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Fluid P Performance Improved With Polymers

Studies have shown new polymer technology combined with fluid P has significant effects on P-use efficiency and crop yields.

Taking advantage of information that has been recently developed with new P fertilizer technology can be of substantial benefit for 2006 winter wheat and the 2007 growing season. The realization of P fertilizer benefits has been a reality for many years and a key to North American growers competing in world markets. Getting the most out of P or any other fertilizer input is a necessity for success in lowering production costs per unit and competing successfully in those markets.

Recent studies at Kansas State and other universities have verified that a polymer chemistry improves P fertilizer-use efficiency. The dicarboxylic copolymer Avail® is a high-charge density polymer (cation exchange capacity of approximately 1,800 meq/100gams) that sequesters multivalent cations that would normally form insoluble precipitates with P fertilizer. It can be added to P fertilizer solutions

SUMMARY

A new polymer technology (Avail®) has been shown to significantly improve phosphorus (P)-use efficiency when added to P fertilizers. The high-charge density of the polymer inhibits P fixation reaction by acting as a platform for sequestration of P fixing cations calcium (Ca) and magnesium (Mg) in high pH soils, and iron (Fe) and aluminum (Al) in low pH environments. Higher concentrations of the polymer have been required in fluid fertilizers than when coated on solid P sources because of a less precise geometry of the affected microenvironment of the fluid band.

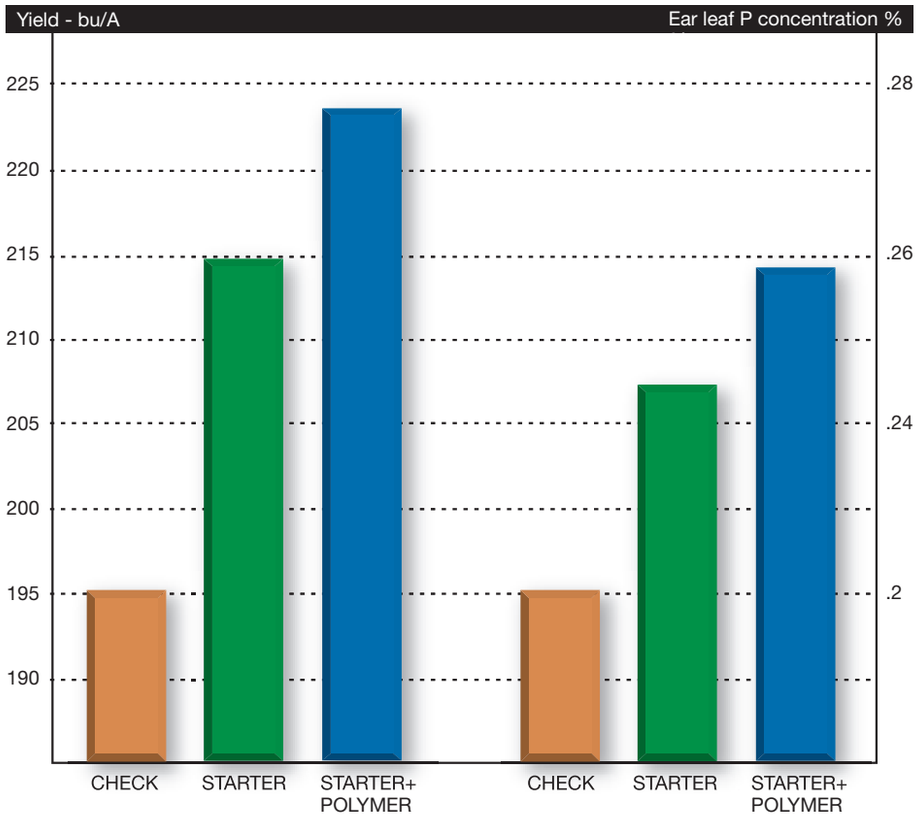

Figure 1. Effects of fluid starter and polymer on corn yield and plant P concentration, Scandia, KS, 2003-2005.

such as 10-34-0, 11-37-0, 6-24-6, 3-18-18, or 7-21-7. The polymer does not react with the P but does react with antagonistic positively charged multivalent cations such as calcium, magnesium, aluminum, and iron. The process creates a zone of access and higher P availability, allowing more P to be taken up and used more efficiently by plants than where no polymer is included.

Fluid starter

A three-year fluid starter study with irrigated corn at the North Central Kansas Experimental Field, located near Scandia, Kansas, has confirmed polymer benefits. Study treatments consisted of a no-starter check plot, starter alone, and starter plus the polymer at various concentrations. Fluid starter application rates consisted of 30 lbs/A of N, 30 lbs/A of P_2O_5, and 5 lbs/A of K_2O. Starter was applied on the soil surface two inches to the side of the row at planting. Additional N was sidedressed at the V2 stage so that all plots received a total of 200 lbs/A of N regardless of starter treatment. Use of the fluid starter increased corn grain yield by 19 bu/A over the no-starter check (Figure 1). The addition of the polymer to the starter fertilizer further increased yield by an additional 9 bu/A. Corn ear leaf concentrations were greater in plots receiving the starter plus the polymer than in plots receiving no starter or starter alone. This indicates that the use of the polymer does result in an increase in P uptake by plants and ultimately in greater grain yield.

These initial studies indicate that polymer concentrations in high volume fluid starters need to be in the 1.5-percent-by-volume range to produce the desired effects. This percentage is of the entire fluid mix, not just the P component, because of the impossibility of treating only the P solution. Studies have also shown that a lower 2.0 polymer pH formulation is more effective than the higher 5.5 pH formulation initially used and allows the polymer concentration for side band placement to be reduced to 0.5 percent by volume. Concern for seed damage from the pH 2.0 polymer led to recommendations for use of the pH 5.5 formulation for popup starters at a concentration of 1.5 percent.

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