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Musings On Iron Deficiency Chlorosis (IDC)

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According to Webster, to muse is to consider or to ponder. So, considering the explosion of iron deficiency chlorosis in the week of June 19 through 23, it seems appropriate to attempt to explain the cause and to ponder about what might be expected with this problem during the remainder of the summer.

There is probably no easy, simplistic answer. Iron Deficiency Chlorosis is the end result of a complex combination of factors. So, let's review what we think we know.

The problem starts with soil chemistry. Uptake of iron by the soybean plant is reduced or impaired by bicarbonate in soil. Bicarbonate is not stable. It is lost as carbon dioxide (CO_2) in calcareous soils. The conversion of bicarbonate to CO_2 is rapid and concentrations of bicarbonate are nearly impossible to measure. When soils are sealed, loss of CO_2 is diminished and, as a consequence, the concentration of bicarbonate increases.

Sealing of soils can occur after rain. Much of western Minnesota received rain from June 16-18. Concentration of bicarbonate is known to increase when soil moisture increases and temperatures are warm. Warm and wet from June 16-18 describes soil conditions in much of the area subject to iron deficiency chlorosis.

Some areas where IDC is a yearly problem did not receive much rain. In these areas, it's likely that salts moved upward from subsoil to topsoil as drying continued. IDC is known to be associated with high concentrations of soluble salts. So, as soils dried, soil conditions became more favorable for development of IDC.

So, moisture and temperature in mid-June probably acted to restrict the uptake of iron by the soybean plant.

From past observations, we have developed a theory that metabolism of iron in the plant is inhibited by high concentrations of nitrate-nitrogen. In the spring of 2006, soil conditions have been nearly ideal for mineralization (breakdown) of soil organic matter. Formation of nitrate-nitrogen is the end result of this process. There are reports of as much as 75 lb. N per acre produced from the process of mineralization in

the spring of 2006. This increase was reported in a period from late April through mid-June. These reports combined with the overall dark green color of the corn crop suggest that there was or is ample nitrate-nitrogen in the soil system.

Considering the ample amounts of nitrate-nitrogen in the soil, it's reasonable to expect high concentrations of nitrate-nitrogen in the soybean plant. Thus, an exaggeration of IDC might be expected where soil conditions are appropriate for development of IDC.

So, it appears that two factors are working together to produce the large amount of IDC seen this year. First, high concentrations of salts and/or bicarbonates inhibited the uptake of iron. Thus, projected higher than normal concentrations of nitrate-nitrogen in the plant tissue interfered with plant metabolism and iron taken up by the plant could not be converted to the usable form. As a result, IDC has become a serious problem within the past week.

With the IDC problem so visible across the landscape, it's logical for soybean growers to ask "what can I do now?" Unfortunately, there is not a management practice for correction of the problem that is known to be reliable or consistent.

Results of preliminary trials conducted in 2005 suggest that use of small grain as a competition crop can reduce the severity of IDC. Those results are confirmed by observations in the early part of the 2006 growing season. Research plots or farmer trials were put in place to test this idea. So far, soybeans are green where the competition crop was used. This year, the impact of the competition crop on IDC and soybean yield is being evaluated in a variety of field trials. Several soybean producers are also evaluating the planting of a competition crop. We plan to get yields from these evaluations. Stay tuned.

What will happen in the remainder of the 2006 growing season? It's doubtful if anyone can predict the future for IDC. In past years the symptoms have disappeared and the problem diminished. Based on this history, we can hope that the severity will diminish. The impact of IDC early in the season with subsequent disappearance on soybean yield, however, is not really known.
