Ask Ms. Ag Expert

How do plants absorb micronutrients?

There is so much market noise in choosing which micronutrient is going to be the best choice for addressing a deficiency indicated by a recent soil test. How do plants absorb nutrients and how do you know what nutrition fertilizer product is going to work for a soil already deficient in a micronutrient?

Craig from Saskatoon

Plants absorb nutrients in two different phases. The first stage is the micronutrient coming in close proximity to the root. The second phase is getting it to where it needs to go within the plant.

Roots don't search for nutrients in the soil so all nutrients including the micronutrients have to come in contact with the roots. This happens in one of three ways;

1. Mass flow - Over 95% of nutrients taken up by the plant move to the roots in this way. The plant moves soil water from the roots upwards to the leaves where the water is then transpired into the atmosphere. This causes a flow of moisture containing the dissolved nutrients through the root zone, bringing it into contact with the roots where it can be absorbed. The key here is for the water to move the dissolved nutrient ions to the roots and therefore the nutrient must be soluble in water so it can move and so that the plant can absorb it. I will come back to this fact.
2. Root interception – Here the root or root hairs accidentally bump into the nutrient as they grow, simply by chance. Less than 1% of the nutrient uptake of the plant is absorbed this way.
2. Diffusion – This is movement from a higher concentration to a lower concentration but this movement is very slow. P, K and Zn move in the soil by diffusion.

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The Short Answer……..

Now that you know how nutrients are absorbed when choosing the best micronutrient to address a soil deficiency, consider the form of the nutrient and how soluble is it. The nutrient or micronutrient must have at least 50% solubility to enter the plant before it can address a deficiency. Manufacturers can provide this information or it can be found on the SDS sheets for the products.

The Story Continues……..

When a root comes in contact with micronutrient ions like Cu++ or Fe+++ or Fe++ they cannot just enter into the plant like there is an open door. Plants can bring an ion like Cu++ inside root, through the epidermis or outer layer but in order to reach the major water movement pathway called the xylem, the ion is checked at the Casparian Strip. This is the second phase of absorption, in which the plant absorbs only the micronutrient and blocks entry of any other particles or organisms that could cause potential harm to the plant. Plants absorb micronutrients only when they are dissolved in water and they have to pass a checkpoint, (Casparian Strip) before entering the xylem, the water highway of the plant. If the nutrient form is not soluble in water, the plant cannot absorb and transport it within the plant.

Think of this as a flight outside the country. The micronutrient can enter the airport (the root), but to get on the plane (xylem) one must first be approved by customs (Casparian Strip). Once past the barrier of the Casparian strip, the dissolved ion moves freely upward with water movement to where it is needed in the plant.

Micronutrients can come in a number of forms. Each form has its own solubility capability which is the deciding factor in the ability of roots to absorb the nutrient. Below is a list of the most common forms of nutrients, and their relative solubility.

- Oxides are less than 10% soluble in the oxide form. Microbes will digest oxides and convert them into a form that improves their solubility but this takes time and it's hard to predict microbial activity.
- Sulphates are highly soluble and therefore readily available to the plant.
- Oxy-sulphate are combinations of sulphate and oxide and can address immediate plant needs but also over the crop year, can increase soil levels with the deficient nutrient.

A 1999 study by Colorado State University and Alberta Agriculture, examined zinc (Zn) from different sources, each with a different solubility. The results indicated corn growth increased as the solubility of the zinc fertilizer increased. If a low soluble form was used, to maintain the same rate of growth, four times the rate of fertilizer was required. The study concluded that in order to be effective, a Zn fertilizer must be at least 50% water-soluble. To see the full study results.http://www.spectrumanalytic.com/support/library/rf/Solubility_of_Micronutrients.htm