Soybean Nutrient Profile

Zinc

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

Zinc (Zn) is taken into the plant as the cation Zn^{2+}. Zinc is required for many enzymatic activities and the metabolism of protein, carbohydrates, and lipids in the plant. It is also required for the synthesis of chlorophyll and has been shown to contribute to plant resistance against diseases and drought stress. Zinc is also vital in the synthesis of tryptophan. Tryptophan, an amino acid, is subsequently required for the production of plant hormones, such as indoleacetic acid, that regulate the development of new tissues.

Figure 1. *Soybean zinc deficiency causes interveinal mottling leading to necrosis of older leaves, shortened internodes, and malformed development of new tissues. (IPNI, D. Whitney, 2018)*

In the Soil

Zinc availability is highly influenced by soil pH and will decrease in availability to plants as pH increases. Zinc deficiencies can occur in high pH, calcareous soils as

Zn is adsorbed strongly to calcium complexes in the soil and can become unavailable to plants. Similar to iron, Zn is often chelated in soils and thus moves towards the plant roots in soil solution through diffusion from high to low concentrations. Therefore, drought environments can also reduce the movement of Zn to the plant, reducing availability.

Deficiency Symptoms

Being less sensitive to Zn deficiencies than corn and other small grains, Zn deficiencies are fairly uncommon in Louisiana soybean. When deficiency symptoms are observed, they will begin in the older growth due to the mobile nature of Zn in the plant. Symptoms will appear as an interveinal mottling, light green and yellow spotting between leaf veins. As symptoms progress in the older leaves, a more typical interveinal chlorosis will be observed before leaf tissues begin to show signs of bronzing and necrosis and will eventually fall from the plant (figure 1). Because of the role Zn plays in the synthesis of plant hormones, internodes will be shortened and newly emerging leaves will often be small and distorted. Few flowers and pods will be set and those that are will develop abnormally and eventually abort.

Deficiency Corrections

Producers should soil test on a regular basis to monitor Zn levels in soils. Prevention of low soil levels is the best method of maintaining proper plant nutrition. Soil tests should be maintained at least every three years and recommendations should be followed annually until the next soil samples are analyzed as most soil test recommendations are given for plant use and not for the buildup of nutrients in soils. If necessary, ½ lb of an elemental Zn product per acre or 1 lb of a zinc sulfide or zinc oxide product can be applied foliar to correct deficiencies.

Takeaways

- Zinc is essential for the synthesis of chlorophyll and plant growth hormones as well as the metabolism of proteins, carbohydrates, and lipids.
- Zinc availability is affected by varying soil conditions and is greatly reduced in high pH soils.

- Beginning in older leaves, Zn deficiency symptoms begin as interveinal mottling progressing to chlorosis and necrosis. Shortened internodes and small, distorted new tissues are also signs of inadequate Zn levels.
- Preventative measures should be taken through regular soil testing regimens. If necessary, applications of 0.5 lb A^{-1} of elemental Zn or 1 lb A^{-1} of zinc sulfide or zinc oxide are required to correct deficiencies.

References

Images: IPNI, D. Whitney. 2018. IPNI Crop Nutrient Deficiency Image Collection. Version 2018-05-07.

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