# Soybean Nutrient Profile

## Copper

*This nutrient profile is a part of a weekly series dedicated to the function of the 16 essential nutrients in soybean. After excluding carbon, hydrogen, and oxygen, we are left with a thirteen part series in which we will explore how nutrients are used throughout the plant as well as how to identify deficiency symptoms and develop nutrient management decisions.*

### In the Plant

The micronutrient copper (Cu) is taken into the plant as $Cu^{+2}$. Copper is used throughout the plant for electron transport in both photosynthesis and respiration because of the ease with which it can both accept and donate electrons. Plastocyanin, a protein involved in energy transfer during photosynthesis, contains about 50% of the Cu found in the chloroplast. Additionally, several Cu containing enzymes are needed for the synthesis of lignin, the constituent of plant cell walls that gives strength to plant tissues. The reduction of lignin development due to a copper deficiency can also increase disease susceptibility. Copper also plays roles in the metabolism of carbohydrates and nitrogen.

### In the Soil

Very little $Cu^{+2}$ is found in the soil solution. It is often encountered by the roots in the form of organic complexes and the diffusion of these Cu chelates through the soil solution. Copper is more strongly bound to organic matter than most nutrients and can also be adsorbed onto clay minerals in the soil. Coarse, highly leached soils, soils high in organic matter, and those with high pH are at the greatest risk of Cu deficiencies. High levels of zinc, iron, and phosphorus can also reduce Cu absorption by the roots.

### Deficiency Symptoms

Copper deficiencies are rare and symptoms can vary but most often results in the stunting of plants and chlorosis of leaves as nitrogen fixation is reduced. Flowering and maturity are

often delayed and pollen can be sterile resulting in blank pods. Deficiencies will often begin in new leaves as Cu is fairly immobile in the plant.

**Deficiency Corrections**

Routine soil testing as part of an overall fertility management plan will alert a producer to any potential issues related to low Cu. Copper sulfate ($CuSO_4$), at 2 to 4 lb $A^{-1}$, will provide adequate Cu for several years when soil test levels are low.

**Takeaways**

- Copper is essential in small amounts to aid in electron transport during photosynthesis and respiration, for the synthesis of lignin in cell walls, and for the metabolism of carbohydrates and nitrogen.
- Only small concentrations of Cu are found in solution as most is strongly bound to the organic fractions of the soil. Soils at a greater risk for Cu deficiencies include coarse sands, soils high in organic matter, or soils with high pH.
- Copper deficiencies appear as a general stunting of the plant and chlorosis of young leaves due to its role in photosynthesis and the reduction of nitrogen fixation. Flowering and maturity is often delayed and pollination efficiency reduced.
- Routine soil testing as part of a fertility management plan will help to prevent Cu deficiencies.

**References**

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Taiz, L. & E. Zeiger. 2010. Plant Physiology. Sunderland, MA: Sinauer Assoc. Inc.