Nutrient Advantage®
AGRONOMY COMMUNITY

Agronomic Insight
16 February 2018

Could copper be holding your crops back?

By Craig Farlow - Technical Agronomist

Given what's invested in growing crops these days, growers can ill-afford to risk reduced yields due to trace element deficiencies.

Many soils in the southern Australian cropping zone are known to be inherently deficient in one or more trace elements.

Although they are only required in very small quantities, trace elements are no less essential than the macro elements (NPKS) for healthy and productive crops.

In fact, copper deficiency is capable of causing almost total crop failure.[1]

Growers are acutely aware that, with an increase in cropping intensity and the high yields that have been achieved in recent years, more nutrients are being exported out the farm gate in grain and hay than ever before.

With increasing demands on cropping soils, it comes as no surprise that growers might suspect a micronutrient deficiency to be at the heart of an unhealthy crop, lacking in colour and growth.

This is especially true when crops come under stress, be that a dry spell or prolonged waterlogging event.

The root cause of non-performing areas within cropping paddocks can be many and varied.

Copper deficiency is one such issue that appears to have re-emerged in recent years among symptoms that could easily be associated or confused with drought, disease or frost damage.

The effects of copper deficiency can be seen in the crop on the right, which did not receive a copper spray.

There are numerous reasons copper deficiency may be re-surfacing.

Although copper lasts a long time in the soil, previous soil applications of copper made many years ago may be running down.[1] Foliar applications of copper, although effective for correcting any immediate deficiency, have little to no residual effect and need to be reapplied in the following crop.

Increased fertiliser use, particularly nitrogen, has increased yield potential and copper demand. Conversely, a nitrogen deficiency can have the opposite effect, impeding the movement of copper within wheat from old to young tissue.[2]

More regular zinc applications to soils with low copper levels may also be leading to competition for uptake.

Dry conditions are often associated with limited copper availability, especially in top soils prone to drying out. A lack of soil moisture restricts both the movement of copper into the roots (by diffusion), as well as the ability of roots to explore the soil. These effects can be temporary with crops recovering as conditions improve.

Poor spatial distribution and limited soil mixing of copper fertilisers may be another factor affecting plant availability of copper under modern minimum-tillage systems.

Copper deficiency is seen here by the leaf tips dying back and twisting into curls.

Identifying a need for copper

Copper deficiency rarely produces characteristic symptoms in plants in the field.[1]

Severe copper deficiency symptoms in cereals typically cause the leaf tips to die back and twist into curls. Delayed heading, empty or partially-filled heads and early senescence indicate the damage is already done.

More common, slight to mild copper deficiencies can easily go undiagnosed, resulting in grain yield losses of up to 20% and thousands of dollars' worth of lost income potential annually.

Cereals such wheat, barley and oats are more sensitive to low soil copper levels than canola, which is more efficient at accessing copper.[3]

Neither past responses to copper fertiliser, nor a lack of copper fertiliser applications are a reliable guide to copper requirements. Seasonal conditions, both dry or very wet, can have a significant bearing on whether a copper response experienced in one year may appear in subsequent crops.[2]

This highlights the importance of tissue testing as the most effective way to diagnose a micronutrient deficiency.

Tissue testing can be used routinely to confirm any 'hidden hunger' in crops, especially those which are well supplied with nitrogen and have a high yield potential.

Increasingly, precision agriculture (PA) crop monitoring and mapping tools are proving very useful in detecting and quantifying areas of crop variability across fields. Weak sections are more easily identified and investigated, using tissue testing to diagnose any possible nutrient deficiency.

Growers should aim to conduct tissue testing in cereals from mid tillering (fifth to eighth leaf stage). Copper concentrations below 1.5 mg/kg in YEBs of cereals are considered deficient.[1]

Supplying copper

Copper needs to be available throughout the life of the crop.

Although foliar applications are a cheap and effective means of overcoming any immediate copper deficiency, timing is critical and applications must match plant demand.

Early booting stage (GS41) is the most critical stage for copper supply as this is when pollen is formed. Two foliar applications of copper, one at late tillering and another pre-booting, may be required to treat severe copper deficiency.

Soil applications have traditionally been considered the best long-term strategy for correcting the problem in crops and pastures. The residual value of soil applied copper can last many years depending on the rate applied and the nature of the soil to 'fix' copper. [2]

Like zinc, copper is immobile in the soil and there is very limited movement of it via diffusion towards the roots. Uptake of copper from the soil and into the plant relies greatly on roots seeking out copper in the soil (root interception).

In practice, this means that the copper fertiliser and the seed need to be in close proximity. Copper fertiliser placed within 2 cm of the seed increased uptake and biomass production of young wheat in a well-watered copper-deficient soil.[4]

A copper trace element coating on a MAP and urea blend (left).
Blending and coating copper on despatch at Incitec Pivot Fertilisers' Port Lincoln PDC (right).

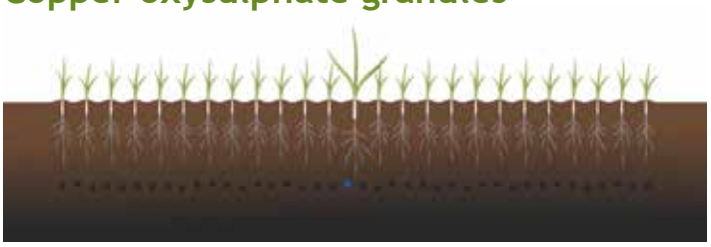
Methods for applying copper fertiliser to soils include:

- Copper oxysulphate granules (25% Cu) dry blended with starter fertiliser. The high copper concentration keeps application rates down, but provides very few granules along the seed row. Depending on the rate used, it can be in the order of one or two granules/100 cm of row.
- SuPerfect Cu Concentrate (4% Cu) dry blended with the starter fertiliser. This lower analysis compound fertiliser improves the number of point sources of copper along the seed row to approximately 1 granule/10 cm row), but increases the application rates required. Compatibility can be an issue in some blends.
- Trace Element Coating onto starter fertilisers and blends. Provides copper on every granule and depending on the rate of application, many point sources along the seed row (~1 granule/1-2 cm row). The coating can be applied on despatch during the blending and fungicide application process. Commonly 0.3% to 0.5% copper is applied on to the starter fertiliser. (see picture)
- Liquid banding providing a constant stream of copper along the seed furrow. This provides the best spatial distribution and rate flexibility for applying copper. On the down side, growers have the cost of fitting a liquid injection system. Once set up for liquids, however, growers have the ability to liquid band other nutrients at the same time, as long as they are compatible.

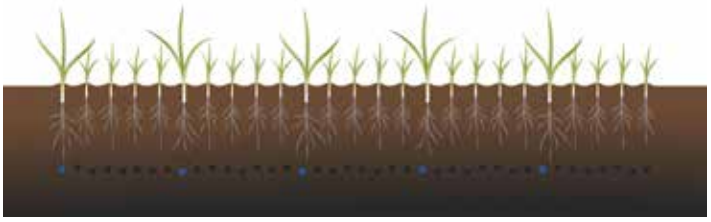
Where copper deficiency is confirmed by tissue testing, a corrective foliar copper spray can be applied before flowering, followed by a soil application of granular copper fertiliser for next year's crop.

For more information on copper fertiliser options or potential copper deficiency, feel free to give me a call on 0407 342 103 or send me an email at craig.farlow@incitecpivot.com.au.

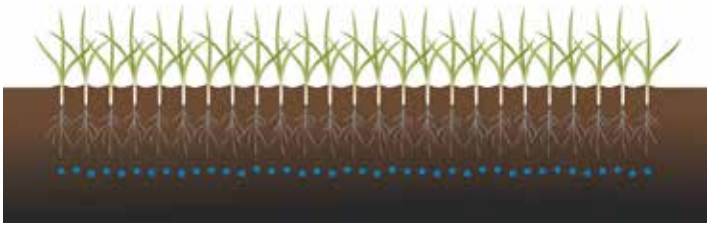
Copper oxysulphate granules



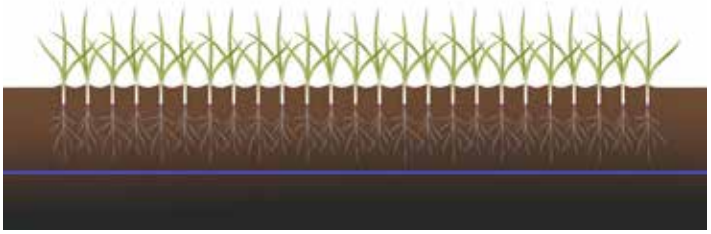
SuPerfect Cu Concentrate



Trace Element Coating



Liquid Banding



References:

[1] *Wilhem et al, 2016 'Detecting and managing trace element deficiencies in crops', GRDC Project DAS001146*

[2] *2013 'Copper as a nutrient for agricultural crops in southern Australia', Project: Diagnostic Agronomy. Accessed from: http://www.croppro.com.au/resources/Review%20Copper%2026082013.pdf*

[3] *Lee, N. 2016 'Time right to test for copper deficiency', GRDC Accessed from: https://grdc.com.au/news-and-media/news-and-media-releases/west/2016/06/time-right-to-test-for-copper-deficiency*

[4] *Gilkes et al, 1979 'The Influence of placement geometry on the effectiveness of copper superphosphate. Aust. Journal Soil Res. 17 (121-128)*

Nutrient Advantage®
Knowledge | Productivity | Responsibility

Organisation FERTCARE®

Incitec Pivot Fertilisers

incitecpivotfertilisers.com.au
nutrientadvantage.com.au