

Why Mineral Supplementation on Cereal Crops is Essential this Winter

Grazing winter cereal crop is popular as it meets a feed gap in our region and offers a large amount of dry matter that is very good quality. Wheat crops tested across the region could be expected to have >13.5MJ ME/kgDM and >30% crude protein (see table 1):

			0001
Results	Units	LOR	Wedgetail Wheat
Dry Matter	%	0.5	19.1
Neutral Detergent Fibre	%	10	48
Acid Detergent Fibre	%	4	23
*Water Soluble Carbohydrate	%	4.0	9.5
Crude Protein	%	2.0	31.1
Inorganic Ash	%	3	12
Organic Matter	%	75	88
DMD	%	39	89
DOMD	%	38	83
*AFIA Grade			NO GRADE
Metabolisable Energy	MJ/kg DM	4.3	13.8

Table 1: Example feedtest from a Wedgetail Wheat crop

While there are great benefits to grazing these lush crops, there are also risks, and in recent weeks our District Vets have had calls to dead sheep and cattle on cereal crops. These deaths are mainly due to mineral deficiencies – specifically calcium and magnesium deficiency in unsupplemented stock.

It is well acknowledged that cereal crops are low, or marginal in these minerals, as measured in the 2006 Grain and Graze trials (see table 2), which describe the levels in the crop, compared with the requirement for growth in young sheep¹

Item	Mineral, % DM			
	Mg	Ca	K	Na
<i>Requirement for growth</i>	0.12	0.15	0.50	0.05
<i>Forage content</i> range, Experiments 1-4	0.10-0.17	0.15-0.30	2.96-3.50	0.005-0.05

Table 2: Mineral concentrations in wheat forage in relation to requirements for growth in young sheep

Furthermore, a 2017 survey of 18 farms grazing crops² with pregnant ewes indicated a high proportion of grazed crops had forage calcium (Ca), sodium (Na) and magnesium (Mg) below published requirements and potassium (K) above the published maximum tolerable level.

In addition to the frank deficiencies in Ca and Mg, the extremely high K level and very low Na content result in a very high ruminal K:Na ratio, which is known to greatly impede micromineral absorption³.

So why are these minerals so important?

Calcium is not only a major component of bones and milk, but is involved in a wide variety of physiological processes in the body including muscular contraction, blood coagulation, enzyme activity, nervous function and hormone secretion. Calcium deficiency (also known as milk fever) in heavily pregnant or lactating livestock (especially ewes), but growing stock and dry stock can also be affected⁴.

Similarly, magnesium is involved in many physiological processes in the body, including muscle contractions and brain function. Magnesium deficiency, also known as grass tetany is most commonly seen in older, lactating cows, but it also can be seen in other classes of livestock⁵

Both deficiencies can present as sudden death in stock, or stock that go down, have muscle tremors and in the case of magnesium deficiency some pretty spectacular neurological signs such as staggering, bellowing and convulsions.

The solution is always to provide mineral supplementation when grazing cereal crops. A dry lick that contains a source of calcium, magnesium and sodium is a good idea – you can mix your own or purchase a pre-mixed commercial preparation. Your local District Vet can provide assistance in recommending the correct supplement for your local area and grazing situation.

If saving lives, and keeping your vet happy, wasn't a good enough reason to supplement with minerals on crop, here's the clincher: grazing trials have proven massive improvements in weight gains when livestock are supplemented^{1,6,7}.

In the 2006 Grain & Graze project, a combined Mg/Ca/Na supplement led to a 54% increase in lamb liveweight gain, compared with unsupplemented lambs grazing a dual-purpose wheat crop. Further experiments were then conducted to separate the responses to Mg or Na, which resulted in an increased liveweight gain of 24 and 37% respectively. Increases in liveweight gains were also measured when animals were supplemented with straw only while grazing the cereal crop¹. Other studies have shown that in both sheep and cattle, mineral supplementation has resulted in increases in liveweight gain of 15-60%⁷.

These experiments prove the benefits of mineral supplements, both from an animal health and a production perspective, and they assume the impressive results are due to correction of dietary deficiencies.

I do wonder if that is the entire story though, and postulate that some of the benefits might be due to the rumen buffering ability of these supplements. We know that a crop that is lush, green and rapidly growing will be readily fermentable, high in water soluble carbohydrates and low in effective fibre. Ingestion of a large volume of this diet will cause high levels of volatile fatty acid (VFA) concentrations in the rumen, which as their name suggests are acids, causing a slight drop in rumen pH.

Most of the mineral supplements discussed are either basic in their very nature, or are salt based which makes the animals salivate, causing the recycling of sodium bicarbonate into the rumen, creating a more neutral pH which is the optimum environment for rumen microbes to do their best

fermentation. A similar effect can be achieved with straw, except that this fills up valuable rumen space with feed that is poorly nutritious, hence the better results achieved with licks.

Further evidence of this rumen buffering theory may possibly be seen in a recently published study which looked at feeding lambs a diet of perennial wheat, annual wheat; or mixing these two wheats with lucerne. No mineral supplements were provided to any of the groups. The addition of the lucerne to the diets increased the Ca and Mg intake, however, did not improve liveweight gains⁸. Whether this is due to the rumen still being filled with a lush, readily fermentable, low fibre diet resulting in a suboptimal rumen pH; or the fact that the Na deficiency and Na:K ratio was unresolved by the addition of the lucerne, it is hard to say, but worthy of thought.

Regardless of the reasoning behind the impressive benefits, it is well worth embracing the magic (and a little bit of science!) that is the rumen putting out some mineral supplements. If you're grazing a crop this winter, or about to put stock onto one, give your local District Vet a call to discuss the options for supplementation in your environment.

References:

1. Dove, H., McMullen, G., Kelman, W. M. (2007). Growth rate responses to magnesium or sodium supplements in lambs grazing dual-purpose wheats. *Journal of Animal and Feed Sciences*, 16(Suppl. 2), 465-470. <https://doi.org/10.22358/jafs/74583/2007>
2. Masters David G., Hancock Serina, Refshauge Gordon, Robertson Susan M., McGrath Shawn, Bhanugopan Marie, Friend Michael A., Thompson Andrew N. (2018) Mineral supplements improve the calcium status of pregnant ewes grazing vegetative cereals. *Animal Production Science* 59, 1299-1309. <https://doi.org/10.1071/AN17403>
3. Martens H, Kubel OW, Gabel G, Honig H (1987) Effects of low sodium intake on magnesium metabolism of sheep. *Journal of Agricultural Science, Cambridge* 108, 237–243.
4. Blackwood, I. (2009). Assessing stockfeed additives and mineral supplements. NSW DPI Primefact 656. [Assessing stock feed additives and mineral supplements \(nsw.gov.au\)](https://www.nsw.gov.au/assessing-stock-feed-additives-and-mineral-supplements)
5. Elliott, M. (2009). Grass tetany in cattle. NSW DPI Primefact 240. [Grass tetany in cattle \(nsw.gov.au\)](https://www.nsw.gov.au/grass-tetany-in-cattle)
6. Dove H., McMullen K. G. (2009) Diet selection, herbage intake and liveweight gain in young sheep grazing dual-purpose wheats and sheep responses to mineral supplements. *Animal Production Science* 49, 749-758. <https://doi.org/10.1071/AN09009>
7. Dove H, Kirkegaard J, Kelman W, Sprague S, Hamblin P (2011) Integrating dual-purpose crops – capturing the whole-farm benefits. In 'Grains Research Technical Update, Young, NSW, 15–16 February 2011'. (Eds K Toomey, J Crane) pp. 141–148. (ORM Communications: Bendigo, Vic.)
8. Matthew T. Newell, Benjamin W.B. Holman, Gordon Refshauge, Alexandra R. Shanley, David. L. Hopkins, Richard. C. Hayes (2020). The effect of a perennial wheat and lucerne biculture diet on feed intake, growth rate and carcass characteristics of Australian lambs. *Small Ruminant Research*, Volume 192, 106235. <https://doi.org/10.1016/j.smallrumres.2020.106235>