



Soybean Nutrient Profile

Nickel

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

In the latter part of the 20th century it was determined that nickel (Ni) was an essential component of urease, an enzyme necessary for the breakdown of urea in plant cells. Urease is the only enzyme in the plants that is able to “extract” the available nitrogen from urea. Without the ability to breakdown urea, toxic levels can build up resulting in leaf-tip necrosis. Producers may be familiar with these symptoms as they may also be observed after a foliar application of urea, “urea burn” (figure 1).



Figure 1. *Nickel deficiency symptoms in soybean mimic “urea burn” due to the buildup of urea levels associated with deficiencies (Mississippi State University, B. Golden)*

Nickel has also been shown to be a vital component of hydrogenase, an enzyme required for the breakdown of hydrogen gas in nodules that is associated with the fixation of nitrogen. When hydrogen gas is formed in the fixation process, it essentially robs the process of vital energy. Hydrogenase allows for the breakdown of this byproduct releasing electrons back into the fixation process. A lack of Ni availability reduces hydrogenase levels and subsequent efficiency of nitrogen fixation.

Deficiency Symptoms

Nickel is needed in such small amounts that it is rarely considered when producers think about plant nutrition. In almost all circumstances Ni is supplied in adequate amounts by native soils. Deficiency symptoms are similar to those seen if urea is applied foliar to crops. Necrosis of the leaf tips are observed due to a buildup of toxic urea levels (figure 2).



Figure 2. *Nickel deficiency symptoms in soybean mimic “urea burn” due to the buildup of urea levels associated with deficiencies (Mississippi State University, B. Golden)*

Contact your local county agent for any questions as to symptoms you may observe.

References

- Havlin, J.J, Beaton, J.D., Tisdale, S.L., and Nelson, W.L. 2005. Soil Fertility and Fertilizers. Upper Saddle River, NJ: Pearson Prentice Hall.
- Taiz, L. & E. Zeiger. 2010. Plant Physiology. Sunderland, MA: Sinauer Assoc. Inc.