

COPPER FACTSHEET

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COPPER IN SOILS

Copper (Cu) is present in relatively small amounts in soils, with sandy soils low in organic matter having the lowest concentrations. Copper is most available for plant uptake in acid soils. As the soil pH increases above 7.0, copper availability declines due to stronger copper adsorption.

Elevated soil concentrations of copper are found in regions where copper rich ores, e.g. of silver, lead or zinc, are found, and where copper fungicides have been routinely used.

Copper is held very tightly on clay and organic exchange sites in the soil. Consequently, copper is very immobile. Low copper concentrations are found in the soil solution, and it is not easily lost by leaching.

COPPER IN PLANTS

Copper is taken up by plants in very small quantities, as divalent ions (Cu^{2+}). It plays an important roles in metabolic processes, e.g. enzyme and chlorophyll formation, photosynthesis, respiration, and the metabolism of carbohydrate and some proteins. An adequate supply of copper is essential at pollination in wheat. A deficiency may result in barren heads

Copper is not readily mobile in the plant although it can be translocated from older to younger leaves. The movement of copper appears to be strongly dependent on the copper status of the plant. In wheat plants well supplied with copper, movement readily occurs from leaves to the grain, but in deficient plants, copper is relatively immobile.

DEFICIENCY SYMPTOMS

In Australia, copper deficiency occurs less commonly in crops than does zinc, but more often than iron or manganese. Crops differ in their sensitivity to copper deficiency. Copper responsive crops include oats, wheat and lucerne, whilst potatoes and soybeans are less likely to respond.

As copper is relatively immobile in plants, deficiency symptoms first develop on the growing points and the leaves. Common symptoms are chlorosis or yellowing, first developing on the leaf edges. In cereals, white leaf tips and narrow, twisted leaves that fail to unroll may be evident at tillering. Ears may form but not fill. In extreme cases ear or panicle formation is absent. In sugarcane the symptoms are known as "Droopy-top". "Die-back" occurs in tree crops.

TOXICITY SYMPTOMS

The range between deficiency and toxicity can be narrow, but varies. Some plant species are capable of accumulating copper to levels 2 to 50 times the normal value of copper in leaf dry matter without toxicity occurring. Legumes are particularly susceptible to high copper while grape vines are reported to be the most tolerant. Ingestion of copper by grazing animals may be harmful to stock, while the pasture itself is unaffected.

The inhibition of root and shoot growth is one of the first symptoms of copper toxicity, especially in bean, citrus and maize. Copper can displace metal ions (particularly iron) from their centres of activity within the plant, resulting in induced iron deficiency (chlorosis).

COPPER IN ANIMALS

In eastern Australia, copper deficiency in cattle and sheep most commonly occurs on acid sandy soils, particularly in areas of high rainfall. In South Australia, deficiency is more widespread, occurring on acidic and alkaline soils, and on sands, loams, clays and peats. It commonly occurs on calcareous sands.



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Common symptoms of deficiency are retardation of growth, failure to fatten, coarsening and depigmentation of hair (pale, harsh dry coats), steely wool in sheep, nervous disorder (swayback) and muscular incoordination (ataxia), scouring (diarrhoea), abnormal bone formation (bones fracture easily and anaemia (low haemoglobin in blood). Cattle are more susceptible to copper deficiency than sheep.

As in plants there is a narrow range between copper deficiency and toxicity in animals. Copper poisoning is basically caused by an accumulation of copper in the liver of animals, which develops quickly into a toxæmic jaundice.

An imbalance in dietary copper, molybdenum and sulfur may induce nutritional problems in livestock, particularly if animals are stressed, or suffering liver damage. High concentrations of molybdenum and/or sulfur in forage can induce copper deficiency in grazing animals. Conversely, high dietary copper, low molybdenum and low sulfur may cause copper poisoning.

COPPER FERTILIZERS

Copper Granules – a copper oxysulfate product containing 25 % Cu, that is manufactured by partially acidulating copper oxide with sulfuric acid. It is suitable for dry application to the soil only, either on its own or in blends. On application of the granules to the soil, the copper sulfate dissolves, releasing fine particles of insoluble copper oxide. As copper oxysulfate is not fully soluble, it cannot be used in foliar sprays. This is the only solid copper fertilizer marketed by Incitec Pivot Limited.

Bluestone or Copper sulfate pentahydrate (25 % Cu) - Fine crystalline grades of Bluestone can be applied in solution (dissolved in water) to the soil or foliage. Bluestone is very corrosive. Finely divided suspension grades of **Copper oxychloride**, **Copper oxide** and **Copper hydroxide** may be used in place of Bluestone in sprays to reduce the corrosivity risk to equipment.

Copper chelate can be applied in solution, either to the soil or as a foliar spray. Chelated trace elements are less subject to fixation in the soil than is sulfate, but are more costly.

Copper can be applied to the soil or as foliar sprays. If high enough rates are applied, soil applications can remain effective for a number of years, while foliar applications need to be applied at least annually.

Where copper fungicide sprays are used on a routine basis, e.g. in some horticultural crops, there will be no need to apply additional copper as a fertilizer to the soil and/or foliage.

FURTHER READING - An Agritopic on “Copper” is available if more detailed information is required.

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