Small Ruminant Research 91 (2010) 103–109

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Sheep production, plant growth and nutritive value of a saltbush-based pasture system subject to rotational grazing or set stocking☆

H.C. Norman[a,b,*], M.G. Wilmot[a,b], D.T. Thomas[a], E.G. Barrett-Lennard[b], D.G. Masters[a]

[a] CSIRO Livestock Industries, Centre for Environment and Life Sciences, Private Bag 5, Wembley, WA 6913, Australia
[b] Future Farm Industries Cooperative Research Centre, University of Western Australia, Crawley, WA 6009, Australia

ARTICLE INFO

Article history:
Available online 21 February 2010

Keywords:
Saltland pastures
Grazing management
Shrubs
Chenopodiaceae
Diet selection
Digestibility

ABSTRACT

Saltbush (*Atriplex* spp.) pastures are utilised by farmers in the Mediterranean-climate zones of Australia as maintenance feed for livestock during the autumn feed gap. The pastures are generally managed by set stocking at relatively low grazing pressures, allowing animals to choose their diet from the saltbush and understorey species on offer. Intensifying the grazing management of saltbush-based pastures may improve the long-term nutritional status of sheep by limiting the opportunity to selectively overgraze components of the diet which can lead to an inability to select a balanced diet in the future. The primary hypothesis investigated in this experiment was that rotational grazing of saltbush-based saline pastures will (a) increase sheep productivity per hectare (both liveweight gain and wool production) over set stocking, and (b) reduce the pattern of rapid liveweight gain/liveweight loss during autumn. An additional hypothesis was that the intake of saltbush, as a proportion of the total diet, will be negatively correlated to the digestibility of the understorey sward. To test these hypotheses two adjacent, 26 ha saltbush-based pastures were grazed with seven 6-month-old Merino sheep/ha for 250 days from early March (start of autumn) until mid November (spring). One paddock was set stocked while the other was divided into 10 subplots of 2.6 ha and rotationally grazed. Liveweight change, condition score, wool growth, biomass production and nutritive value of the pastures were measured on a fortnightly basis. Diet selection was estimated using carbon isotopes in faeces and pasture. The saltbush-based pastures, consisting of wide spaced rows of saltbush with a sown legume understorey were capable of supporting 7 growing sheep/ha for over 8 months of the year on mildly saline land in the low rainfall wheat belt of Western Australia (330 mm annual rainfall). We found that the differences between the flocks managed by rotational grazing or set stocking were relatively small (3.5 kg after 250 days of grazing and wool of marginally higher value) and it is unclear if rotational grazing would be justified given the higher labour and infrastructure inputs required. The proportion of saltbush selected by sheep reflected the quality of the saltbush and understorey. In autumn, when the saltbush and understorey had similar organic matter digestibility, the sheep managed to maintain liveweight by selecting a diet of approximately half of each component. In spring, when the understorey was highly digestible and in plentiful supply, the sheep still included an average of 13% saltbush in their diets. The growth rate of old man saltbush (*Atriplex nummularia*) edible dry matter ranged from 0.29 to 3.43 kg/ha day (or 0.45–5.27 g/shrub day).
© 2010 Elsevier B.V. All rights reserved.

☆ This article is part of the special issue entitled "Potential use of halophytes and other salt-tolerant plants in sheep and goat feeding" guest edited by H. Ben Salem and P. Morand-Fehr.

* Corresponding author at: CSIRO Livestock Industries, Centre for Environment and Life Sciences, Private Bag 5, Wembley, WA 6913, Australia. Tel.: +61 8 9333 6636; fax: +61 8 9383 7688.
E-mail address: Hayley.Norman@csiro.au (H.C. Norman).

0921-4488/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.smallrumres.2009.11.022

1. Introduction

Saltbush-based pastures are currently utilised by farmers in the Mediterranean-climate zones of Australia as maintenance feed for livestock during the autumn feed gap. The pastures are generally managed by set stocking at relatively low grazing pressures, allowing animals to choose their diet from the saltbush and understorey species on offer. This management system can lead to rapid weight gain followed by weight loss as the animals select the most nutritious components of the diet first (Norman et al., 2002). The animals are then left with an unbalanced diet consisting of poor quality (and high fibre) residues from annual understorey species and saltbush. Saltbush forage is distinctive from many other forages in that it has high levels of soluble salts with figures of up to 35% reported (Beadle et al., 1957). If animals choose to eat the entire senesced understorey before the saltbush they are likely to reach a situation where total dietary intake is limited by salt in the remaining feed on offer (saltbush). Masters et al. (2005) found that wethers will stop eating salty forage after they have ingested approximately 200 g of salt in a day. This means that if the edible component of saltbush forage has a soluble ash concentration of 25% DM and has a digestibility of 50%, a 50 kg mature wether will stop eating after ingesting about 800 g of forage DM, 250 g short of the 1050 g that would be required to maintain liveweight (Freer et al., 1997; Masters et al., 2007). Thomas et al. (2007b) fed sheep high salt diets with a range of low salt alternatives in a pen feeding trial and found that sheep may not eat the low salt alternative (understorey) if it has a DM digestibility below 52%. Additionally, if the DM digestibility of the low salt feed is above 60%, the sheep will only eat small amounts of the salty diet. This suggests that providing animals with a large quantity of saltbush and understorey may not result in the optimal use of resource for animal production.

Intensifying the grazing management of saltbush-based pastures may improve the long-term nutritional status of sheep by limiting the opportunity to selectively graze components of the diet with the highest feeding value and by allowing plants to recover from grazing. Rotational grazing of saltland pastures may also increase productivity of the understorey by allowing it to maintain optimal leaf area for photosynthesis (Morley, 1966). Examples of higher herbage production from pastures that are rotationally grazed compared to pastures that are set stocked include Rossiter (1958), Doyle et al. (1993) and Chapman et al. (2003).

The primary hypothesis investigated in this experiment was that rotational grazing of saltbush-based saline pastures will: (a) increase sheep productivity per hectare (both liveweight gain and wool production) over set stocking, and (b) reduce the pattern of rapid liveweight gain/liveweight loss. A secondary hypothesis was that the intake of saltbush, as a proportion of the total diet, will be negatively correlated to the digestibility of the understorey sward. Finally, this paper presents data concerning growth rates and nutritive value of saltbushes across seasons.

2. Materials and methods

The experiment was conducted at 'Bundilla', a 2000 ha property 350 km SE of Perth, near the town of Lake Grace. The property was originally settled in the 1920s, however the clearing of native perennial vegetation did not occur until the 1960s. By the mid 1970s dryland salinity was becoming a problem and by 2000, 40% of the property was salt-affected. The area has a Mediterranean-type climate with hot dry summers and the majority of rain falling during winter and spring. Mean annual rainfall for the 12 years prior to the experiment was 327 mm and the rainfall in the experimental year was 330 mm. The experimental site consisted of 52 ha of non-saline to highly salt-affected soils (0.7–14 dS/m ECe and pH of 7 in top 30 cm, sampled in October) above extremely saline groundwater (7500 mS/m, pH of 5.5 at 1.2–2.5 m depth). Saltbush belts (10–13 m apart) consisting of 650 shrubs/ha of old man saltbush (*Atriplex nummularia* Lindl.) and 950 shrubs/ha of wavy-leaf saltbush (*A. undulata* D. Dietr) were established on the site by direct seeding in 1999. The paddocks contained an average of 800 m of double saltbush rows/ha. In late autumn 2003, a mixture of balansa clover (*Trifolium michelianum* Savi.), subterranean clover (*T. subterraneum* L.), burr medic (*Medicago polymorpha* L.) and Italian ryegrass (*Lolium multiflorum* Lam.) were sown on the site and allowed to naturalise. Prior to grazing in March, there was approximately 1.7 t/ha of senesced understorey dry matter (DM) and 0.25 t/ha of saltbush edible dry matter (EDM—leaves and stems <3 mm) in the plots.

To examine the hypotheses, the 52 ha area was divided into two 26 ha plots. One half was left as a 26 ha set stocking area while the other was divided into 10 subplots of 2.5 ha each with a central laneway (rotational grazing area). Fencing occurred in 2004. For the rotationally grazed area, a single mob of sheep was moved between the 10 plots; i.e. all the animals were in one plot at any time so that 9 plots were not stocked. The time of sheep movement between the rotationally grazed plots was determined by pasture availability and by the life stage of the annual understorey plants. In summer and autumn, sheep were left in a plot until nearly all the saltbush and senesced understorey biomass had been consumed (2–3 week in each plot). In winter, sheep were rotated quickly to allow them access to as much feed as possible while minimising overgrazing of the germinating understorey (3–7-day rotation). In spring the rotation was fast to minimise heavy grazing of the annual understorey during seed set (3-day rotation).

Both grazing areas were stocked with seven 6-month-old Merino sheep/ha (mixed ewes and wethers) from 10 March to until 14 November (a total of 250 days). A subset of 50 wethers within each grazing treatment were weighed and condition scored (Suiter, 1994), every 14–30 days for the duration of grazing. Animals were not fasted before weighing (either before or during the trial) and were weighed within 1 h of removal from their plot. Of the 50 'core' animals, 20 were used to estimate wool growth per day using the dyeband technique described by Langlands and Wheeler (1968). Fleece weight of core animals was recorded at shearing (after animals had been removed from the plots) and a mid-side sample was taken for estimating yield, fibre diameter and staple strength. Sheep had access to unlimited fresh drinking water at all times during grazing. On three occasions (in April, July and September), faecal samples were collected from 20 sheep in the set stocked plots. The faecal samples and samples of the saltbush and understorey that were collected on the same day were used to estimate saltbush in the diet using the carbon isotope technique (Coates et al., 1987; Norman et al., 2009).

Understorey and shrub biomass were determined on a monthly basis in the set stocked plot as well as immediately prior to and after grazing in the rotationally grazed plots. All understorey measurements were obtained from 'w' shaped transects across plots. Understorey biomass and botanical composition were assessed using calibrated quadrat cuts and the dry-weight-rank method of Mannetje and Haydcock (1963). Prior to grazing, individually numbered permanent transects of 10 m in length were randomly allocated within the saltbush rows for measurement of saltbush biomass. Each of the 10 rotationally grazed plots contained 5 saltbush transects and the set stocked plot contained 10 saltbush transects. Saltbush edible dry matter (EDM; leaves and stems with a diameter <3 mm) was estimated using the 'Adelaide' technique of Andrew et al. (1979). This is a non-destructive comparative ranking technique where a branch representing approximately 20% of a typical shrub is compared to other shrubs within transects. The representative branch is then striped of all leaves and small stems (<3 mm) and the material is dried at 65 °C for 48 h. The mean shrub rankings within transects are then multiplied

Download English Version:

https://daneshyari.com/en/article/2457457

Download Persian Version:

https://daneshyari.com/article/2457457

Daneshyari.com