IRON DEFICIENCY CHLOROSIS

Soybean Diseases

Overview

Iron Deficiency Chlorosis (IDC) of soybean is a physiological disorder caused by iron deficiency in the plant that can result in substantial yield loss within affected areas of a field. IDC is not caused by a lack of iron in the soil, but by an inability of the plant to take it up.

Soybeans are particularly susceptible to IDC. Soybean plants obtain iron from the soil by

releasing acids from their roots into the soil that help solubilize the iron into a form more readily taken up by the roots. In high pH soils with high levels of calcium carbonate, the fine calcium carbonate particles contact the soybean root and slowly neutralize the excreted acid meant to solubilize iron in the soil. The effect is that the plants cannot take up iron that is in the soil.

Iron is necessary for the formation of chlorophyll, which is the green pigment in plants necessary for photosynthesis to occur. When the plant does not take up enough iron, chlorophyll synthesis is inhibited, and yellowing begins to occur between the leaf veins. Because iron is not mobile in the plant, the deficiency is observed in the youngest leaves first. When weather related, the deficiency may be temporary with no effect on yield. Under more severe conditions both growth and yield are affected.

Scouting

IDC often shows up first in low, wet areas of a field. Lack of oxygen around the roots inhibits the plants ability to take up certain nutrients including iron. As soils warm and dry, the symptoms gradually begin to fade. In some soybean growing areas, especially in the Great Plains production region, many soils are naturally calcareous and can have a pH that exceeds 8.0. In these areas, IDC can be an annual problem. High pH can also occur where land-leveling or soil erosion has exposed subsurface layers of the soil that are naturally higher in pH.

Symptoms will appear on the youngest leaves first. The leaves are yellow with the veins remaining green. The older trifoliolate leaves remain green. IDC can be confused with other problems such as atrazine injury. With atrazine injury, however, the yellowing will be on the lowest leaves and the upper leaves will retain their green color. Other causes of yellowing that should be considered include nitrogen deficiency, potassium deficiency, the temporary yellowing sometimes caused by mid-season glyphosate applications, and soil carryover injury from Group 2 ALS inhibitor herbicides. When IDC persists or is severe, leaves turn white and plant growth may be severely stunted.

Root rot often occurs on plants suffering from IDC. This is thought to be due to the increased susceptibility of chlorotic plants to root pathogens. Cysts of soybean cyst nematodes, which are favored by high pH soils, are often found on plants showing IDC symptoms.

If you suspect you have IDC:

- Check with your university Extension diagnostic laboratory.
- Be sure to submit both a plant and a soil sample for diagnosis. Include information on when the symptoms began to occur, recent weather, and the location in the field of the symptoms.

It is best to submit both healthy and affected plants and soil samples from both the affected and healthy areas of the field.

Management

Research indicates that the following variables are associated with IDC problems.

- History of IDC in a field
- High soil pH (> 7.5)
- High clay content soils that remain wet, or low, wet areas of the field
- Saturated soils
- High calcium carbonate equivalents and high soluble salts as reported by a soil test
- Low soil temperatures
- Residual nitrates from previous crops

1. **Variety selection**
   Soybean varieties vary greatly in their tolerance to IDC. The most successful management strategy therefore is to select a soybean variety with tolerance to IDC. Most seed companies report IDC tolerance values for their varieties.
2. **Minimize the amount of nitrate carry-over from the previous crop**
   Excess soil nitrates can worsen an IDC problem by furthering inhibiting the plants ability to take up iron.
3. **Apply iron as EDDHA iron chelate on the seed at planting**
   Iron chelate fertilizers placed in direct contact with the seed (in-furrow), can be an effective way to get iron into the plant. The type of iron chelate is important; the EDDHA, or “ortho-ortho” formulation keeps iron available to the plant for a long enough time to prevent IDC from developing. Other, less expensive forms of iron chelate products do not. Fortunately, there is little or no risk of seedling injury from these compounds, even though starter fertilizer is generally not recommended for soybeans. However, do not mix iron containing fertilizer products with a starter solution that contains potassium since potassium will damage the seed if it comes in direct contact with it. Adding iron fertilizer to soil will not correct an IDC problem. Applying an iron chelate to soybean leaves has had mixed results and it is hard to predict when and how much to apply. Research on foliar application of iron is ongoing.
4. **Plant an oat cover crop**
   Researchers at the University of Minnesota report that planting oats as a competition crop just ahead of planting soybeans, and then killing the cover crop with glyphosate at a height of 10 to 12 inches, has proved to be a consistently effective management practice. The oat crop absorbs enough excess nitrate-nitrogen and soil moisture to keep soil iron available to the soybean crop.

Timing is important, however. Killing the cover crop at 10 inches allows enough growth for the cover crop to influence soil conditions, but not enough growth to compete with the soybean stand.

Distribution

Iron Deficiency Chlorosis in Soybean *Plant Management Network*, 2011

Managing Iron Deficiency Chlorosis in Soybean, University of Minnesota, 2018

Micronutrients for Soybean Production in the North Central Region,
North Central Soybean Research Program and Iowa State University Extension, 2017

Resources

Managing Iron Deficiency Chlorosis in Soybean
University of Minnesota, 2018
https://extension.umn.edu/crop-specific-needs/managing-iron-deficiency-chlorosis-soybean

Micronutrients for Soybean Production in the North Central Region
North Central Soybean Research Program and Iowa State University Extension, 2017
https://store.extension.iastate.edu/Product/15259

Soybean IDC
Jim Orf, University of Minnesota, 2011
https://www.youtube.com/watch?v=lmLmCwMwvJ0

Soybean Iron-Deficiency Chlorosis Scores
North Dakota State University, 2018
https://www.ag.ndsu.edu/varietytrials/soybean

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