

Micronutrients for sheep health and productivity

Meat and Livestock Australia estimates copper deficiency could be costing southern Australian sheep producers more than \$15 million a year.¹ It can cause slow animal growth rates, reduced wool quality, sway back or lack of muscle co-ordination in lambs, scouring, lameness and infertility.

Even if you are not in a known copper deficient area, you should understand the mechanism of both primary and secondary deficiency. Primary copper deficiency occurs when a soil with low copper levels produces a pasture with low copper levels and therefore the sheep also have low levels.

Secondary deficiency occurs due to the antagonistic relationship of copper with other nutrients. Molybdenum, sulfur and iron can all reduce the availability of copper to animals by forming insoluble complexes. They can act alone or in combination.

This means graziers who are improving the productivity of their pastures – by liming, lifting phosphorus fertility with SuPerfect®, or applying molybdenum – may be inadvertently reducing the copper available to their sheep.

MOLYBDENUM

Molybdenum is essential for the formation of enzymes in legumes which regulate nitrogen metabolism and promote root nodulation and nitrogen fixation. However, it is only required in small amounts. If molybdenum becomes excessive relative to copper in the pasture, this excess molybdenum could then combine with sulfur in the sheep to form thiomolybdate complexes. These readily bind to copper, making it unavailable for absorption and inducing copper deficiency.

When applying molybdenum, care should be taken to ensure copper levels in pasture are also adequate. Options include plant tissue testing to assess copper levels, applying a fertiliser that supplies both molybdenum and copper or considering copper feed supplements, drenches or injectables on the advice of a veterinarian or animal health adviser.

Be aware that molybdenum levels can increase with liming. Liming increases the pH which in turn increases molybdenum availability to the plant. If you are liming, it is not recommended to apply molybdenum in the same year. Wait and check the molybdenum levels with a plant tissue test.

SULFUR

Sulfur also has the potential to interrupt the availability of copper to sheep. Sulfur can bind with copper within the animal to form

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copper monosulphide, which can't be absorbed. Where SuPerfect® (11% sulfur) or other high sulfur pasture fertilisers are used at rates which increase soil sulfur levels, this has the potential to decrease copper availability.

IRON

The ingestion of iron can also have an effect, although less is known about this interaction. High levels of iron in relation to copper (100:1) or diets containing over 150 mg of iron/kg of dry matter are likely to reduce copper availability. Be aware that iron levels can often be inflated in tissue test results because of dust contamination, so if testing for iron the sample may need to be washed with distilled water.

CRITICAL VALUES

The critical tissue copper levels for sheep are shown in Table 1. As the pasture copper concentration decreases, or the copper to molybdenum ratio decreases, copper deficiency in livestock becomes more severe. At a copper to molybdenum ratio of more than 5:1, the adequate concentration of copper in pasture tissue is more than 7 mg of copper per kilogram of dry matter.

TISSUE TESTING

If you suspect copper deficiency, make sure you conduct a tissue test before deciding on a course of action. The Meat and Livestock Australia review of copper deficiency found leaf tissue testing was the most useful and cost-effective way to identify a potential copper deficiency. It also has the advantage of being able to assess the influence of other minerals. Blood tests were found to be a poor indicator of copper status in livestock. Liver biopsies are effective in determining an animal's copper status, but there are obvious limitations with this approach.

The Nutrient Advantage® laboratory offers a complete pasture tissue testing service for graziers and their advisers. Tissue tests can be done at any time, but they are usually conducted in winter or spring when the pasture is actively growing and it's easy to select a good representative sample.

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Table 1: Watch points for pasture copper concentration and pasture Cu:Mo ratio.

Deficiency state	Pasture Cu concentration	Pasture Cu:Mo ratio	Action required
Adequate	>7 mg/kg DM	>5:1	N/A
Marginal	7 mg/kg DM	5:1	Continue monitoring pasture mineral concentration and observe for any levels of reduced productivity in the flock.
Moderate	5 mg/kg DM	3:1	Consider supplementation to coincide with timing of deficiency, particularly where signs of reduced productivity are observed in the flock.
Severe	3 mg/kg DM	2:1	Supplementation with copper is required to ensure adequate animal health and productivity.

Source: Copper deficiency: a review of the economic cost and current constraints to effective management of copper deficiency in southern Australian sheep flocks, by Hamish Dickson, published by Meat and Livestock Australia Limited, 2016.

FERTILISER STRATEGIES

If you need to apply copper there are several options (including granule blends or spray on coatings), depending on product and rate requirements. Typically, copper is applied to the soil at 1 to 2 kg/ha. How long the application remains effective will depend on climate, soil, and nutrient management.

If copper has not been applied to a pasture for a number of years, it could be worth considering applying a low rate with the autumn

SuPerfect application, followed by a tissue test in winter or spring to assess copper levels in the pasture.

Animal health experts may also suggest products such as copper licks, blocks, water additions, feed additives, rumen boluses, drenches and injectables. Make sure you are sharing information between your veterinarian and pasture adviser so as not to double up on copper.

If your pastures also need molybdenum and boron make sure you tissue test, then if required, apply with an autumn or spring topdress fertiliser application.

Incitec Pivot Fertilisers is establishing a trial in western Victoria near Naringal this year on a perennial ryegrass and white clover pasture with sub-optimal copper and boron values. The farmer has reported young animals breaking bones due to copper deficiency. The trial will assess pasture responses to different copper and boron fertiliser products, rates and combinations with molybdenum and sulfur. We look forward to bringing you the results of this trial work.

FURTHER INFORMATION

In the meantime, if you have any queries or would like to discuss copper or other micronutrients in more detail, please contact me at lee.menhenett@incitecpivot.com.au or 0412 565 176.

REFERENCES

Copper deficiency: a review of the economic cost and current constraints to effective management of copper deficiency in southern Australian sheep flocks, by Hamish Dickson, published by Meat and Livestock Australia Limited, 2016.

