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## HOW MOBILE ARE PLANT NUTRIENTS?

**Application of supplemental plant nutrients is a common practice in most agricultural fields around the world.** Most often this is done by using fertilizers or animal manures, or some combination of both. The aim is to apply nutrients using the principles of **4R Nutrient Stewardship**. That is, applying the **Right Source** of nutrient at the **Right Rate, Time, and Place** so that adequate nutrients are available to the crop to maximize crop yields and net returns for the farm, but minimize any unwanted nutrient movement away from the field in surface run-off, leaching into groundwater, or gaseous emissions to the air [e.g., nitrogen lost as di-nitrogen ( $N_2$ ) or nitrous oxide ( $N_2O$ )]. Depending on the nutrient, its application can be done pre-planting, at planting, or as a top-dressing during the growing season.

**It is important to know the mobility of the nutrients in the soil to decide how best to apply them.** Often slowly soil-mobile macronutrients such as phosphorus and potassium, and most micronutrients are applied and incorporated before planting using pre-plant tillage operations, placed in the seed furrow with the seed, or precision side-banded close to the seed furrow as part of the planting operation. This allows the crop roots good access to the low mobility nutrients early enough during the life cycle of the crop to gain the benefits of increased yields and often improve crop quality. The two soil-mobile macronutrients, nitrogen and sulfur, can be successfully top-dressed within a month after planting, but in low to moderate rainfall regions they can be applied as pre-plant or at planting operations, and even sometimes in the fall preceding spring planting.

**The effect of the applied rate of nutrient needs to be considered.** Too high a rate of any fertilizer in the seed furrow, or very close to the seed furrow, can result in an adverse osmotic salt effect that can reduce or stop seed germination and emergence. Many nutrients can be seed furrow applied at a low rate to enhance early crop uptake and overall crop yields, especially if the nutrient is slowly mobile in the soil, but the rate applied is critical. For example, copper (Cu) is a nutrient that is slowly mobile in soil and a low rate (1 lb Cu/A) applied in the seed furrow of a small grain cereal grown on a Cu-deficient soil can be beneficial, but a high rate (10 lb Cu/A) can be toxic to seedlings.

**You need to know both the rate of nutrient needed and the nutrient soil mobility, in order to consider how best to apply a nutrient.** Consider the very mobile nutrient nitrogen. Concern over seed safety usually prevents the full nitrogen need of the crop to be placed in the seed furrow. However, applying a low rate (5 to 10 lb N/A) in the seed furrow can be beneficial for early seedling establishment and growth, while the remainder is placed away from the seed furrow to avoid adverse effects. A compound fertilizer that is a homogenous combination of other non-mobile soil nutrients such as P, S and zinc (Zn) is commonly an effective source.

**Seek the advice of an experienced consulting agronomist, or crop adviser in your local area to design an effective nutrient program for each of the crops you grow.**

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