Improving sheep nutrition through assessment of regional feedbase deficiencies

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Key Messages

- The nutritional value and mineral content of a range of Mallee pastures was assessed in both 2020 and 2021 to provide a resource for more informed decision-making regarding livestock nutrition in the Mallee.
- Broadly, the pasture nutritive value followed typical trends of highest quality being observed during active growth (winter) and declining as the plants mature towards flowering and senescence.
- Comparative data across years has shown the influence of different timing of the break of season and stage of growth on nutritive value, which is especially important in the Mallee where seasons can be highly variable.
- Lucerne stood out as offering prolonged high protein content irrespective of season, while veldt grass was one of the poorer quality feeds. Canola and barley stood out as high-quality winter feeds.
- Mineral analyses showed that mineral content was mostly adequate, except in oats and barley in the winter and spring showing some Ca deficiency. It was of interest that cobalt and selenium were adequate in the majority of samples tested.
- Results have highlighted the importance of using feed tests to better understand the nutritive value of pastures in the Mallee, as well as improving our understanding of the Mallee feed base and the impact on livestock production.

Background

The low rainfall Mallee of New South Wales, Victoria and South Australia covers an area of approximately seven million hectares and is an important livestock and wool-growing area of Australia. Farmers in this region have identified that improving their understanding of the nutritive value of pastures in this environment can allow them to better manage their livestock and farm resources.

This project aims to achieve the following objectives:

- Identify the nutritional value and mineral content of a range of Mallee pastures and grazing crops including the variance between seasons over two years.
- Develop a dataset of the nutritional value and mineral content of low rainfall pastures for use by producers and industry.
- Increase producer confidence and decision-making ability in relation to sheep management through the development of region-specific feed base resources.
- Conduct grower events at the end of the project to extend results, with the aim to building database of farmers to target for participating in Lifetime Ewe Management.

About the trial

The six 'core' sample species were:

1. Barley
2. Lucerne

3. Peas
4. Veldt
5. Vetch
6. Regenerating natural pasture (medic base)

The five 'strategic' sample species were:

1. Canola
2. Lupins
3. Oats
4. Serradella
5. Regenerating natural pasture (grass base)

Some pasture samples were collected from commercial farming properties, however the majority were collected from existing research and development sites across the Mallee. **Error! Reference source not found.** shows the location and type of site for each sample species collected in the project.

Table 1 - sampling location and site type for each pasture or crop.

Pasture/Crop	Location	Site type
Barley	Kulwin, VIV	Cereal R&D
Lucerne	Turiff, VIC	Pasture R&D
Peas	Tempy, VIC	Pulse R&D
Veldt	Yarto, VIC	Commercial Farm
Vetch	Piangil, VIC	Pasture R&D
Regenerating natural pasture (medic base)	Piangil, VIC	Commercial Farm
Canola	Kulwin, VIC	Brassica R&D
Lupins	Tempy, VIC	R&D
Oats	Kulwin, VIC	R&D
Serradella	Piangil, VIC	Pasture R&D
Regenerating natural pasture (grass base)	Tempy, VIC	Commercial Farm

Sampling was expected to start in autumn of 2021, with sampling to be undertaken each successive season, representing different stages of growth. Due to the late break of the season (June 2021), autumn 2021 samples were not collected. Sufficient pasture for sampling sample was only available by July and the decision was made to skip the autumn sampling period. Samples were collected in winter (Jul/Aug), spring (Oct) and summer (Dec) of 2021.

Samples were collected by cutting plant material from each sample location using shears. The sample material was representative of the whole plant. Care was taken to avoid excessive soil material in the samples which could affect mineral analyses. The harvested material was immediately dried in a laboratory oven and subsequently sent to Feedtest laboratory (Werribee VIC) for nutritive value and mineral content analysis.

Results

The laboratory analyses of the pasture and crop samples submitted showed the nutritive value across the season declined as the plants matured and became senescent. This can be seen in Figure 1 as the energy and protein content declined from fresh winter growth to senescent dry summer feed.

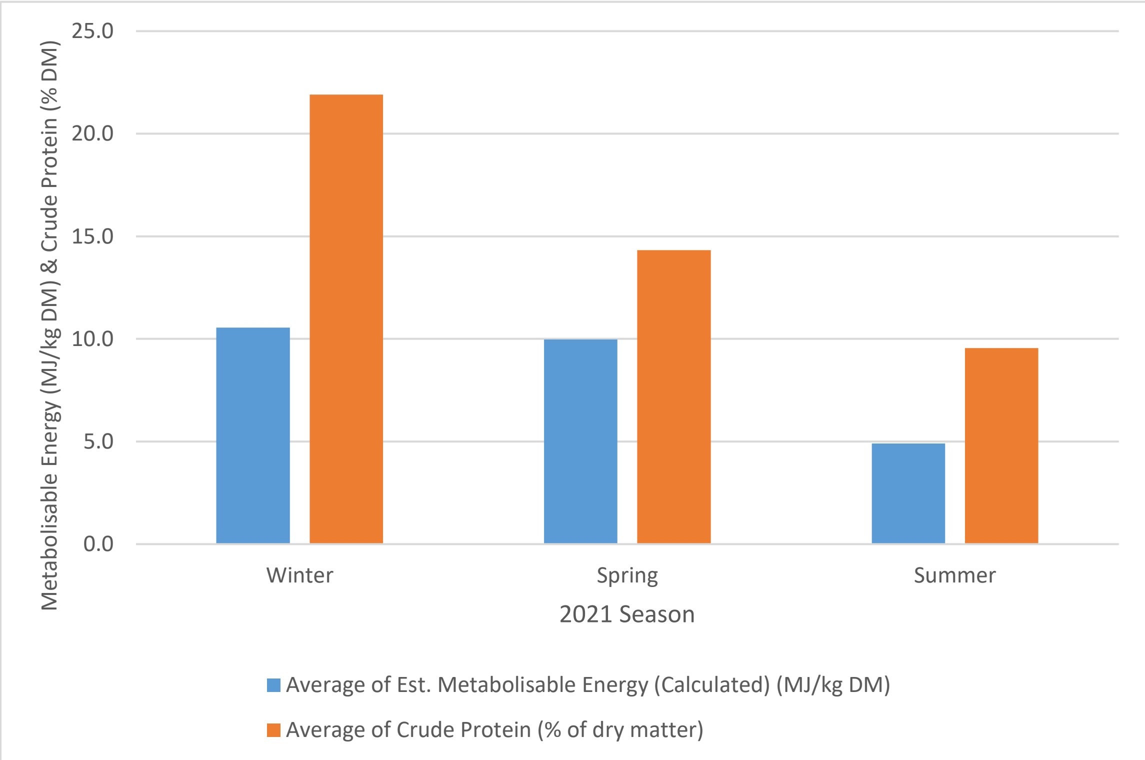

Figure 1 - Average metabolisable energy and crude protein content of all samples combined for each season.

The metabolisable energy content of the samples generally showed the same trend of declining from winter to summer across each individual species, however the level of decline varied between species (Figure 2). For example, vetch significantly declined from winter to summer, whilst lucerne was more stable in feed quality throughout the season.

The highest energy content species in winter included canola, barley and oats. The lowest energy content species included veldt grass and natural regenerating medic pastures.

Veldt showed an increase in energy content from winter to spring and then declined significantly to summer as dry feed. The winter growth of veldt had been slow and sampling also included some dry residual plant material which is likely to have affected the winter feed test results.

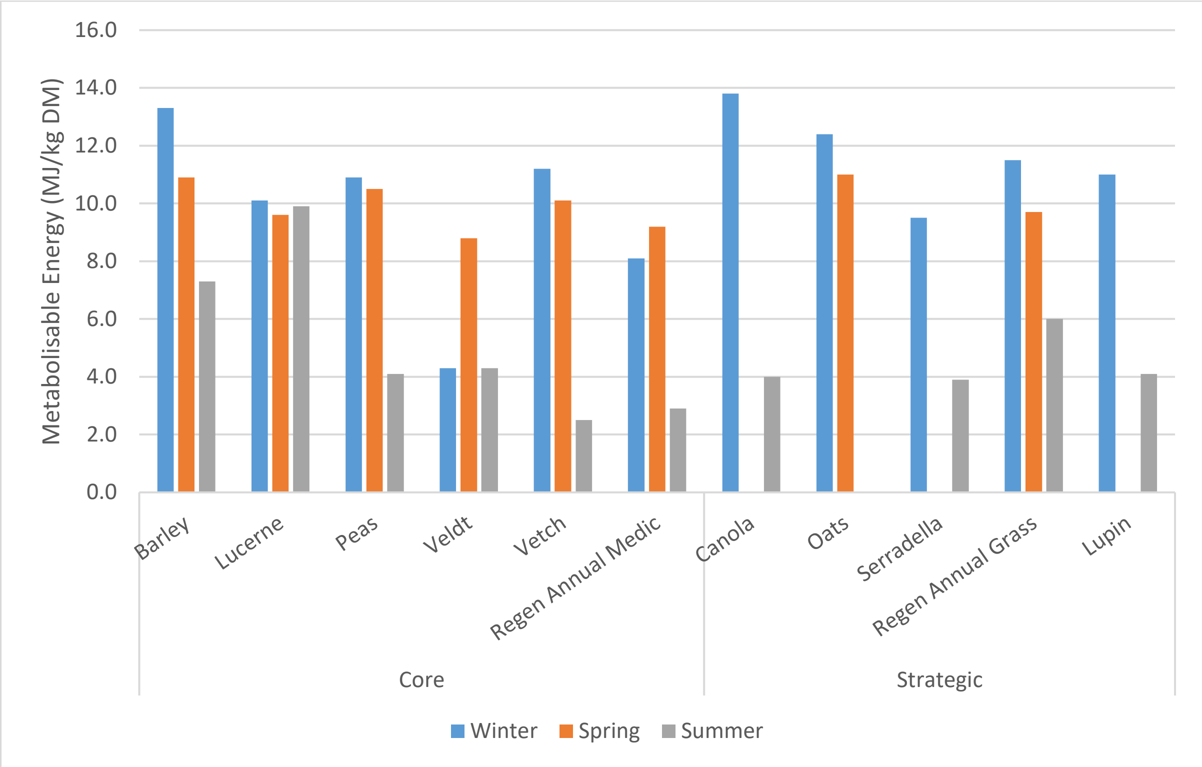

Figure 2 - Comparative metabolisable energy content of each species across seasons.

The crude protein content of different species again followed the trend of declining from winter to summer (Figure 3). In general, grass type species (barley, oats, veldt) showed lower protein content across all samples than compared to legume species (lucerne, peas, vetch).

Lucerne had the highest protein content of 34.1% in winter, while the summer veldt sample had declined to 5.1% to result in the lowest protein content tested of all species.

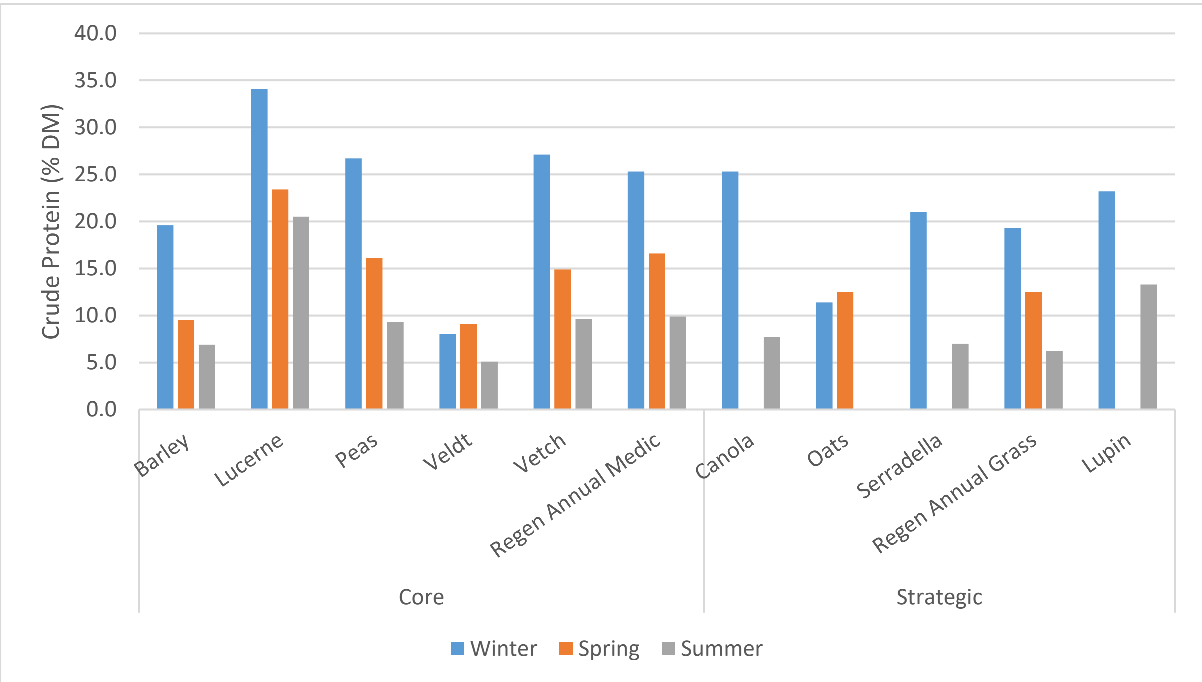

Figure 3 - Comparative crude protein content of each species across seasons.

All feed samples were also analysed for mineral content. The content of pastures for minerals such as calcium, magnesium, sulphur, cobalt, selenium and copper were assessed as the minerals typically of most interest to sheep producers.

Calcium content of all pastures were generally satisfactory in these samples as they reached the minimum required amount for sheep of 2000mg/kg DM, with many samples exceeding the typical upper reference range of 8000mg/kg Ca as well. Oats in winter and barley in spring were the only samples not to meet the minimum required level. In general, the cereals and grass pastures were lower in calcium content than legume species, with an exception being veldt grass that tested similarly to species such as lucerne, peas and vetch.

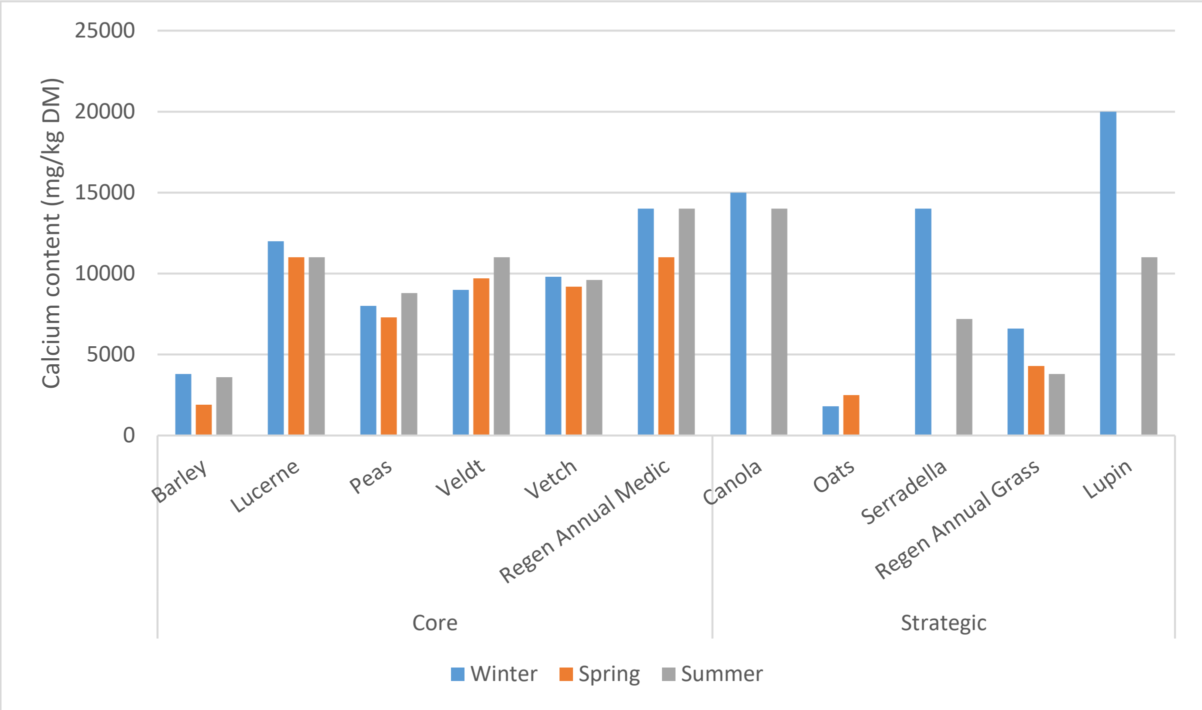

Figure 4 - comparative calcium content of each species across seasons.

Sulphur content of pasture during winter was largely within normal range for sheep (1400 – 2600mg/kgDM), with all samples except for oats above the minimum level. Canola in winter recorded the highest sulphur content of 4,300mg/kg DM. Spring and summer samples showed a significant number of deficiencies with 61% of samples deficient in sulphur.

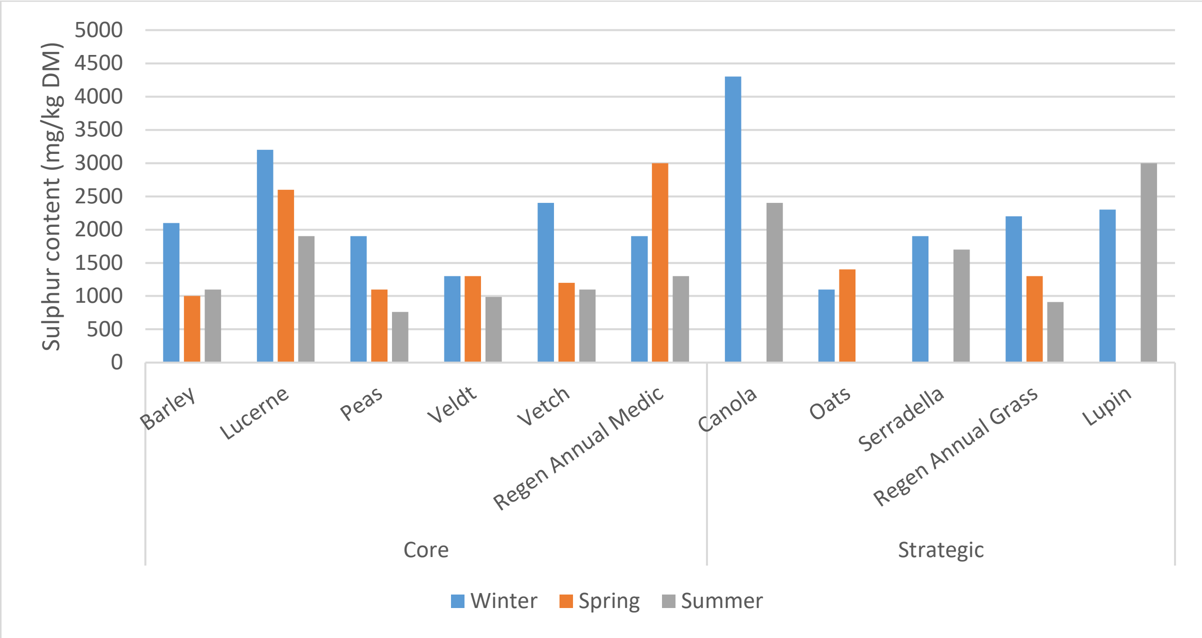

Figure 5 - comparative sulphur content of each species across seasons.

Cobalt content of pastures was highly variable, however mostly adequate for sheep, with 75% of samples above the minimum required level of 0.1mg/kg DM. Cobalt content of pasture typically was lowest in spring compared to winter and summer.

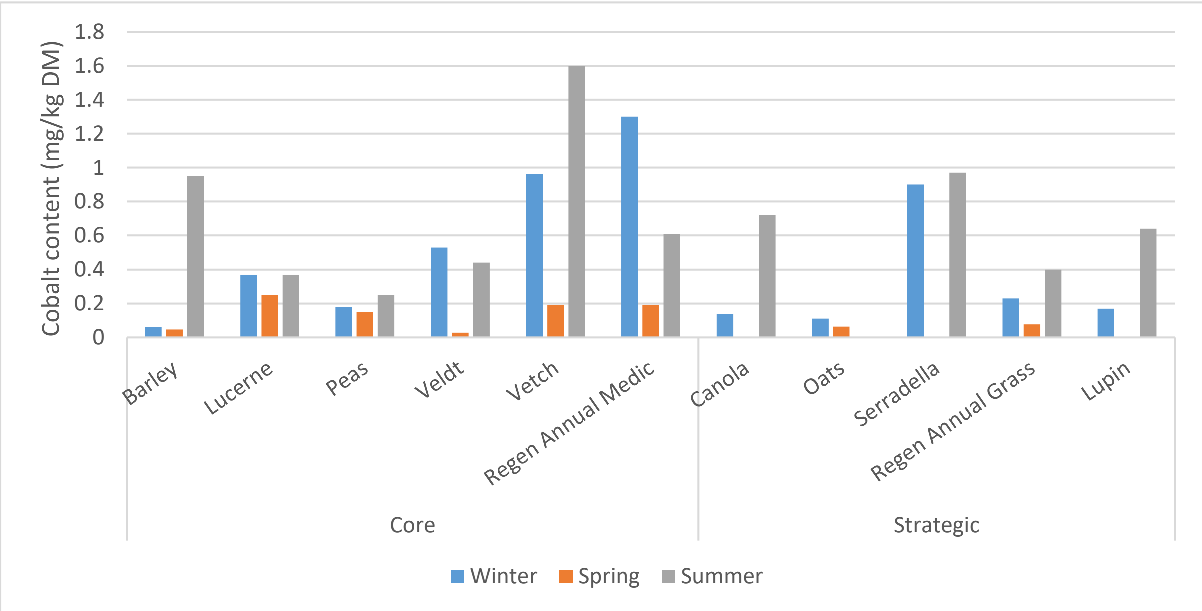

Figure 6 - comparative cobalt content of each species across seasons.

Copper content of the species tested showed high variability between species and season. Approximately half of the samples tested were considered deficient as assessed by the minimum required level of 5mg/kg DM.

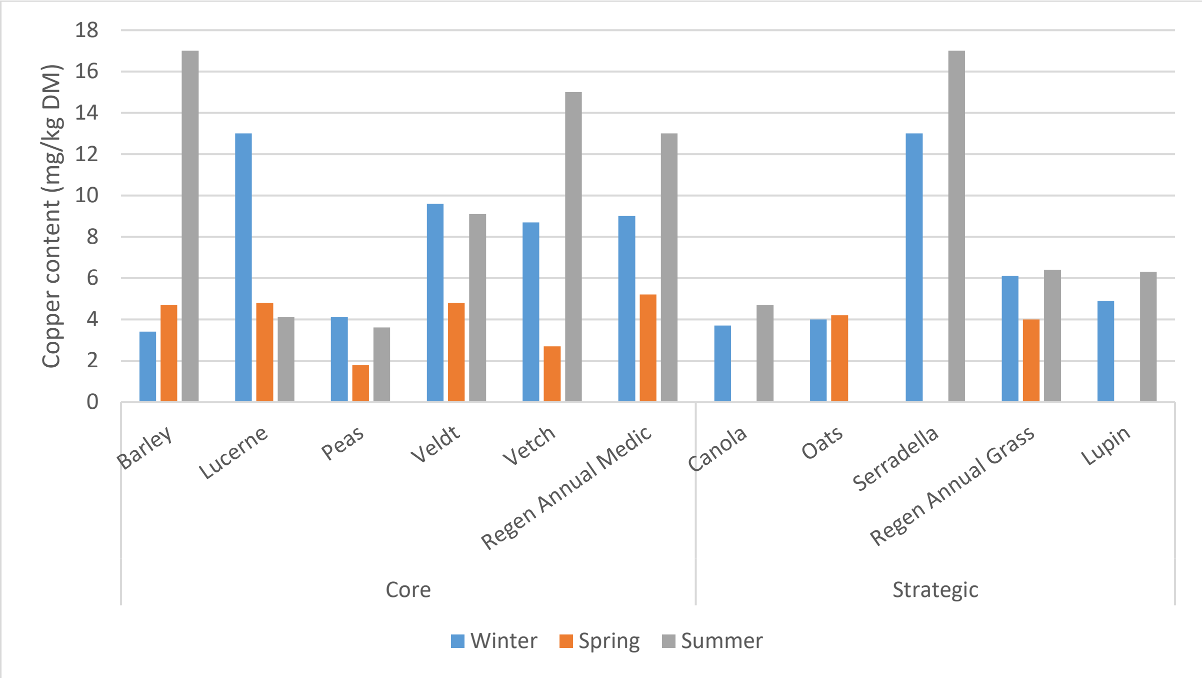

Figure 7 - comparative copper content of each species across seasons.

Selenium content of the pasture was adequate in all samples except for peas in winter, as well as peas, oats and barley in spring where the content was below the minimum required level of 0.1mg/kg DM. For many species that were tested each season, it was common for selenium content to decline from winter to spring and then increase to maximum level in summer. Lucerne was an exception to this trend that displayed the highest selenium content in winter.

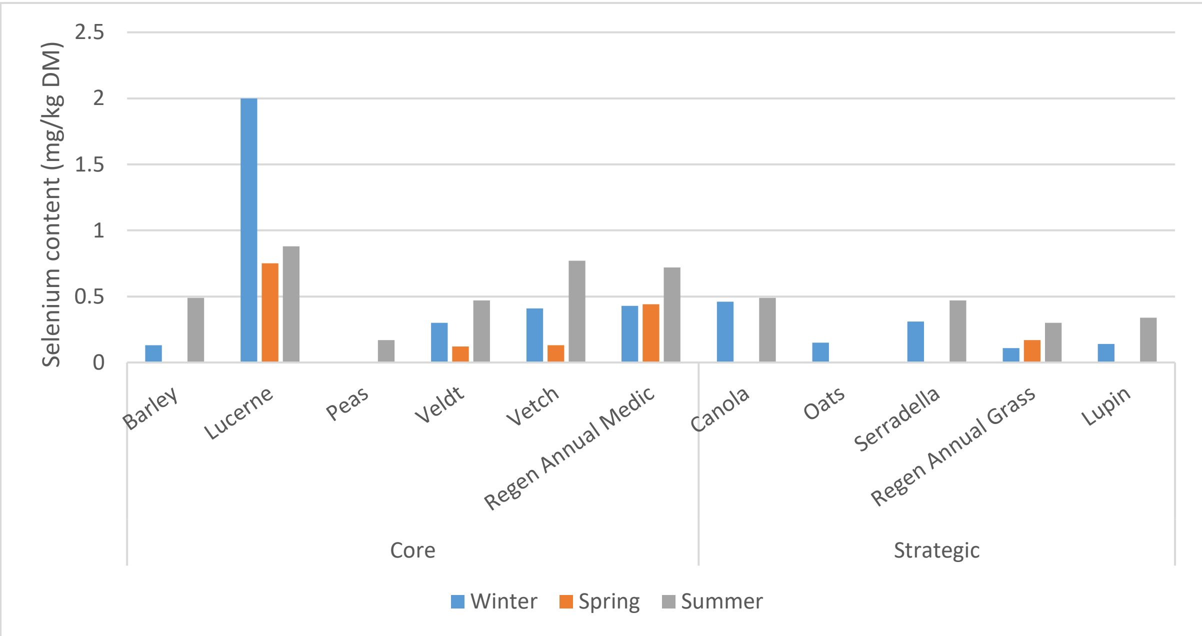

Figure 8 - comparative selenium content of each species across seasons.

Discussion

The results have demonstrated the value of feed testing pastures and crops intended for grazing as some findings are outside of the expected results such as particularly high energy content of winter barley and the relatively poor quality of the winter veldt.

However, there are also some findings that have followed expected trends such as the general seasonal change in quality from winter (early growth) to summer (dry senescent feed). This was demonstrated in Figure 1 and reflects the accepted change in quality shown in Figure 9 where a significant decline in nutritive value occurs as the plant progresses past reproductive stage (ie flowering).

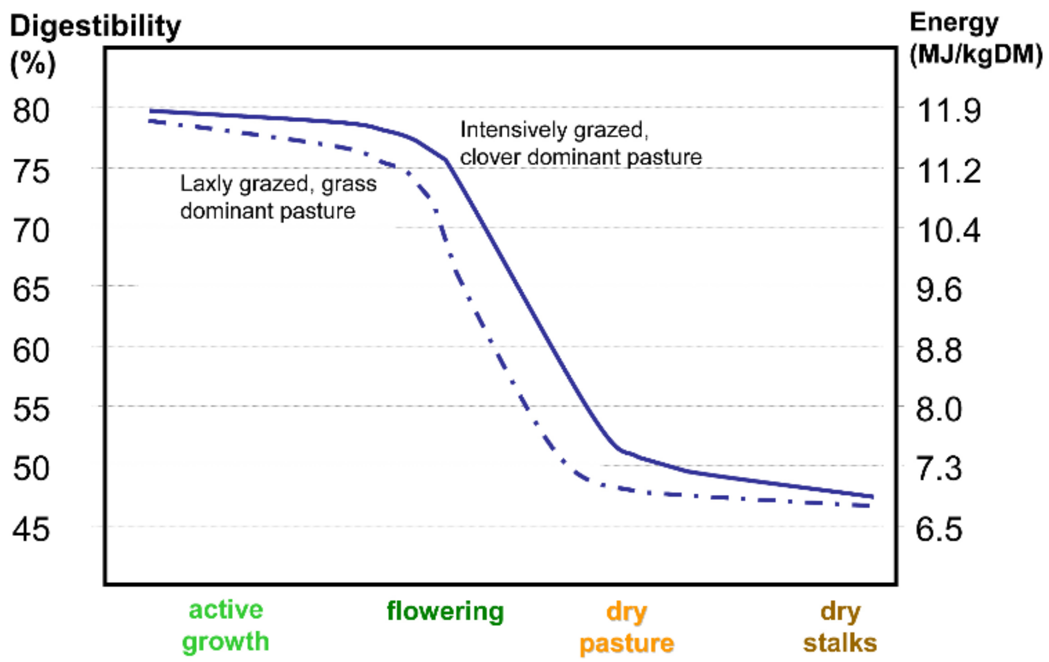

Figure 9 - change in feed quality of pastures for each stage of growth (source DAFWA).

Whilst most species declined significantly in quality from winter and spring to summer, lucerne was the standout species that from winter to summer maintained a relatively stable energy content and provided a protein content above 20% in each season (Figure 3). Whilst it would be expected that a plant species such as lucerne with some summer growth activity would maintain a higher quality in summer, these samples have demonstrated the extent to which it can provide a high quality summer feed resource compared to other species (Figure 10). One of the poorer quality summer feeds was veldt grass which declined to 4.3MJ ME/kg DM and 5.1% CP.

Figure 10 – Comparison of lucerne and veldt grass pasture sampled in summer 2021.

Veldt grass was one species that did not gradually decline in feed quality from highest quality in winter to lowest in summer. The feed value of veldt peaked in spring at 8.8ME compared to 4.3ME in winter and summer. The images in Figure 11 show the appearance of veldt at each sampling time. The green plant material suggests in each season there has been some level of recent growth. However from the winter sample in particular it would be expected that the grass would be greater than 4.3ME. This may suggest some level of inclusion of older dry plant material in the sample as well which would have reduced the overall feed quality of the sample.

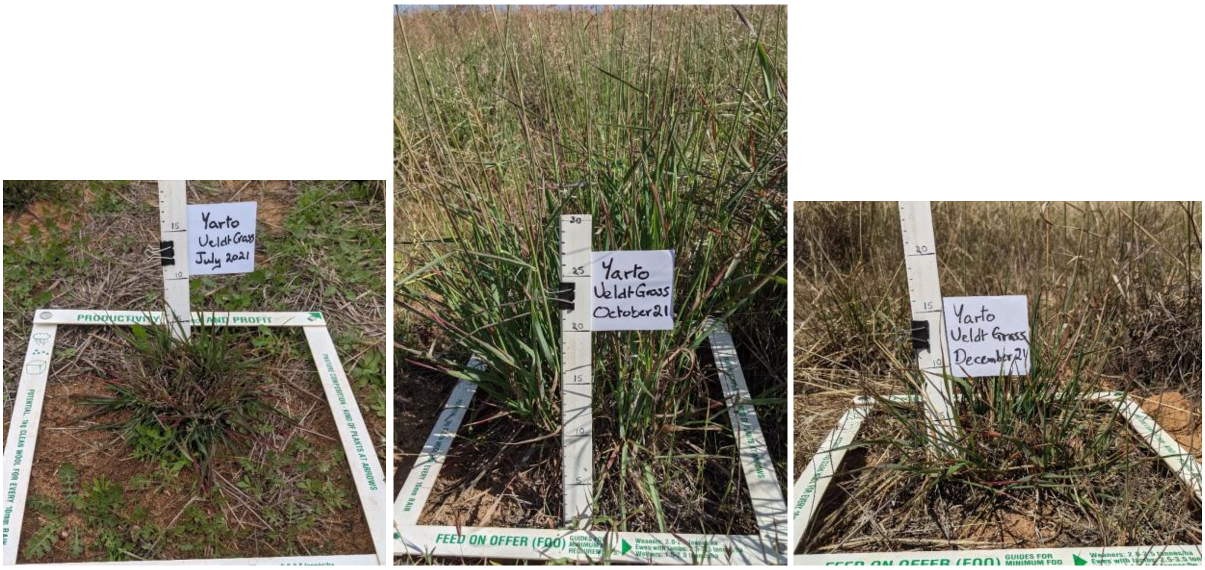

Figure 11 - comparative images of veldt grass in winter, spring and summer 2021.

Canola and barley were the standout species for winter feed quality, and this highlights an opportunity for tactical grazing of these species when seasonal conditions permit. This may be in a good season where grazing can be expected to have little effect on grain yield, or in low rainfall year it may present a grazing opportunity to extract value from a failed crop.

The mineral analyses showed several interesting findings that can impact substantially on farm management in the Mallee. Results have shown that minerals such as calcium were largely adequate, particularly in non-cereal species. The oats and barley samples showed some deficiencies and particularly if considering interactions from minerals such as potassium and sodium and magnesium, calcium supplementation for high demand animals such as pregnant or lactating ewes and young growing stock could still be considered important.

Many animal health products such as drenches and vaccines have additional selenium or vitamin b12 added to provide a supplement to stock. Cobalt is synthesised into vitamin b12 in the rumen and therefore if adequate levels of cobalt are available then adequate levels of vitamin b12 will be produced for the animal. Results from these analyses have shown that most samples in the Mallee were adequate for both selenium and cobalt, representing a possible significant saving in operational costs for producers using large quantities of these supplements. In addition, excess supplementation of selenium in particular can produce toxicity effects, and this has been observed previously in the Mallee where stock have been supplemented with selenium through a combination of drench, vaccine and loose lick products all containing selenium which created an animal toxicity as the feed base was already adequate for selenium levels.

These samples have assisted in identifying the nutritive value and mineral content of a range of Mallee pastures and crops. The results from these samples will be combined with the first-year project results to compare trends between years. This information will create a full dataset of the nutritional value of Mallee feeds for producers and industry to utilise as a standalone resource or included in packages such as Lifetime Ewe Management.

Acknowledgements

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Appendix

Table 1 – Laboratory tests results for nutritive value of Mallee pastures species in 2021.

Project sample season	Species	**Dry Matter %**	**Moisture %**	**Crude Protein (% of dry matter)**	**Acid Detergent Fibre (% of dry matter)**	**Neutral Detergent Fibre (% of dry matter)**	**Digestibility (DMD) (% of dry matter)**	**Digestibility (DOMD) (Calculated) (% of dry matter)**	**Est. Metab Energ (Calc (MJ/l**
Winter	Regen Annual Medic	87.4	12.6	25.3	22.6	42.4	56.2	54.5	
Winter	Lucerne	86.3	13.7	34.1	21.7	31.4	67.9	64.3	
Winter	Barley	38.8	61.2	19.6	16.5	29.7	86.6	80.2	
Winter	Vetch	86.9	13.1	27.1	23	34.6	74.4	69.8	
Winter	Veldt	89.6	10.4	8	41.8	66.6	33.8	35.5	
Winter	Regen Annual Grass	86.6	13.4	19.3	20.3	42.3	76.1	71.3	
Winter	Lupin	19.1	80.9	23.2	22.4	27.5	73.1	68.8	
Winter	Oats	86.2	13.8	11.4	18.7	40.4	81.3	75.7	
Winter	Canola	21	79	25.3	14.4	22.1	89.8	82.9	
Winter	Serradella	40.9	59.1	21	20.6	39.9	64.5	61.5	
Winter	Peas	28.5	71.5	26.7	25.7	34.7	72.9	68.6	
Spring	Regen Annual Medic	53.7	46.3	16.6	29.9	46.7	62.9	60.1	
Spring	Lucerne	43.2	56.8	23.4	28.8	34.5	65.2	62.1	
Spring	Barley	65.5	34.5	9.5	20.5	45.7	72.5	68.2	
Spring	Vetch	55.9	44.1	14.9	26.1	40.7	68.3	64.7	
Spring	Veldt	79.5	20.5	9.1	34.8	64.7	60.3	57.9	
Spring	Regen Annual Grass	55.9	44.1	12.5	30.4	54.6	65.8	62.6	
Spring	Peas	40.2	59.8	16.1	26.2	38.7	70.4	66.5	
Spring	Oats	45.5	54.5	12.5	22.7	43.3	73.5	69.1	
Summer	Regen Annual Medic	92.5	7.5	9.9	47.1	68.5	26.4	29.2	
Summer	Lucerne	89.2	10.8	20.5	25.9	36.6	66.9	63.5	
Summer	Barley	91.5	8.5	6.9	36.6	69.1	52	50.9	
Summer	Vetch	93.6	6.4	9.6	55.5	71.8	23.7	26.9	
Summer	Veldt	92.5	7.5	5.1	46	74	34.4	36	
Summer	Regen Annual Grass	91.4	8.6	6.2	44.4	74.3	44.4	44.4	
Summer	Lupin	89.8	10.2	13.3	41.2	54.4	33	34.8	
Summer	Canola	92.8	7.2	7.7	48.4	66	32.9	34.7	
Summer	Serradella	91.3	8.7	7	40.1	64.2	32.1	34	
Summer	Peas	92	8	9.3	48.2	68.9	33	34.7	

Table 2 - Laboratory test results for mineral content of Mallee pasture species in 2021.

Project sample season	Species	Boron (mg/kg of dry matter)	Calcium (mg/kg of dry matter)	Cobalt (mg/kg of dry matter)	Copper (mg/kg of dry matter)	Iron (mg/kg of dry matter)	Potassium (mg/kg of dry matter)	Magnesium (mg/kg of dry matter)	Manganese (mg/kg of dry matter)	Molybdenum (mg/kg of dry matter)	Sodium (mg/kg of dry matter)	Phosphorus (mg/kg of dry matter)	Sulphur (mg/kg of dry matter)	Selenium (mg/kg of dry matter)	Zinc (mg/kg of dry matter)
Winter	Regen Annual Medic	28	14000	1.3	9	2900	24000	3200	110	3.7	1000	2000	1900	0.43	23
Winter	Lucerne	52	12000	0.37	13	310	28000	3100	36	1	2300	4100	3200	2	27
Winter	Barley	7.8	3800	0.06	3.4	160	24000	1600	20	0.96	4800	2700	2100	0.13	8.1
Winter	Vetch	29	9800	0.96	8.7	1400	27000	2500	76	2.5	3700	3100	2400	0.41	26
Winter	Veldt	13	9000	0.53	9.6	1300	6000	1500	43	5.2	690	780	1300	0.3	26
Winter	Regen Annual Grass	11	6600	0.23	6.1	640	36000	1400	83	3	770	4500	2200	0.11	17
Winter	Lupin	27	20000	0.17	4.9	210	25000	4400	150	1.2	270	4400	2300	0.14	23
Winter	Oats	5.9	1800	0.11	4	210	21000	1400	27	2	5700	2900	1100	0.15	15
Winter	Canola	23	15000	0.14	3.7	230	35000	4000	30	1.6	300	3900	4300	0.46	19
Winter	Serradella	34	14000	0.9	13	1800	27000	3000	79	7.5	2100	2300	1900	0.31	31
Winter	Peas	17	8000	0.18	4.1	160	31000	2200	36	1.2	250	4300	1900	<0.1	22
Spring	Regen Annual Medic	34	11000	0.19	5.2	850	16000	2400	78	2.3	1400	2400	3000	0.44	20
Spring	Lucerne	62	11000	0.25	4.8	100	14000	2500	61	0.44	600	1300	2600	0.75	15
Spring	Barley	3.9	1900	0.046	4.7	140	11000	1300	34	0.49	870	1200	1000	<0.1	12
Spring	Vetch	26	9200	0.19	2.7	390	12000	2200	34	0.72	280	1900	1200	0.13	15
Spring	Veldt	4.9	9700	0.028	4.8	130	21000	1400	34	2.2	2000	570	1300	0.12	33
Spring	Regen Annual Grass	17	4300	0.076	4	320	19000	1500	61	0.65	790	2000	1300	0.17	13
Spring	Peas	24	7300	0.15	1.8	140	11000	2100	66	0.26	290	2200	1100	<0.1	21
Spring	Oats	18	2500	0.063	4.2	90	23000	1800	91	0.35	7900	1400	1400	<0.1	21
Summer	Regen Annual Medic	33	14000	0.61	13	1700	2400	1500	39	7.4	120	1700	1300	0.72	23
Summer	Lucerne	49	11000	0.37	4.1	140	21000	1700	32	0.82	130	1700	1900	0.88	20
Summer	Barley	40	3600	0.95	17	1700	5100	1100	41	11	5800	1600	1100	0.49	32
Summer	Vetch	36	9600	1.6	15	3500	2300	1300	84	10	350	930	1100	0.77	27
Summer	Veldt	16	11000	0.44	9.1	1300	5700	1100	39	4.8	660	490	990	0.47	25
Summer	Regen Annual Grass	12	3800	0.4	6.4	940	3900	1000	42	3	200	1200	910	0.3	17
Summer	Lupin	29	11000	0.64	6.3	1100	20000	2900	110	3.2	3400	1100	3000	0.34	24
Summer	Canola	32	14000	0.72	4.7	2200	11000	1800	44	2.5	6300	1200	2400	0.49	21
Summer	Serradella	51	7200	0.97	17	2200	5700	1900	71	9.3	3700	1500	1700	0.47	31

Summer	Peas	25	8800	0.25	3.6	470	2700	1300	32	1.7	140	1000	760	0.17	9.1

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