

USING STABLE CARBON ISOTOPES TO MEASURE DIET SELECTION IN SHEEP GRAZING SALTLAND PASTURES

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Sheep grazing saltbush-based pasture typically select a diet containing both saltbush and understorey. In autumn, the feed characteristics of saltbush and understorey tend to restrict feed intake differently (i.e. high salt and low digestibility). Sheep select forage combinations of high and low salt feeds that improve their diet (Thomas *et al.* 2006). Therefore, providing sheep with appropriate combinations of saltbush and understorey can increase their intake of digestible organic matter and improve growth rates. Management strategies in these shrub-based systems will depend on the availability of forage and the animals' selection among the widely different components of the feed on offer. Current techniques for estimating diet selection in saltland pasture (e.g. biomass depletion, alkanes) are labour intensive, indirect and/or unreliable. This paper reports a preliminary study using the $\delta^{13}\text{C}$ ratio measured in faeces to estimate the selection of saltbush from understorey plant species.

The $\delta^{13}\text{C}$ ratio is derived from the proportion of natural ^{12}C and ^{13}C isotopes of carbon measured in organic matter. The $\delta^{13}\text{C}$ ratio in an animal represents the $\delta^{13}\text{C}$ ratio in the digestible plant material that it consumes (Jones 1979). Plants, such as the understorey species typical in saltbush systems, which have a C3 photosynthetic pathway have a different $\delta^{13}\text{C}$ ratio than C4 plants, such as saltbush. Therefore, it is possible to measure diet selection between C3 and C4 plants by taking samples from animals, or their digesta.

Faecal samples were collected from sheep grazing a saltland pasture at Pingaring, W.A. on April 13 (Autumn), July 20 (Winter), September 29 (Spring) and November 16 (Summer), 2005. Saltbush and understorey plant material was collected in April. Samples were analysed for $\delta^{13}\text{C}$ in a 20/20 Mass Spectrometer and Anca-SI preparation system (Europa PDZ, United Kingdom). Estimated saltbush intake (ESI) was calculated using the equation of Jones (1979), with estimates of organic matter digestibility using *in vitro* pepsin-cellulase digestion in samples taken in previous years at several sites in W.A. (unpublished data; Table 1).

Saltbush and mixed understorey species had distinct $\delta^{13}\text{C}$ ratios (-15.3 v -27.5‰). The $\delta^{13}\text{C}$ ratios for sheep grazing during autumn, winter, spring and summer are reported in Table 1. The estimated proportion of saltbush eaten by the sheep was 69, 24, 18 and 55% of dry matter intake (DMI), for these periods. The results are consistent with an animal house study by Thomas *et al.* (2006), where sheep offered a high-salt feed (18.5% added NaCl) together with a low-salt alternative feed increased their intake of the high-salt feed as the nutritive value (energy) of a low-salt alternative decreased. In the previous study, sheep selected approx. 70% DMI of high-salt feed when it was offered with a low-energy, low-salt alternative. However, sheep still selected some high-salt feed (approx. 14% DMI) when a high-energy, low-salt alternative feed was offered.

Table 1. Faecal $\delta^{13}\text{C}$ ratios, estimated organic matter digestibility (OMD) and estimated saltbush intake in sheep grazing saltland pastures during autumn, winter, spring and summer

Season	$\delta^{13}\text{C}$ of faeces		OMD (%)		Saltbush Intake	
	Mean ‰	SE	Saltbush	Understorey	DMI %	SE
Autumn (n = 27)	-22.8	0.21	76	50	69.4	1.40
Winter (n = 18)	-24.8	0.36	74	85	23.8	2.59
Spring (n = 17)	-26.9	0.07	78	75	18.3	0.69
Summer (n = 20)	-24.3	0.20	78	60	55.0	1.98
P-value	<0.001				<0.001	

Saltbush comprised about two-thirds of the diet of sheep in autumn, but declined to about one-fifth of the selected diet in spring when there were abundant, high quality understorey species. In summer, the proportion of saltbush in the diet was intermediate between autumn and spring values. The results from predicting diet selection using stable carbon isotopes are within an expected range and this method may potentially be developed for use in the field.

This project was supported by Land, Water and Wool and hosted by Michael and Margaret Lloyd, Pingaring.

JONES, R.J. (1979). *J. Agric. Sci. (Camb.)* **92**: 91-100.

THOMAS, D.T., RINTOUL, A.J., MASTERS, D.G. (2006). *Appl. Anim. Behav. Sci.* (in press).

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