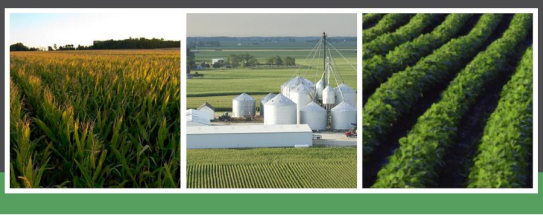

Agronomic Spotlight

Soybean Leaf Yellowing

- Nutrient deficiencies are the most common cause of yellowing in soybean leaves, most notably with nitrogen, iron, manganese, or potassium.
- Temporary nutrient deficiencies can occur when root growth is restricted because the roots cannot reach sufficient levels of nutrients in the soil to sustain normal growth and development.
- Yellow leaves result when chlorophyll production is disrupted; the yellow carotenoid pigments become visible in the absence of the green chlorophyll pigments.

Nutrient deficiencies are the most common cause of yellowing in soybean leaves. Many nutrient deficiencies can be corrected or prevented with the use of soil tests to determine fertility inputs and maintaining soil pH for optimal plant growth and nutrient availability. It is also important to note that any condition that restricts root growth (cool weather, saturated or extremely dry soils, soil compaction, root damage from diseases, insects, or herbicides) can lead to temporary nutrient deficiencies in the plant because the roots cannot reach sufficient levels of nutrients in the soil to sustain normal growth and development. Many nutrient deficiency symptoms will quickly disappear once environmental conditions improve and root growth resumes, provided that soil fertility levels are adequate.

Nitrogen

The symptoms of nitrogen (N) deficiency are chlorosis (yellowing) of the lower leaves of the canopy. Nitrogen deficiency symptoms can be observed during the time that the rhizobial bacteria are forming nodules (Figure 1), which provide up to 50% of the N needed by soybeans.[1] Once the nodules begin producing adequate amounts of N, the normal dark green color should return. Nitrogen deficiency can also occur in soybeans planted into fields that have been extremely dry or that have been saturated for an extended period of time. These conditions not only slow soybean root development, limiting access to nitrates in the soil, but can also inhibit rhizobia populations in the soil, which can affect nodulation. If soybeans fail to nodulate properly, a rescue N application may help preserve yield potential.

Figure 1. Soybean plants with yellow leaves due to a temporary nitrogen deficiency caused by wet soil conditions and a lack of nodule formation.

Iron

Iron (Fe) is necessary for the development of chlorophyll (the green pigment critical for photosynthesis) and for nodule formation, and is involved in many metabolic processes within the plant. The distinctive symptom of iron deficiency is the development of interveinal chlorosis (yellowing of the leaves while the veins remain dark green, Figure 2), which is the result of low chlorophyll formation. Iron is immobile in plants so deficiency symptoms typically appear on the youngest, uppermost leaves between the first and third trifoliate growth stages. This condition is referred to as Iron Deficiency Chlorosis (IDC).

Figure 2. Interveinal chlorosis is a symptom of iron and manganese deficiencies.

Iron deficiency most commonly occurs when iron in the soil is tied up due to high soil pH caused by the buildup of carbonates, and not simply due to low iron levels in the soil. Iron deficiency chlorosis often occurs in shallow depressions in a field or low-lying areas where water and solutes collect over time. The most important management option is the use of soybean products with tolerance to IDC. Iron chelate products in the ortho-ortho form can be applied in-furrow at seeding in affected areas of the field to improve the plant's access to iron in the soil. Look for products that carry

Soybean Leaf Yellowing

the ortho-ortho-EDDHA Fe chelate form on the label as this is the only form that is effective at reducing IDC.[2]

Manganese

Symptoms of manganese (Mn) deficiency appear similar to IDC and it may be difficult to distinguish between the two. Like iron in plants, Mn is also immobile so symptoms will generally appear on the younger leaves, although older leaves may show symptoms as well.

Like most nutrients, soil pH affects the availability of Mn; as soil pH increases, the availability of Mn decreases. Manganese deficiency is most common on poorly-drained soils, especially clay and silt loam soils on eroded knolls where the pH is higher than the rest of the field. To avoid manganese deficiencies, soil pH should be maintained below 6.5. Roots must reach Mn to absorb it, so factors that limit root growth can lead to Mn deficiency. A foliar application of manganese sulfate may improve Mn deficiency symptoms; however, Mn deficiency will likely reoccur in the same field areas each year. In this case, consider banding manganese sulfate in a 2-by-2 band at planting in deficient areas of the field.

A phenomenon called “Yellow Flash” can sometimes occur after a post-emergence application of a high rate of glyphosate under dry conditions. The symptoms of yellow flash are temporary chlorosis of the uppermost, newly expanding leaves and can sometimes look similar to Mn deficiency (Figure 3). Yellow flash generally occurs on plants that were already under an environmental stress (temperature or drought) when the glyphosate was applied and may be more common at the edges of fields and/or in spray-overlapped areas where application rates of glyphosate were higher. Yellow flash has not been shown to affect yield potential and affected soybean leaves generally return to their normal color within a week after the application. If soybean growth was hindered due to stressful conditions when glyphosate was applied, yellowing may not occur until 10 to 21 days later. If it remains dry, these leaves may remain yellow until the crop resumes growth after rain or irrigation.

Figure 3. "Yellow flash” in soybean following a post-emergent application of glyphosate.

Potassium

Potassium (K) is mobile in the plant and deficiencies will first appear as chlorosis along the edges of the oldest leaves (Figure 4). The chlorosis can intensify and spread up through the plant canopy to newer leaves as the deficiency worsens. With severe deficiencies, the leaf edges may become brown and necrotic, although the newest leaves may appear normal, and affected plants will appear stunted. Potassium deficiencies can occur due to restricted root growth or insufficient K levels in the soil. If the deficiency is due to inadequate K levels in the soil, a rescue K application by broadcasting potassium chloride (potash, 0-0-60) with sufficient irrigation to move the fertilizer into the soil may help protect yield potential.[3]

Figure 4. Symptoms of potassium deficiency. Photo courtesy of Daren Mueller, Iowa State University, Bugwood.org.

Soybean Cyst Nematode

Serious infestations of soybean cyst nematodes (SCN) can cause yellowing in soybean leaves and stunting, often in circular patches of the infested areas. SCN infestations reduce the plant’s ability to tolerate stress, so symptoms of nutrient deficiencies or drought stress may be amplified in SCN infested soybean fields.

Sources

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