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BEST PRACTICE GRAZING MANAGEMENT: UTILISING THE NUTRITIVE VALUES OF PREFERENTIALLY GRAZED RANGELAND PLANT SPECIES

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INTRODUCTION

The nutritive value of pastoral plant species is currently under investigation in the Outback Lakes region of South Australia to enable pastoralists to gain a better understanding of best practice management of grazed rangeland pastures. Strategic grazing management based on species nutritive value and their relationship with plant maturity, soil type and seasonal conditions is aimed at preserving high value plant species and reducing land system degradation. The aim of this project is to optimise the long term sustainability of grazing enterprises in the arid lands of South Australia and to increase our understanding of the nutritive value of preferentially grazed species.

METHODOLOGY

A key point of the project was a plant identification workshop to ensure participants had a consistent understanding of the botanical name and the common name of each species to be sampled. Pastoralists from Billa Kalina, Dulkaninna, Muloorina and Farina stations located within the Outback Lakes region of South Australia, collected samples of 16 plant species regularly over a two year period. Eight species were consistently tested across all properties and each property also selected two other species of interest test. The species chosen were all identified as preferentially grazed or highly abundant. Each sample was tested for nutritive value and mineral levels; details including sample location, growth stage, proportion of total feed on offer, preference as determined by pastoralists and time since last rain were also recorded. Blood samples were taken from sheep and cattle at irregular intervals to compare plant mineral levels with animal uptake.

RESULTS

Pastoralists' knowledge of plant species identification was greatly enhanced by attending a plant identification workshop prior to the onset of sample collection.

Table I Copper, phosphorus and glutathione peroxidase (GSH PX) blood serum levels for sheep and cattle tested over two rounds

Round	Animal	Copper	Phosphorus	GSH PX (Selenium)
		µmol/L	mmol/L	U/gHb
	Target range sheep:	***8 to 30***	***1.61 to 2.35***	***50 to 300***
1	Sheep	13.7	3.70	727
1	Sheep	12.0	3.53	752
2	Sheep	9.5	2.47	N/A
	Target range cattle:	***8 to 30***	***1.29 to 2.26***	***40 to 300***
1	Cattle	10.8	2.29	315
1	Cattle	10.8	2.50	346
1	Cattle	7.9	2.52	381
1	Cattle	8.7	2.24	375
1	Cattle	10.3	2.61	275
1	Cattle	9.5	2.72	282
2	Cattle	10.1	1.30	506
2	Cattle	9.1	1.32	N/A

Blood phosphorus levels in both sheep and cattle taken during the first round of analyses were unexpectedly high (Table I) on all properties in relation to plant phosphorus levels analysed, which were either low or within the recommended levels for sheep and cattle. This observation was not consistent for the second round of blood testing; although sheep blood phosphorus levels were still above the target range, cattle blood phosphorus levels were relatively low.

On average, 12 of the 16 (preferentially grazed) species tested contained high selenium levels (>0.2mg/kg), corresponding to high levels of glutathione peroxidase in the blood (Table I). Serum calcium, magnesium and zinc were found to be within the normal range required by sheep and cattle however the Vitamin B12 status of cattle grazing on Muloorina station in winter, 2006 was deficient.

Although the majority of plant species tested contained copper levels sufficient to meet the requirements of sheep and cattle, the copper status of sheep at Farina and cattle at Dulkaninna and Muloorina was low during winter (Table 1). The mineral levels of cattle grazing on Billa Kalina station were consistently high. No relationship was found between the condition of either sheep or cattle and their mineral status.

There was a positive correlation between crude protein level of grass species and maturity ($P<0.0005$), however the relationship was not strong. Crude protein also accounted for 12.5% of the variation in preference as identified by the pastoralists ($P<0.005$). These trends were either weak or not apparent for the tree, legume, bush and forb species tested to date.

Trigonella suavissima, *Cullen australasicum* and *Cullen cinereum* had the highest average nutritive values of all preferentially grazed samples, while *Zygochloa paradoxa* was consistently found to be deficient in crude protein and metabolisable energy for grazing animals (Figure I),but high in neutral detergent fibre (NDF).

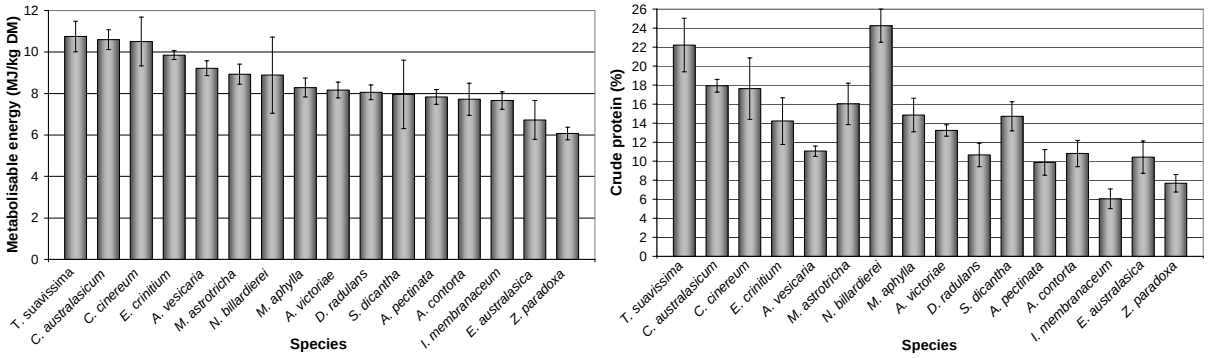

Figure I Average metabolisable energy (MJ/kg DM) and crude protein (% of DM) levels of plant species observed as preferentially grazed by pastoralists showing standard error bars.

DISCUSSION

This project has provided valuable information to date about the nutritive value of plant species in the Outback Lakes region and builds on the knowledge gained from similar projects in the southern rangelands of South Australia (Franklin-McEvoy, 2004). Potassium, selenium and Vitamin B12 levels in livestock grazing in the southern rangelands across 4 properties were found to be considerably higher than in the Outback Lakes region, where toxic levels were less apparent.

Interestingly, in the second round of blood testing, sheep phosphorus levels remained above the target range, however the levels in cattle decreased to within the normal range. These results support the findings of Cohen (1974) who suggested 'that sheep may be more efficient than cattle in retaining phosphorus when intakes of this nutrient are low'. These unexpectedly high blood phosphorus levels may not be an accurate representation of the phosphorus status of the animal as highlighted by Gartner *et al.* (1965) who found that blood phosphorus levels were directly related to the level of animal excitation prior to blood sampling. As rangeland sheep and cattle tested during this project were not

regularly mustered or yarded, it is possible that their elevated blood phosphorus levels could be attributed to mustering activity. A further explanation could be that the livestock were selecting species in their diet that contained high levels of phosphorus which had not been analysed as a part of this project.

Although blood glutathione peroxidase levels were consistently high, no signs of selenium toxicity such as dullness, emaciation, roughness of coat, loss of hair, soreness and sloughing of hooves, stiffness and lameness, respiratory distress, abdominal pain, increased urination or bloating (Hungerford, 1990; Underwood & Suttle, 1999) were reported in the sheep or cattle.

Ruminants may be deficient in copper whilst returning blood tests within the normal range therefore, to eliminate copper deficiency, liver testing should be carried out on slaughter animals (Vermunt & West, 1994; Xin *et al.*, 1993). Although the sheep at Farina and cattle at Dulkaninna returned copper levels at the low end of the normal range, few plant species were found to be deficient in copper, therefore a clinical copper deficiency in animals grazing within the Outback Lakes region appears unlikely. Most other blood mineral parameters were within the normal range, which correlated well with plant levels.

Crude protein levels of rangeland grass species decreased with increasing maturity, which is similar to the findings of Franklin-McEvoy (2004 unpublished data) who found that forbs and grasses had their highest energy and protein levels during the vegetative growth phase in spring. It is possible that metabolisable energy (ME) available from fermentation of rangeland grass species may also follow this trend; as further results become available, any trends may become clearer. An increase in sample numbers should allow for soil types and possibly rainfall events to be accounted for, which may strengthen the present correlations.

It has been reported that livestock show a preference for plant species that are high in ME and protein (Hutton, 1962; Smit *et al.*, 2006). Similar trends were found in the rangeland grass species tested in the Outback Lakes region. Weak correlations between nutritive value and preference may be partly due to differences in the pastoralists' perception of 'preference'; this concurs with the findings of Daly *et al.* (in press) during investigation into the nutritional profiles of native plants in the Arid Shrublands of Western Australia. Weak correlations could also be attributed to anti-nutritive factors contained within particular plant species, which were not analysed as a part of this project. Further samples of tree, legume, bush and forb species may provide a clearer picture of the relationship between preference and nutritive value, as may current investigations by the Future Farm Industries CRC into the relationship between plant anti nutritive factors, preference and palatability.

Animal requirements for maintenance and early pregnancy are likely to be met if the diet is comprised of a mix of preferentially grazed species shown in Figure 1 (National Research Council, 2007). Animals with higher nutrient requirements such as lactating or growing stock may demonstrate higher levels of productivity if allocated to areas where species of greater nutrient density (*Trigonella suavissima*, *Cullen australasicum* and *Cullen cinereum*) may be found in higher concentrations. It is becoming clear that these species may be useful as "indicator species" to provide a guide to the allocation of grazing stock to areas that most appropriately meet livestock requirements, and as an indicator for either supplementation (where permitted) or destocking.

CONCLUSION

This project has been another small but invaluable step toward understanding the value of preferentially selected plant species to livestock, for all who live and work in the Outback Lakes region of South Australia.

The long term aim of this work is to determine best practice grazing management based on the nutritive value of indicator species, particularly in prolonged dry times, and the compilation of a comprehensive database is an important step in that direction. Although the lack of effective rainfall

across the region has limited the number of species analysed, the project still has 3 months until completion, and it is hoped that winter rainfall may still provide additional data.

To date the relationship between the nutritive value of grazes species, soil type and land class have not been determined, but should be considered.

RECOMMENDATIONS

To date, the project has identified three areas of further research:

1. Determination of the exact cause of high blood phosphorus levels given low plant phosphorus levels
2. Implications of high glutathione peroxidase levels on animal production
3. Determination of copper status of stock grazing in the Outback Lakes region by liver testing

It is worth noting that additional selenium in the form of drenches, vaccinations, back liners or lick blocks appears not to be required for animals grazing on these properties, and that supplementation could result in selenium toxicity.

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