**PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE**
**Official publication of The Australian Rangeland Society**



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# SHEEP NUTRITION IN THE ARID SHRUBLANDS OF WESTERN AUSTRALIA

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## ABSTRACT
The nutritional values of native plants in the arid shrublands of Western Australia were compared to the nutrition (dietary) profile of Merino sheep estimated from faecal samples. Plant profiles had generally high CP content, but low OMD and ME content. However, faecal profiling indicated that the dietary levels of CP, OMD and ME were all of adequate levels to maintain sheep. Therefore the sheep were able to select a diet that met their maintenance nutritional requirements despite the generally low nutritive values of the plants species sampled.

## INTRODUCTION
It is generally accepted that a combination of plant species provide livestock with adequate nutrition rather than intake of one species alone, and livestock will select the most nutritious diet available (Heady 1964; Franklin-McEvoy and Jolly 2006). However, little is known about the nutritional content of arid shrubland plants in Western Australia and knowledge of palatability and nutritional value is limited to one popular source by Mitchell and Wilcox (1994) as well as anecdotal observations of livestock grazing. In this paper the nutritional content of plant species covering a range of palatabilities is obtained and compared to dietary nutrition estimated from faecal samples.

## MATERIALS AND METHODS
### Plant and faeces collection sites
Leaf material from native plants and Merino sheep faeces were collected from two pastoral stations near Yalgoo, Western Australia (28º18'S 116º38'E) during 2006 and 2007.

Faeces were collected near watering points and along tracks where fresh dung was likely to be encountered. Shrub foliage was collected generally within 1-2 km from water in grazed paddocks. Collections generally occurred once per season as frequency was constrained by time and distance.

### Selection of plants for collection
New leaf material was collected from the entire plant of several individuals; however, if new leaf material was not present older leaves were collected. Stems, flowers and fruit were avoided. The plant species targeted for collection were known to be palatable based on pastoralists' observations of livestock (Merino sheep) grazing, evidence of utilisation observed in the field and information stated in Mitchell and Wilcox (1994) and Russell and Fletcher (2003). Species collected depended on those available for forage in paddocks being grazed.

### Analytical procedures
The samples were kept cool in an esky during collections and later oven dried at 50°C. The samples were then ground through a 1 mm screen and stored at room temperature pending chemical analyses.

Total N was determined using the Kjeldahl oxidation procedure (Mossberg 1979). The N content was multiplied by 6.25 to give the crude protein (CP) content, expressed as a percentage of the dry matter (DM). *In vitro* organic matter digestibility (OMD) and metabolisable energy (ME) were determined using the gas fermentation technique described by Makkar (2003) and Menke *et al*. (1979). CP, OMD and ME were corrected for ash content.

Dietary CP, ME and OMD (dCP, dME and dOMD) were estimated from faecal samples using Near Infrared Reflectance Spectrophotometry (NIRS) calibration equations developed with data from controlled feeding experiments (K. Mahipala, unpub.data).

**RESULTS**

Table I shows that the plant species have variable CP, OMD and ME; however, all have high CP content (12 - 27%) with the exception of *Acacia* sp (10%), *Melaleuca* sp (8%) and *Scaevola spinescens* (9%). The OMD and ME content of all the selected plants were below sheep maintenance requirements, >50% and >8 MJ/kg, respectively (McDonald *et al*. 2002).

**Table I: Average OMD (%), ME (MJ/kg DM) and CP (%) of shrubs from the arid shrublands of Western Australia**

| Species | Common Name | OMD | ME | CP |
|---|---|---|---|---|
| *Acacia grasbyi* | Miniritchi | 31.1 | 4.5 | 9.8 |
| *Acacia tetragonophylla* | Curara | 30.9 | 4.5 | 10.1 |
| *Atriplex amnicola* | River saltbush | 46.8 | 6.6 | 18.0 |
| *Atriplex bunburyana* | Silver saltbush | 46.7 | 6.6 | 16.9 |
| *Cratystylis subspinescens* | Sage | 41.0 | 5.9 | 11.9 |
| *Enchylaena tomentosa* | Ruby saltbush | 42.0 | 5.9 | 22.8 |
| *Eremophila forrestii* | Wilcox bush | 43.2 | 6.3 | 15.1 |
| *Maireana convexa* | Mulga bluebush | 45.7 | 6.4 | 22.7 |
| *Maireana planifolia* | Flat leaved blue bush | 36.0 | 5.0 | 21.9 |
| *Maireana pyramidata* | Sago bush | 37.3 | 5.1 | 23.6 |
| *Maireana thesioides* | Lax bluebush | 42.8 | 5.9 | 21.5 |
| *Maireana tomentosa* | Felty bluebush | 41.7 | 5.6 | 17.6 |
| *Maireana triptera* | Three-winged bluebush | 42.6 | 5.9 | 24.6 |
| *Maireana villosa* | Silky bluebush | 45.7 | 6.4 | 26.9 |
| *Melaleuca* sp | Paperbark | 38.7 | 5.7 | 8.1 |
| *Ptilotus obovatus* | Cotton bush | 44.0 | 6.3 | 17.9 |
| *Rhagodia drummondii* | Lake fringe rhagodia | 42.5 | 6.1 | 16.6 |
| *Rhagodia eremaea* | Tall saltbush | 45.1 | 6.3 | 22.9 |
| *Scaevola spinescens* | Currant bush | 29.3 | 4.2 | 9.2 |
| *Sida calyxhymenia* | Tall sida | 49.1 | 7.2 | 16.3 |
| *Solanum lasiophyllum* | Flannel bush | 35.8 | 5.1 | 17.0 |

There was a large range in dCP, dME and dOMD over the 2 year test period (Table II). On average, dCP, dME and dOMD were above maintenance requirements for sheep (Table II).

**Table II: Mean (± SD) organic matter digestibility (%), metabolisable energy (MJ.kg DM) content and crude protein (%) content of the diet of Merino sheep grazing in the rangelands, derived from NIRS**

| | dOMD | dME | dCP |
|---|---|---|---|
| **Range** | 47.2-74.0 | 6.7-10.6 | 22-94.4 |
| **Average** | 58.7 ( ±6.2) | 8.8 (±1.0) | 68.7 (±16.8) |

**DISCUSSION**

The plant results (Table I) indicate that livestock in the area had access to plants containing high protein but low energy contents and with generally low OMD. To meet their nutrient requirements (for maintenance at the very least) sheep would need to be highly selective to find digestible feed. The

plant analyses results are similar to those of Franklin-McEvoy and Jolly (2006), who reported shrubs like saltbush (*Atriplex* sp) and bluebush (*Maireana* sp) have insufficient energy content for sheep maintenance requirements.

The results illustrate how variable the nutritive value of plants found in the same environment can be. This variability is due to many factors, with soil type and rainfall likely to be among the dominant influences, both of which are highly variable in the rangelands. During this research there was high summer rainfall and very low winter rainfall in 2006, and below average rainfall in 2007. Variability is an important survival mechanism for rangeland ecosystems to cope with the harsh environment (Specht and Specht 1999).

The dietary results in Table II indicate that the sheep were generally able to select a diet adequate in dME, dOMD and dCP. However, during the study dietary OMD and ME dropped below maintenance requirements in late autumn and winter in 2007.

Analysis of the nutritive value of individual plants (even on the knowledge or assumption of their inclusion in the diet) does not necessarily reflect the nutritive value of the diet of the grazing animal. The results indicate that livestock must be highly selective and 'work hard' while grazing to obtain adequate nutrition. The high selectivity and competition for nutritious material can result in land degradation if livestock are not managed correctly (Brennan *et al*. 2006).

**ACKNOWLEDGEMENTS**
Desert Knowledge CRC and Curtin University for funding and support. Chemistry Centre of Western Australia for analysing the plants and faecal samples. Rob & Kathryn Mitchell and Bill, Ellen & Justin Rowe for their generosity, enthusiasm and use of paddocks and sheep. Greg Brennan, Bev Pratt, Glen Brayshaw and Mark Alchin for assistance with sampling and laboratory work.

**REFERENCES**

Brennan, G.A., Milton, J.T.B., Norton B.E. and Krebs, G.L. (2006). Rumen ecology driving productivity and landscape ecology in the shrublands of the West Australian rangelands. *In* 'Conference Papers of the 14th Biennial Conference of the Australian Rangeland Society: The Cutting Edge.' (Ed P. Erkelenz). **Renmark,** pp. 81-84.

Franklin-McEvoy, J., and Jolly, S. (2006). Towards a better understanding of animal nutrition in pastoral South Australia. *In* 'Conference Papers of the 14th Biennial Conference of the Australian Rangeland Society: The Cutting Edge.' (Ed. P. Erkelenz). **Renmark,** pp. 155-159

Goering, H.K., and Van Soest, P.J. (1970). Forage Fibre Analyses. *In* 'Agricultural Handbook No. 379.' **ARS-USDA, Washington, DC**.

Heady, H.F. (1964). Palatability of herbage and animal preference. *J. Range Mgmt.* 17: 76-82.

McDonald, P., Edwards, R.A., Greenhalgh, J.F.D., and Morgan, C.A. (2002). 'Animal Nutrition, 6th edn.' **Prentice Hall, London.**

Makkar, H.P.S. (2003). 'Quantification of Tannins in Tree and Shrub Foliage.' **Klumer Academic Publishers: Dordrecht, The Netherlands**.

Makkar, H.P.S, Blummel, M., and Becker, K. (1997). *In vitro* rumen apparent and true digestibilities of tannin-rich forages. *An. Feed Sc. Tech.* 67: 245-251.

Menke, K.H., Raab, L., Salewski, A., Steingass, H., Fritz, D., and Schneider, W. (1979). The estimation of the digestibility and metabolisable energy content of ruminant feedstuffs from the gas production when they are incubated in rumen liquor *in vitro*. *J. Ag. Sc. (Camb.)* 92: 217-222

Mitchell, A.A., and Wilcox, D.G. (1994). 'Arid Shrubland Plants of Western Australia.' **Department of Agriculture Western Australia and University of Western Australian Press, Perth**.

Mossberg, R. (1979). 'Determination of Kjeldahl Nitrogen Content by the Kjeltic System 1. Occasional Application Note No 16/79.' **Tecator**.

Russell, P., and Fletcher, W. (2003). Relative palatability of selected perennial plants in the southern rangelands of Western Australia – Results of a survey of rangeland practitioners. *In* 'Range Management Newsletter 03/3' **Society of Range Management** pp. 1-8

Specht, R.L., and Specht, A. (1999). 'Australian Plant Communities – Dynamics of Structure, Growth and Biodiversity.' **Oxford University Press, U.K**.