

ENHANCED EFFICIENCY PHOSPHORUS APPLICATION FOR A CORN-SOYBEAN ROTATION

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Background:

Phosphorus (P) is an essential mineral plant nutrient that is taken up by plants as inorganic ions (H_2PO_4^- and HPO_4^{2-}) found in soil solution. Phosphorus in plants is an important structural element in nucleic acids (RNA and DNA), serves as an energy transfer element (ATP), and has a critical role in cellular regulation, and carbon partitioning. Soluble forms of P or P bound to clay particles can be lost from agricultural land through runoff and surface erosion. Unless the soil is coarse-textured or artificial drainage is present, P leaching is generally considered very low. Precipitation reactions involving P affects the availability of P and are dependent on soil pH. At a low soil pH, the P will form precipitates with Fe and Al which makes the P less available for plant uptake. Precipitation of calcium phosphate compounds at high pH (>8) can also reduce P availability.

With high fertilizer cost, farmers are evaluating application rates and considering enhanced efficiency P applications or treatments. AVAIL[®] (Specialty Fertilizer Products, Leawood, KS), NutriLife Max[®] (Advanced Microbial Solutions, Pilot Point, TX), and P₂O₅ Max[®] (Rosen's Inc., Fairmont, MN) are three new products that may enhance the efficiency of P-based fertilizers. AVAIL is a stabilizer product for granular phosphate fertilizers including DAP, MAP, and other phosphate fertilizers. It was designed to reduce the impact of metals in the soil around the fertilizer granule on plant uptake, and P sorption, and allow P to be more available to the plant. This product primarily binds with calcium, iron, manganese, and aluminum to prevent precipitation of P. When applied to single crops, Blevins (2009) reported a 19 to 22 bu/acre increase in corn grain yields when AVAIL was added to MAP at 20 lbs P₂O₅/acre and applied as a broadcast or banded treatment. Dunn (2009) reported increased Bray-P1 soil test P availability and a 4 bu yield increase in soybean after applying 50 lbs P₂O₅/acre with AVAIL. Similarly, rice yields increased 8 bu/acre when reduced rates of triple super phosphate were applied (25 lbs P₂O₅/acre) with AVAIL. P₂O₅ Max is supposed to increase P uptake and improves root surface area resulting in better nutrient absorption and higher yields (Rosen's Diversified Inc, 2010). NutriLife Max is supposed to improve fertilizer uptake, thus contributing to overall plant vigor and quality (Advanced Microbial Solutions, 2005). In addition, banded applications of P may also increase P efficiency (Minor et al., 1993). Phosphate placement in the rooting zone of moist soil was suggested to improve efficiency if farms desired to apply reduced rates. Strip till applications may limit P loss if soil particles were eroded into surface waters.

Objectives:

1. Evaluate the effect of P placement, rate, and P stabilizer on grain yield and P uptake in a corn-soybean rotation.
2. Determine the effect of P source, P stabilizer, and ag lime on gain yield and P uptake in a corn-soybean rotation.

Procedures:

Research trials at the Greenley Memorial Research Center in Novelty, Missouri, at the Delta Center in Portageville, Missouri, and at the Hundley Whaley Research Center in Albany, Missouri were initiated in 2010. Objective 1 is being conducted at Novelty and Albany. Treatments will include a factorial arrangement of application placement (i.e., surface broadcast of strip-till), MAP rate (0, half the recommended rate, and recommended rate), and the presence and absence of the three phosphorus efficiency products [AVAIL[®] (Specialty Fertilizer Products, Leawood, KS), NutriLife Max[®] (Advanced Microbial Solutions, Pilot Point, TX), and P₂O₅ Max[®] (Rosen's Inc., Fairmont, MN)]. Objective 2 is being conducted at Novelty and Portageville. Treatments include a factorial arrangement of a P source (non-treated control and a broadcast application of DAP or TSP), presence or absence of the three phosphorus efficiency products, and broadcast surface application of ag lime (0 and recommended rate).

References:

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