg/ha), *in vitro* DM digestibility (IVDMD), digestible DM/kg liveweight (DDM/kg Lwt) and N, Na and K content (%DM) of four pastures

Treatment	Available DM	IVDMD	DDM/ kg Lwt	N	Na	K
Control	1670[a]	50.1[aA]	2.0	0.55[a]	0.37[b]	0.29[a]
Balansa/Concord	2070[a]	56.7[b]	2.4	0.95[b]	0.82[c]	0.73[b]
Puccinellia	12215[c]	50.8[a]	6.5	0.61[ab]	1.63[d]	0.38[a]
Tall wheat grass	5010[b]	51.1[a]	5.1	0.70[ab]	0.23[a]	0.71[b]

[A] Within columns values followed by different letters (a-c) are significantly different (P<0.05).

Liveweight for both classes of sheep over the 8 week measurement period are shown below (Figure 1). Liveweight of the adult sheep grazing the Balansa/Concord and Puccinellia plots were not different but were significantly heavier (P<0.05) than those on control plots and the tall wheat grass (TWG) at weeks 5, 6, 7 and 8. The weaners on Balansa/Concord and Puccinellia were also heavier (P<0.05) than those on the control plots or the tall wheat grass from week 3 through to 8, with those on the BalansaKoncord heavier (P<0.05) than those on Puccinellia at week 4, 6, 7 and 8.

There were no differences (P>0.05) in wool growth within either sheep class in the first measurement period (Table 2). However, the adult and weaner sheep on BalansaKoncord always grew more wool (P<0.05) than the controls but were similar to the Puccinellia in the subsequent periods. Sheep on the tall wheat grass grew less (P<0.05) wool than those on BalansaKoncord, and apart from the period 10 Jan-3 1 Jan for both classes, less than the Puccinellia. Across all treatments and all measurement periods, the mean wool growth of the weaners was about 68% of the older wethers.

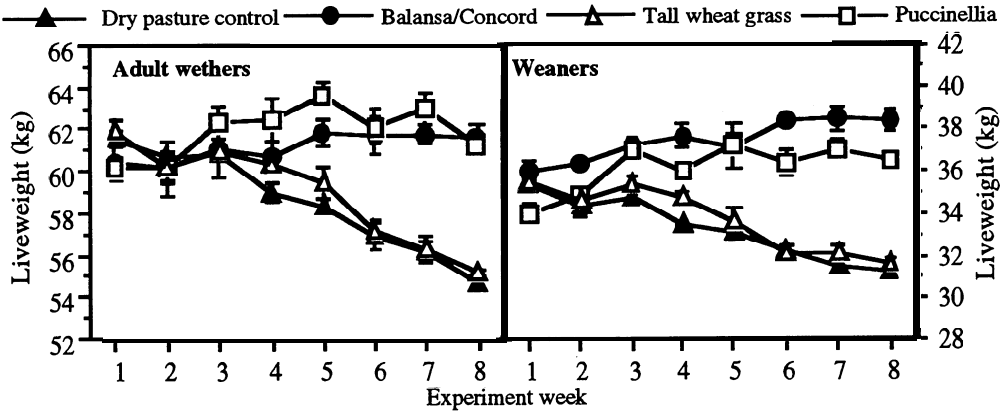

Figure 1. Liveweight (kg ± SE) of adult and young Merino wethers grazing 1 of 4 pastures on waterlogged or moderately saline land over 8 weeks in summer

Table 2. Clean wool growth (g/head.day) of adult and young Merino wethers prior to (14 Dec-10 Jan), during (10 Jan-28 Feb) and after (28 Feb-12 Apr) grazing pastures on waterlogged, moderately saline land

Date	Adults				Weaners			
	Control	Balansa/ Concord	Puccin- ellia	Tall wheat grass	Control	Balansa/ Concord	Puccin- ellia	Tall wheat grass
14 Dec-10 Jan	10.4	10.3	9.8	9.9	6.3	6.4	6.6	5.4
10 Jan-31 Jan	9.9^{aA}	12.7^{b}	11.2^{ab}	10.5^{a}	5.7^{a}	8.0^{c}	7.7^{bc}	6.9^{b}
31 Jan-28 Feb	6.8^{a}	10.6^{b}	10.6^{b}	7.9^{a}	4.6^{a}	8.4^{b}	7.8^{b}	4.9^{a}
28 Feb-12 Apr	6.9^{a}	9.9^{b}	9.2^{b}	7.4^{a}	5.2^{ab}	7.5^{c}	6.6^{bc}	3.9^{a}

[A] In animal class, within rows values followed by different letters are significantly different ($P<0.05$).

Mean water consumption (L/head.day ± SE) over the experimental period for the sheep grazing the Puccinellia was 5.6(±0.18), greater ($P<0.05$) than the Balansa/Concord (3.6(±0.14)), the tall wheat grass (1.8(±0.19)), or the controls (2.1(±0.22)). Intake of water on the Balansa/Concord was also greater ($P<0.05$) than for either of the other 2 treatments.

DISCUSSION

The available DM of the pastures on saline and waterlogged land varied widely. The high available DM on the Puccinellia pastures allowed sheep to be selective and may have enabled them to choose a higher quality diet than shown by digestibility analysis. From this aspect the second years' data will be of interest as less variation in pasture mass may exist.

Even so, it was clear that the waterlogged, moderately saline area with Balansa/Concord pasture supported better sheep production than any of the other treatments on a kg pasture DM/kg sheep liveweight basis, indicating higher pasture quality. After 8 weeks sheep on the Balansa/Concord had consumed the majority of the pasture, including stem material, and there were large areas of bare ground, an erosion risk. This, rather than liveweight loss, led to the removal of the sheep.

The high water intakes of sheep on Puccinellia, in response to the high salt content of the pasture, suggest that water retention in the animal's tissues should be measured as it may have been masking a decline in real bodyweight in a way similar to that of sheep grazing saltbush (Warren *et al.* 1995).

Wool growth generally changed with liveweight over the 8 week period of the grazing experiment and was maintained in both classes of sheep on the Balansa/Concord and Puccinellia pastures. The maintenance of liveweight and wool growth on dry summer feed is unusual in Mediterranean environments. Wool growth

rates usually decline to about half their spring maximum by mid-summer and may decline by another 50% at the end of autumn if supplement is not given. This marked decline also has a major effect on staple strength and other wool quality characteristics. The maintenance of liveweight and wool growth rates into summer and autumn could have a significant impact on sheep management and whole farm profitability.

These findings provide opportunities for new management options for moderately saline, winter-waterlogged land. If young sheep can be maintained through part of summer on pasture produced on this land it could provide an important management tool for wool producers in a spring lambing, early summer weaning system. Higher levels of DM production and improved management on these areas will also assist in water use and in modifying the soil environment.

The results of this preliminary experiment are encouraging and have led to the establishment of a major new project to examine the usefulness of a number of alternative species for moderately saline, waterlogged areas.

ACKNOWLEDGEMENTS

This experiment was undertaken as a component of a much larger project on salt-land grazing and the funding support of the International Wool Secretariat throughout the project is gratefully acknowledged.

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