

## Facts of Foliar Feeding of Corn and Soybeans

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Now more than ever, growers are considering ways to enhance crop yield. This is due in large part to the recent increase in grain prices, making many crop improvement products more easily justified. For example, if a crop input costs five dollars per acre and improves yield by even two bushels per acre, it is a good investment. One such product being heavily marketed, often with claims of significant yield increases, is foliar-applied nutrients. This *Field Facts* will provide an objective discussion of foliar feeding of corn and soybeans.

### Plant Structure

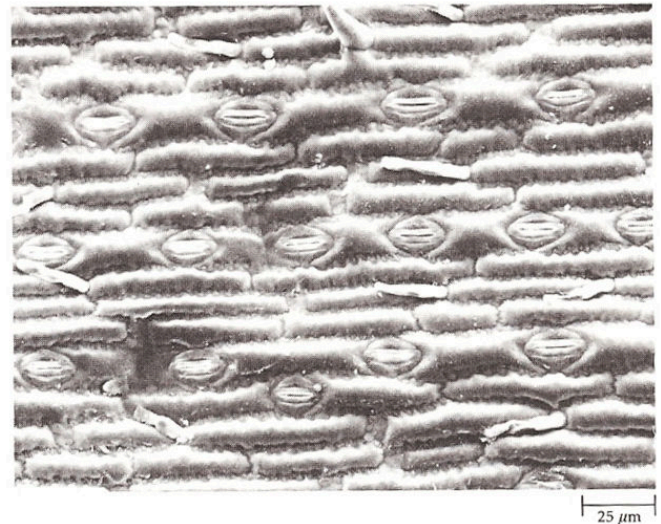
Plant parts are designed for specific functions, and **root hairs** are no exception. Root hairs are specifically designed to provide water and nutrients to the crop plant (Figure 1).



**Figure 1.** Corn root with prolific growth of root hairs for uptake of water and nutrients from the soil.

Uptake of nutrients into the plant is completed largely through a process called active transport. With active transport, plant energy is expended to move nutrients from the soil solution across cell membranes in the tiny root hairs pictured. Root hairs are highly specialized to greatly expand the root surface area in order to acquire more water and nutrients.

In contrast, **leaves** are designed to collect sunlight, photosynthesize, transport sugars to other parts of the plant and transpire water vapor and gases. Leaves are covered by a waxy cuticle, making them virtually impervious to water and carbon dioxide. Stomata make up 10% of the leaf surface and account for 90% of the water and gas movement on the leaf. The football-shaped structures seen below are the stomata (Figure 2.)



**Figure 2.** Electron micrograph of a corn leaf showing stomata. From *Biology of Plants*, 5<sup>th</sup> edition.

In order to get nutrients into the leaf, the nutrient must be able to penetrate the waxy cuticle or enter through the stomata and then across cell membranes. It should be noted that very small amounts of inorganic ions (fertilizers) can enter plants through the leaf surface.

### Products to Consider

Because such small amounts of nutrients can enter plant leaves, macronutrients like nitrogen, phosphorus, and potassium should not be considered for a one- or two-shot foliar feeding program. It is highly improbable that foliar feeding can get enough of these nutrients into the plant to make a difference. In fact, several University studies have confirmed little difference in yield when foliar applying macronutrients to corn and soybeans.

**Micronutrients**, on the other hand, can prove beneficial as a foliar feed, but only if deficiency symptoms exist (Figures 3 and 4). This is due to the fact that micronutrients are required in such small quantities that even a leaf application will be sufficient to improve the plant's health. Even so, once a field is identified to have a problem with micronutrients, growers should subsequently apply micronutrients in a band with starter fertilizers. This method provides more consistent results than foliar feeding.



**Figure 3.** Corn leaf exhibiting zinc deficiency.



**Figure 4.** Soybean leaf exhibiting iron deficiency.

### Application Rates

Generally, companies marketing foliar feed products advertise low use rates from a quart up to three gallons

per acre with products that already have a very low analysis. Before purchasing a foliar feed product, consider how much nutrient you are actually putting on your field. Then calculate the cost of the nutrients on a per pound basis. Would the money be better spent on soil-applied nutrients?

### Application Techniques

Many growers like to apply foliar nutrients while applying herbicides or fungicides to avoid another trip through the field. Consider the following:

- Depending on crop stage, there may be more soil exposed to the spray than foliage. How much of the material that you are spraying is actually hitting the leaves?
- Glyphosate applications generally use low carrier volumes and do not wet entire leaf surfaces. In order to maximize nutrient penetration, leaves should be thoroughly coated. Thus, glyphosate is generally not a good foliar feed product partner.
- Fungicide applications generally utilize a higher carrier volume, sufficiently wetting leaf surfaces. While this is a better choice for a foliar feed tank mix partner, there can be issues. Some foliar feed fertilizers in combination with fungicides may cause leaf damage. Be careful not to damage what you are trying to protect with the fungicide and always read and follow label instructions to insure against product interactions.

### Summary

There is no substitute for a strong soil fertility program. Plants must have adequate nutrition to maximize yields. Since roots are more efficient at nutrient uptake than leaves, macronutrients (N, P and K) are best applied to the soil. In addition, care should be taken to avoid management practices that would reduce root volume (e.g., compaction).

Micronutrients can be applied to foliage with success. Consider the amount of nutrients you are getting for your dollar in a foliar feed program.