



## Soybean Nutrient Profile

### Boron

*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**

Uptake of the micronutrient boron (B) by plants is an active process as boric acid ( $\text{H}_3\text{BO}_3$ ) requires the presence of hydrogen ( $\text{H}^+$ ) to be moved into plant cells. Because of the necessity for  $\text{H}^+$ , B uptake is reduced in alkaline soils. Boron is readily moved to the leaves through the xylem and will remain there because of its immobile nature in the plant. Much of the B found in the plant will be present in cell walls where it is vital for cell elongation, regulation of cell calcium and  $\text{H}^+$ , nitrogen metabolism, and translocation of photosynthetic products from the leaves to the rapidly growing meristematic regions of the plant.

#### **In the Soil**

Boric acid is mobile in soils and is often transported through soil solution by both diffusion and mass flow. Because of its mobility in soils there is a potential for B to leach through the root zone especially in coarse textured, low pH soils. Boron availability is reduced in high pH soils and in the fine textured soils with high pH, that are common in Louisiana, calcium can also impede B



Figure 1. Soybean boron deficiency can cause a stacking of nodes resulting in stunted plants. (IPNI, B.R. Golden, 2018)

availability. Boron deficiencies are also associated with dry soil conditions as moisture is needed to aid in the transport of B through the soil to the root surface.

### **Deficiency Symptoms**

Boron deficiency symptoms can vary but will often begin in the upper part of the canopy on young, newly developing tissues due to the immobile nature of B in the plant. Because of boron's role in cell division and elongation, symptoms are often seen in or near regions of rapid growth, such as shoot terminals. The first visible symptoms will typically occur as a stunting of the plant due to the stacking of nodes (reduced internode lengths) (figure 1). Deficient plants will be shorter than



Figure 2. *Soybean boron deficiency can cause discoloration and cupping downward of leaves. (IPNI, B.R. Golden, 2018)*

neighboring, healthy plants but may have the same number of nodes. Young leaves will be discolored and will often cup downward, similar to some auxinic type herbicides, as symptoms progress (figure 2). Severe symptoms can cause terminal dieback similar to calcium deficiencies. A major portion of the B used by the plant is taken up during the reproductive stages of growth and a deficiency late in the growing season can reduce pod set and seed fill even though vegetative symptoms may not appear.

### **Deficiency Corrections**

Unlike many nutrient deficiencies that can be corrected with no further sign of the offending symptoms, B symptoms will not be eliminated even with proper correction practices. Correction practices can minimize the yield losses, however prevention of the deficiency is a much better option. Soil test reports low in plant available B should be corrected through the use of a granular B product broadcast at 0.5 to 1 lb A<sup>-1</sup>.

Although, numerous products are available to correct boron deficiencies, care should be taken in their application due to the potential of both reduced germination of seed and

phytotoxicity on emerged plants. Boron fertilizers have the potential to reduce soybean germination and therefore, should not be banded near seed. Broadcast applications should be made at least one to two weeks prior to planting to prevent reduced germination of seed. Foliar products can be used during the growing season but should not be applied at rates greater than 0.5 lb A<sup>-1</sup> and should not be applied to soybean under water stress.

### **Takeaways**

- Boron (B) is a micronutrient essential in the function of plant cell walls, including the regulation of calcium and hydrogen and the translocation of many carbohydrates and nutrients found in plant tissues.
- Boron availability decreases with increasing pH and soybean uptake of B grown in fine textured, high pH soils can be impeded by high levels of calcium.
- Boron deficiency symptoms typically include the stacking of nodes on stunted plants and leaves will often be discolored and can be cupped downward. Severe deficiencies can cause terminal dieback.
- Late season deficiencies may reduce pod set and seed fill even without visible symptoms on vegetative structures.
- Prevention of B deficiencies is important as visual symptoms will not be eliminated though yield losses can be minimized through foliar products.
- Fertilization of soybean with boron should be done with care to prevent reduced germination of soybean seed or phytotoxicity of emerged plants.

### **References**

- Images:* IPNI, B.R. Golden. 2018. IPNI Crop Nutrient Deficiency Image Collection. Version 2018-05-07.
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