

FOLIAR FERTILIZATION OF CORN AND SOYBEAN

John Sawyer, Professor, Department of Agronomy, Iowa State University

Corn

Research has been conducted on foliar fertilization of corn over the years, but not overly extensive in Iowa. One reason has been the lack of positive results when studies were conducted. Looking at data from the early 1970's to recent years I don't find cases where foliar fertilization produced positive yield responses. An example is a study we conducted in 1999 with foliar application of low-biuret urea and mono-potassium phosphate at four growth stages from V6 to VT. There was no yield response with urea application, but a statistically significant yield decrease of 5 to 6 bu/acre with mono-potassium phosphate application. Results of recent university trials that I've seen with foliar fertilization have not indicated positive response. I've also on occasion received input from producers about corn growth problems related to foliar fertilizer applications.

A new twist has been promotion of "rate substitution" for nitrogen (N), where a pound of foliar applied N product can substitute for more than 1 lb N/acre soil applied. Greater efficiency with a foliar nutrient application might be a theoretical advantage, however, research with various products has not shown this to occur. The main difficulty with applying N, phosphorus (P), or potassium (K) via a foliar application is the large nutrient requirement by corn (for example, 200 lb N/acre or more total above ground uptake depending upon production level), which cannot be met with a foliar-applied rate. Foliar rates must be low to avoid tissue damage and, therefore, to increase yield significantly repeated applications would be needed but this would be too costly. To meet the large crop demand for nutrients like P and K, the suggested method is soil testing and soil application when a need is indicated.

Soybean

Both early and late season foliar fertilization have been researched extensively in Iowa. A nice summarization of that research can be found in a previous Integrated Crop Management article written by Antonio Mallarino ([Foliar fertilization of soybean: is it useful to supplement primary fertilization?](#)). The short summary of that article is that late-season foliar application has not improved yield, with yield losses documented at rates that caused leaf damage. Early season application sometimes improved yield, but across many trials and various products the yield increase occurred at only about 15 percent of fields and the average yield response across all fields was less than 1 bu/acre. Therefore, early season foliar fertilization is not a recommended practice across all fields. Unfortunately no specific crop or field condition clearly indicated when an early season foliar application would be beneficial. Although soil testing indicated a higher probability of response in low-testing than in high-testing soils, tissue analysis for P or K concentrations at the V5 to R3 growth stages was not a reliable diagnostic tool. Frequency of response was greater in some cases, such as with no-tillage or ridge-tillage systems, and when early plant growth and/or P or K uptake were limited (which can be difficult to identify in early soybean growth). The most consistent yield responses, when they occurred, were with a rate of 3 gal/acre rate of 3-18-18.

What about iron chlorosis in soybean? High soil pH soil conditions, along with free lime – calcareous soils of the north central region of Iowa (the central lobe), can result in low iron availability to soybean and development of [iron chlorosis](#). The most commonly suggested, and best but not always successful way to deal with iron chlorosis is variety selection. Foliar iron application can be beneficial due to the low amount of iron required by soybean, but typically applications must be made at initial development of the symptoms, multiple applications are often needed, and the yield increase is usually not as good as with use of varietal resistance. Iron chlorosis development, and iron availability in the soil and within the plant is quite complex, which makes successful management with foliar fertilization difficult.

What about manganese-glyphosate interactions in soybean, and response to foliar manganese? In areas of the Midwest where manganese deficiency develops in soybean (specific soil conditions in states like Indiana and Ohio), foliar manganese application has been practiced for many years. Use of glyphosate has not reduced that symptom development or need for foliar manganese application, and perhaps has increased it. Because soils can quickly tie up soil applied manganese, the preferred treatment has been foliar application when deficiency symptoms develop. In Iowa we see iron chlorosis in soybean, but not manganese deficiency. Research in areas that do not have manganese deficiency issues has shown the use of glyphosate does not necessitate the need for foliar manganese application nor influenced the development of manganese deficiency. That is, manganese application has not necessarily increased yield when glyphosate has been part of the weed control system. This is an area that could probably use additional research.

Summary

Just because a post herbicide application is being made to a field does not justify inclusion of a foliar fertilizer material. Remember, corn and soybean take up a large amount of N, P and K, during a growing season. This amount cannot be substituted for or compensated with a low foliar rate. If you are still not certain about foliar fertilization or the benefits of promoted products/systems, then try a few well controlled/replicated strips and monitor crop growth and yield before making applications to large acreage.