



Field crops need balanced nutrition for peak performance as measured in optimum yield and crop health. Macro-nutrients like nitrogen (N), phosphorous (P), potassium (K) and sulfur (S) usually get scrutinized when developing a crop fertility plan so that producers can optimize yield. However; with 17 essential nutrients for optimized growth plants need more than just macro-nutrients. Plants have a critical range and specific requirements for each of those nutrients for healthy crop growth and development.

Micro-nutrients while required in smaller amounts sometimes are forgotten in the calculations of deciding how much macros (N, P, K, and S) to apply. It could be a human factor of thinking that something so small, like 1 pound of copper (actual) per acre, would be as important as 100 pounds of nitrogen (actual) for that same acre. However, Mother Nature throws a curveball in how the crop roots obtain this nutrition. Producers can hit this curveball by understanding the science behind how plants absorb nutrition.

All plants take up nutrients in three ways:

1. **Mass flow** - Over 95% of nutrients taken up by the crop move to the roots in this way. The flow of water into the plant brings with it the dissolved nutrients required for growth and development. Water is used to move the dissolved nutrients through the soil and from the roots up to the leaves where both the water and the nutrients are needed most. The key is the nutrient must be soluble in water so that the plant can absorb and then trans-locate or move it.
2. **Root interception** – By chance, the root (or root hairs) can intercept the nutrient, and limited nutrient absorption occurs this way. The method of applying a micro-nutrient coated on granular fertilizer granules (urea) might aid in distribution, but science tells us root interception, and the amount of absorption into a plant (root inception) is approximately 1%.
3. **Diffusion** – This type of nutrient movement is from an area of higher concentration to a lower concentration and can happen very slowly. P, K, and Zn are predominately moved in the soil by diffusion.

Mass flow is the primary method (95%) of moving nutrition to the crop root zone and the resulting absorption of nutrients into the plant roots. If a soil nutrient like copper is not water soluble, the plant cannot absorb what it needs to meet its nutritional requirement.

This is Mother Nature's curveball.

Ask Ms. Ag Expert



Once we understand how solubility affects nutrient absorption, we can look at the common chemical forms of micro-nutrients available to feed the crop. The three most common chemical forms of micro-nutrients and their solubility are:

- Sulfates - meets the need to feed the plant immediately (highly water soluble) however this form is not always compatible with typical macro-nutrient blends.
- Oxy-sulphates (combination of sulfate and oxide provide the need to feed immediately and build soil levels for following years) (water solubility is 30-50%).
- Oxides (very low water solubility).

How does a Producer or an Agronomist know if a micro-nutrient can be absorbed and assimilated by the crop plants? It is merely asking the question; "What is the chemical form of the nutrient? This question can relate to the 4 Rs of Nutrient Stewardship, a framework of best management practices for fertilization of field crops. The goal of the 4 Rs is to match nutrient supply with crop requirements and to minimize nutrient losses from fields. The four R's consist of the right rate, right time, right place and right source.

Understanding the source of the micro-nutrient addresses the time in which the nutrient is available to the plant. "Sulfates will be available for your crop immediately and will address deficiency rapidly (in days).

An oxide tends to be the least costly form but will not provide nutrition until converted into a soluble form. Predicting the date of actual availability to the plant is very difficult.

Producers can hit Mother Nature's curveball on plant nutrition out of the park by using micro-nutrients in the form of oxy-sulfates. This chemical form will address the present crop's nutritional needs and builds the soil for future crop needs. Let us look at an example of batting practice on the curve.

Wheat is a high user of Copper (Cu) as compared to other field crops. Applying a granular form as an oxy-sulfate will feed this year's wheat crop as some of the product is very soluble. In the following years, the remainder of the copper fertilizer will become available, to subsequent rotational crops.

"Feed and Build" the soil with an investment in granular micro-nutrient as an oxy-sulfate; you have ensured sufficient copper for both the current wheat crop and for crops the following year.

Accomplishing this in one pass (current year) is a smart use of a producer's time and a grand slam on Mother Nature's curveball.

When it comes to crop nutrition and, to ensure you are getting the best bang for the micro-nutrient dollar, consider the fertilizer formulation:

- An oxide (low solubility)
- Sulfate (high solubility)
- Oxy-sulfate (high solubility and soil building capacity)

Remember: If it's not soluble in water, your crops cannot readily access the nutrient, no matter how well it's distributed in the soil.

Ms. Ag Expert