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Copper – Steer your crop in the right direction

Do you find white and curved heads in your crop? Do you find that the number of grains per head is reduced? Do you find burnt/wilting leaf tips? Have you had problems with lodging crops?

Copper is the second most important micro nutrient for wheat crops next to zinc. Similar to zinc deficiencies, copper deficiency lead to large reductions in yield without the crop showing any visual symptoms. In Australia, copper deficiency is most common in sandy soils that are low in organic matter content, such as the coastal soils of South and Western Australia. Calcareous and alkaline soils of South Australia are subject to copper deficiency no matter what the physical characteristics of the soil are. Even soils with a high organic content are not excluded by the threat of copper deficiency. This is because the copper cation in the soil is more strongly bound to organic matter than any other micronutrient, rendering it plant unavailable.

White empty heads due to copper deficiency

How can copper deficiency have such an affect on yield?

Copper is essential for many plant growth functions such as, chlorophyll formation, photosynthesis, respiration, amino acid conversion to protein, and lignin formation. In plants well supplied with copper, the cell walls are stronger, the plant is rigid and not wilted (no visible signs of lodging) which makes it more resistant to fungal attack. However, the most important contributor to yield is the necessity for copper for pollen formation and seed production. Copper deficiency affects pollen formation and fertilisation more than the vegetative growth of the plant, as the greatest yield losses occur due to non viable pollen rather than lodged or wilted crops.

Anthesis is most affected by copper deficiency

Copper deficiency symptoms

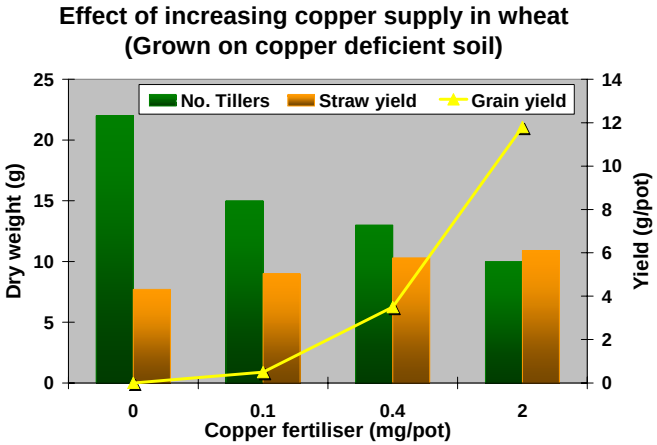
The most characteristic symptom of copper deficiency is poor grain fill and empty heads. Head formation is suppressed, glumes are almost empty, and if some seeds are formed, they are shrivelled. Copper deficiency results in the pollen being sterile as well as fewer in number and the anthers are not properly developed. Crop maturity can be delayed as a result of a copper deficiency resulting in greater risk of foliar disease and frost. Visual vegetative symptoms of a deficiency will often appear after tillering. Younger leaves will look wilted (unrelated to moisture status), then can die back from the tip and twist into curls (whip tip). Because of the late appearance of symptoms, copper deficiency is frequently only picked up at maturity which is too late to correct the problem.

Whip tip

Lodged crops

Correcting copper deficiencies

The most common way of correcting copper deficiency in the past has been to apply a copper fertiliser to the soil. However, copper is relatively immobile in soils and until the copper fertiliser is mixed throughout the soil, copper deficiency is often diagnosed in wheat crops, even after the initial application of fertiliser. In addition to this, wheat and most barley cultivars are very poor at copper uptake from soil. Also, where zinc, copper are used together in the soil, the uptake of zinc will be reduced because both elements are absorbed via the same plant uptake pathway, and it is the copper that is absorbed first. Copper is also detrimental to soil microbes.



Trial 1 (sourced from Marschner, Mineral Nutrition of Higher plants) Each pot had 4 plants each.

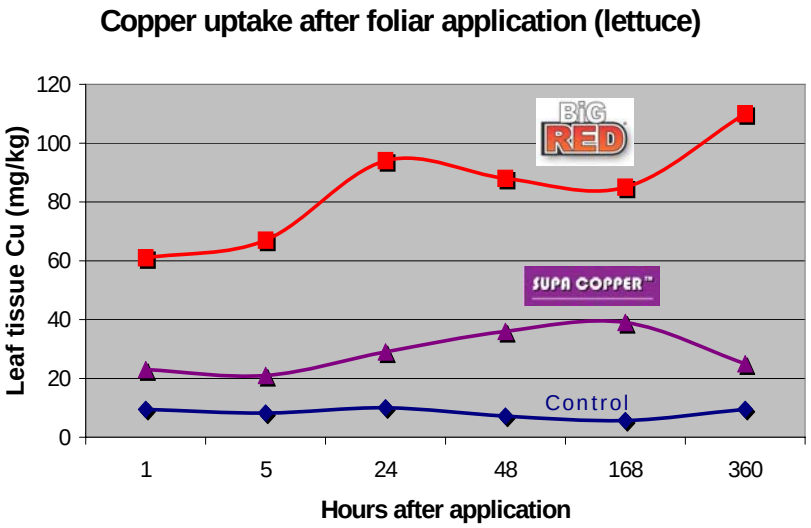
Trial 1, shows that grain yield is affected far more than vegetative growth, when a copper deficiency occurs. When the copper deficiency is severe, no grains are produced even though the straw yield is quite high. This is due to enhanced tiller formation (loss of apical dominance of the main stem). As the copper supply is increased, grain yield rises sharply, whereas the straw yield is only slightly enhanced.

"Don't skip on copper just because growth looks ok"

Forms of copper fertilisers

There are 3 common sources of copper, for plant nutrition. These are copper sulphates, copper oxides and copper chelates. Copper sulphate is the most widely used. It can be applied in a granular form at seeding time or mixed into solution and injected below the seed or applied as a foliar spray. Copper oxides are less soluble and therefore need to be ground into fine particles and applied as a suspension. Big Red copper oxide contains 75% copper oxide.

Oxides have a much lower salt index than sulphates and therefore are safer to the plant if being used as a foliar spray. The lower salt index also means oxides are much less corrosive than sulphates and therefore less harsh on spray equipment. Copper chelates are the most expensive form of copper. Synthetic chelates are best applied to the soil and should be used where there is a soil type that has a high pH or is high in phosphates.



Trial 2 (Agrichem greenhouse.) Trial was conducted using the same amount of elemental copper 0.126g/L

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