SHEEP NUTRITION IN PASTORAL SOUTH AUSTRALIA

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Findings of a nutritional research project conducted by Productive Nutrition Pty Ltd, commissioned by the Central North Eastern Farm Assistance Program (CNEFAP).

The pastoral industry is the dominant land user of Australia's semi-arid and arid regions and accounts for 20-25% of the nation's sheep population. However, compared to the higher rainfall areas of Australia, there is an overall lack of information available for pastoralists to better manage the nutrition of their sheep. Animal nutrition in pastoral areas involves managing the land and ecosystem for animal production, rather than simply formulating rations or supplements based on a few species of plants. Because the quality and availability of plants in pastoral systems varies greatly, the diet of animals grazing rangelands varies considerably over time and between locations.

In an attempt to provide graziers with a better understanding of how to optimise and strategically manage the nutrition of their sheep, four pastoralists, along with consultants from Productive Nutrition Pty Ltd, secured funding through the Central North East Farm Assistance Program (CNEFAP) to systematically study the the nutritive value (NV) of the key plant species in their systems, and to use blood testing of sheep to monitor animal performance. The study period was from August 2003 to November 2004.

(Right) A productive pastoral system contains a mixture of species, including grasses and forbs, as well as shrubs including *Acacia, Atriplex* and *Maireana*. This diversity of species ensures ecosystem stability and provides sheep with a reasonably balanced diet.

[J. Franklin-McEvoy, 2005]

Blood testing

Blood sampling sheep to determine their mineral status is an affordable way of alerting graziers that sheep health may be suboptimal. Producers should discuss with their veterinarian when would be the best time to sample, but from before joining to after weaning is ideal so that remedial action can be taken if necessary.

The overall mean blood test results from this project appear in Table 1. Blood calcium status on all properties in the study was below recommended levels while potassium and glutathione peroxidase (GSH PX, an indicator of selenium status) were elevated.

Table 1: Mean blood test results from two sampling sessions on each of the four properties in the study. Ca = calcium, Cu = copper, GSH PX = glutathione peroxidase (indicator of selenium), K = potassium, Mg = magnesium, P = phosphate, Vit B12 = vitamin B12 (indicator of cobalt), Zn = zinc.

	Ca mmol/L	Cu uM	GSH PX U/gHb	K mmol/L	Mg mmol/L	P mmol/L	Vit B12 pM	Zn uM
MEAN	**2.6**	11.9	**767**	**5.9**	1.1	2.1	2105	14.7
Recommended range	2.9-3.2	9-25	50-550	3.9-5.4	0.9-1.3	1.6-2.4	400-5000	7-25

The low blood calcium is of concern since none of the sheep sampled were pregnant or lactating. The calcium status of lactating animals would certainly be lower than the above results, increasing the risk of hypocalcaemia and related disorders, leading to poor ewe and lamb survival and therefore poor lambing percentage. Blood calcium levels were lower in older sheep, suggesting lifetime calcium deprivation due to insufficient calcium intake and/or retention. Low blood calcium is probably common throughout pastoral SA and is likely to be a major cause of poor lambing success in this area but is reasonably easy to remedy.

The high potassium levels in these sheep are sufficiently high to be increasing the incidence of potassium-related disorders which include impaired calcium status, hypomagnesaemic tetany, and heart disorders.

In addition, copper deficiency occurred on two properties in 2004 while zinc was low on one property in both years.

Both copper and zinc have roles in fertility and bone health. Thus, the low calcium, copper and zinc and high potassium observed in this study suggest that suboptimal mineral status of grazing sheep may be responsible for the reduced fertility and low lambing percentages that are common in pastoral systems. This finding highlights the value of using blood testing as a tool to monitor animal health in the pastoral regions and to make management decisions if necessary.

While the GSH PX is well above recommended levels, it is probably not sufficiently high to be limiting animal performance as sheep tolerate high selenium levels to a much greater extent than for minerals such as potassium and calcium.

Table 2: Common plants in the central north east of SA; (top left) *Sclerolaena* sp., (top right) *Atriplex nummularia,* and (bottom) the exotics *Medicago* sp. (medic) and *Carrichtera annua* (ward's weed).

[J. Franklin-McEvoy, 2005]

Plant sampling

Plant samples were collected every two months on each of the properties involved, and sent to FeedTest, Victoria, for nutritive analysis. Due to the large number of samples collected, only the main nutritional strengths and weaknesses of the main species appear in Table 2.

Target NVs for this report were:
crude protein (CP) = 12%DM;
metabolisable energy (ME) = 8MJ/kgDM;
neutral detergent fibre (NDF) = 30%.

Recommended mineral targets were based on Underwood & Suttle (1999).

Table 2: The nutrition strengths and weaknesses of the main plant species identified in the CNEFAP project. Some plants may have alternative common names to those shown here.
"High" refers to a nutrient that a species consistently contains above adequate levels;
"Low" refers to a nutrient that a species consistently contains below adequate levels;
"xs" refers to a nutrient that a species consistently contains levels that are well in excess of requirements and may be toxic.

Botanical name	Common name	Strengths	Weaknesses
Acacia paporacarpa	Western Myall		Low ME, P, S, Zn
Atriplex holocarpa	Annual saltbush	High CP	xs Cl, K, Mg, Na
Atriplex nummularia	Old man saltbush	High CP, ME	xs Cl, K, Mg, Na. Low NDF
Atriplex vesicaria	Bladder saltbush	High ME	xs Cl, Fe, K, Mg, Na. Low P, Zn
Carrichtera annua	Ward's weed	High CP, Ca	xs Fe
Maireana appressa	Bluebush	High CP, Ca	xs Fe, Na. Low P, Zn
Maireana astroticma	Bluebush	High Ca	xs Cl, K, Na. Low CP, P
Maireana georgii	Sanity bluebush	High CP	xs Cl, Na. Low P, Zn
Maireana pyramidata	Black bluebush	High CP, Ca	xs Cl, Fe, Mg, Na. Low P, Zn
Maireana sedifolia	Pearl bluebush	High CP	xs Cl, Na. Low P, Zn
Medicago sp.	Medic	High CP, Ca	xs Al, Cu, Fe
Myoporum platyoarpum	Sugar wood	High ME	xs Cu. Low NDF, P, Zn
Rhagodia sp.	Rhagodia	High CP, Ca	xs Cl, K, Mg, Na. Low P, Zn
Salvia verbenaca	Wild sage	High CP, Ca	xs Al, Cu, Fe. Low Na
Sclerolaena ch., dia., eria.	Copperburr	High CP, ME, Ca	xs Cl, Fe, Na. Low P, Zn
Sclerolaena obliquicuspis	Limestone copperburr	High Ca	xs Na, Fe, NDF. Low P, Zn
Sisymbrium erysimoides	Mustard weed	High CP, ME, Ca	xs Fe, K, Na. Low NDF, P
Soliva pterosperma	Bindii		xs NDF, Al, Cu, Fe, Na. Low ME, P
Stipa sp.	Speargrass		xs NDF. Low ME, P, S, Zn
Tetragonia tetragonoides	Spinach	High CP, ME, Ca	xs Al, Cu, Fe, K, Na. Low NDF

Many species in this study contained low energy levels suggesting that energy intake by animals is limiting their performance. There was some significant variation in plant NV between properties, suggesting that producers should determine NV of their main species on their own property in order to gauge the NVs of their own feed.

In addition, feed quality varied across the year, with CP being highest in September-October and NDF being highest in summer. This was best illustrated in *Medicago,* where spring CP and NDF were 27% and 35% respectively while in summer the CP of the stubble fell to 15% and the NDF rose to 60%.

All annuals had poorer nutritive value in summer and autumn, often with insufficient energy and protein to sustain animals at maintenance level of production. The high fibre content also lowers voluntary feed intake.

However many shrubs, especially the *Atriplex* and *Maireana*, contain usefully high levels of nitrogen throughout the year. This additional nitrogen improves overall feed utilisation while providing adequate dietary protein.

The very high salt levels of these species (Na up to 6%, K up to 4%, Cl up to 6%) present grazing animals with a further nutritional challenge although there is little producers can do about this, other than to ensure an adequate supply of low-salinity drinking water.

Better understanding sheep nutrition in pastoral South Australia

This study, which is representative of the central north east pastoral zone of South Australia, identifies some nutritional concerns for sheep producers.

It is first vital to recognise that the range of plant species available provide sheep with a reasonable diet to grow wool and rear lambs while maintaining the health and stability of a relatively fragile natural environment. In no agricultural system does a single plant species provide a perfect, balanced diet but as is evident in a pastoral system, most species contribute positively to animal nutrition. This shows the importance of managing the system to ensure a balance between the higher quality but low stability annuals and forbs and the lower quality but more stable shrubs.

Based on the plant sampling results, it would appear that CP intake is adequate due to the number of plants which contain adequate or high CP levels. Most of the *Atriplex* and *Maireana* species contain 17-20% CP, which is adequate for pregnant and lactating ewes, meaning that there is probably little value in providing sheep with a dietary protein supplement.

However, energy content of the majority of species is less than ideal, meaning that supplementing the diet with a source of energy should realise a production benefit.

Barley is typically the most cost-effective energy source for sheep but there is also the risk of excessive intake leading to acidosis which may result in sheep deaths. Successful feeding of barley-based supplements requires regular feeding (3+ times per week) and careful monitoring. Due to the constraints of properly managing a supplementary feeding program in pastoral country, lupins are commonly fed. Lupins are a good source of both energy and protein and although the protein is probably not required in these systems, sheep cannot get grain poisoning from lupins so they are a safer supplement than barley. Oats are a good alternative as they provide energy without having high levels of protein and also do not cause grain poisoning.

Based on the blood testing, supplementary feeding with calcium, copper and zinc should be beneficial. Calcium can be provided as a dump of crushed limestone or gypsum near watering points. Calcium, copper and zinc can be supplied as a lick, also located near watering points.

It may be worthwhile considering the use of hay-based pellets manufactured for feeding to ewes during joining and pregnancy. The hay will slow rumen fermentation of the grain in the pellet and any minerals that are required (as determined by blood testing) can be added during the manufacturing process. Given the current high sheep prices (2004-5), strategic supplementary feeding may boost lambing rates and be economically viable.

Conclusion

This study suggests that sheep in the central north east of South Australia consume a diet that leaves them deficient in energy, calcium and in some cases copper and zinc. These four nutrients are all involved in fertility and growth, so supplementing the diet of pastoral sheep with these nutrients is likely to improve animal production and ultimately lead to improved economic viability of the whole property.

Other fact sheets available:

Key Species for Sheep Nutrition in Pastoral South Australia, *A fact sheet designed particularly for graziers in South Australia's central north east pastoral zone to provide a better understanding of the quality of the main plant species in that region , Productive Nutrition Pty Ltd 2005*

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