Fertilizer Facts: August 2002, Number 29

Effects of Dust Control Coatings on Phosphorus Fertilizer Availability and Crop Yield

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Montana has the second highest percentage (78%) of soil samples testing either medium or lower in soil test phosphorus (P) in the U.S. (Fixen, 2001). Phosphorus fertilization often does not substantially increase soil test levels because P can quickly convert from plant available to unavailable, due to our calcareous soils. In addition, soils that have been fertilized with P for at least 20 years in Montana have been found to have significantly lower Olsen P test levels compared to paired, non-fertilized soils, likely due to increased plant P uptake and subsequent plant removal in fertilized soils (Jones et al., 2002). Therefore, efficient use of P fertilizers in the state and region is necessary to maintain, or increase, soil P test levels, and thereby optimize crop yield and quality.

Many P fertilizer manufacturers coat granular P fertilizer to decrease dust production during packaging, transport, storage, blending, and spreading. The coatings, some of a proprietary nature, are made of oils or waxes and have the potential to affect P availability, uptake, and yield. Unsubstantiated reports from the field have suggested that dust control coatings may decrease plant growth, yet there are no known published results on the effects of dust control coatings on P availability, uptake, or yield.

Methods

Coated and uncoated MAP (11-52-0) fertilizers were obtained from IMC-Agrico Company and J.R. Simplot Company. The use of these products does not indicate support or endorsement by Montana State University; the products were only selected as examples of coated and uncoated MAP fertilizers. The coatings consisted of a proprietary oil and a wax.

A pH 5.6 soil was obtained near Belt, Montana from native range, and a pH 8.0 soil was collected near Flat Willow, Montana from a spring wheat field. Soil was added to 24 plastic pots (8 in. diameter) in the MSU Plant Growth Center. MAP was then either broadcast or incorporated to 6 in. depth at a rate equivalent to 40 lb P_2O_5 /acre (10 ppm) in triplicate. Two silage corn seeds (Rea Hybrid 3107, 108 day length) were planted in the center of each pot. The weaker looking seedling was removed approximately 1 week after germination. To avoid and alleviate nutrient deficiencies, soils were fertilized at rates equivalent to 50 lb N/ac, 20 lb S/ac, and 10 lb Fe/ac (chelated), after the corn was established. Soil samples were collected using a stainless steel corer prior to fertilization (Week 0), and then at 1, 2, and 4 weeks after fertilization. Soils were submitted to an independent laboratory for analysis of Olsen P. After 8 weeks, corn was harvested, dried, weighed, and analyzed for total P.

Results:

Olsen P concentrations were not significantly different between coated and uncoated fertilizer treatments in the pH 5.6 soil (Figure 1). In addition, the coated fertilizer treatments never had significantly lower Olsen P concentrations in the pH 8.0 soil after the fertilizer was applied (Figure 2). P uptake was also never significantly lower in soils applied with coated fertilizer granules, yet conversely, was significantly higher in the low pH soil when fertilizer was incorporated (Figure 3). Finally, aboveground crop biomass was never significantly lower in soils applied with coated MAP fertilizer, yet was significantly higher than the uncoated, incorporated treatment in the high pH soil.

Fertilizer Fact:

Dust control coatings on MAP did not significantly decrease Olsen P levels, P uptake by corn, or biomass in either a low or high pH soil.

Acknowledgments

This work was funded by a grant from the Montana Fertilizer Advisory Committee. We would like to thank Neal Fehringer, Billings, Montana, and Lionel Ashley, Belt, Montana for assistance in providing access to soils used in this study, and David Baumbauer for assistance in the greenhouse.

References

Fixen, P. 2001. Soil test levels in North America. PPI/PPIC/FAR Technical Bulletin 2001-1. Potash and Phosphate Institute.

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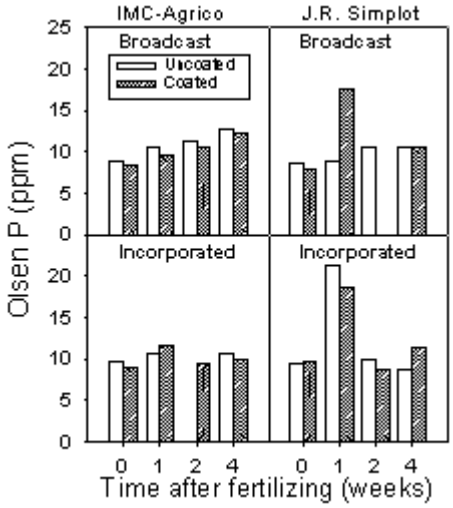

***Figure 1**. Comparison of Olsen P between coated and uncoated MAP fertilizer treatments in a pH 5.6 soil. A missing bar indicates samples were spilled by laboratory. There were no significant differences (P<0.1) between treatments.*

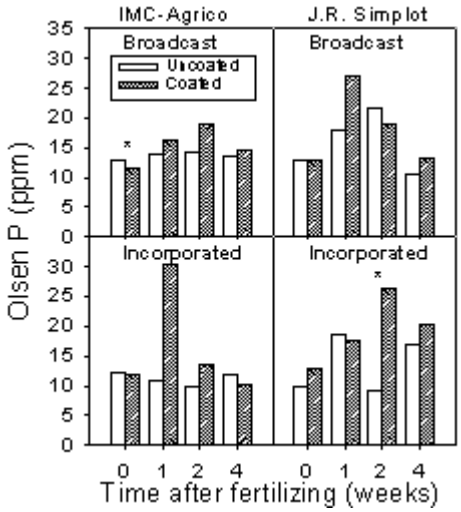

***Figure 2**. Comparison of Olsen P between coated and uncoated MAP fertilizer treatments in a pH 8.0 soil. * - Significant at P<0.1.*

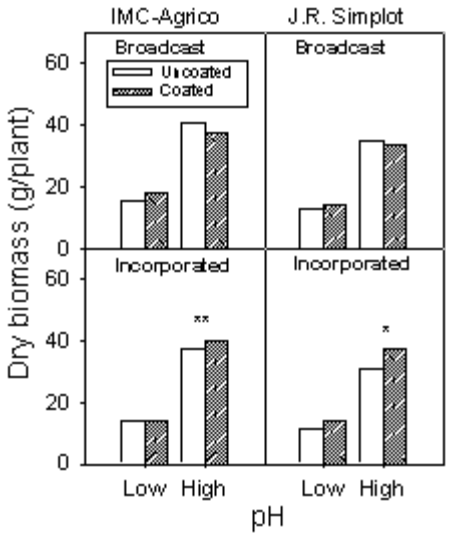

Figure 3. *Comparison of P uptake by corn between coated and uncoated MAP fertilizer treatments. ** - Significant at P<0.05.*

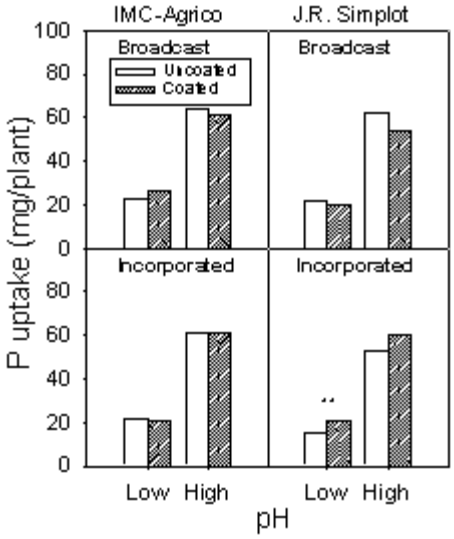

Figure 4. *Comparison of aboveground biomass between coated and uncoated MAP fertilizer treatments.*

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