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Phosphorus Improves Yields In Corn/Wheat Rotation

Researchers report, however, varying P levels in soil had an effect on some responses.

Summary: *Because short-season corn planted early is gaining popularity in the Central Plains region, studies were undertaken to compare the effects of phosphorus (P) rate, sulfur (S) rate, and S source on early maturing corn planted early, and the effects of residual P on wheat planted after corn. Rossville and Norway, Kansas, were the sites selected for the four-year study.*

Early-season corn growth responses to P were found at Rossville but not at Norway, with no response to S or S source at either location. Corn grain yield at Rossville was 18 percent higher with 30 lbs/A phosphate, compared to no P. Increasing phosphate rates to 60 and 90 lbs/A had no effect on yield. There were no treatment effects on corn grain or stover yields at Norway.

Wheat grain yields and boot-stage dry matter yields were significantly increased by P applied at planting and by residual P at both locations. A significant interaction between P applied at planting and residual P was found for boot-stage dry matter yields and grain moisture at Norway. Phosphorus applied at planting masked the effects of residual P.

Another study compared S sources and rates/or corn on a coarse-textured soil that had been S responsive before. Dry matter production at the V6 stage was sign ificantly higher when S was applied at 30 lbs/A, compared to no S. There was, however, no effect of S rate or source on grain or stover yields.

Droughty conditions during July and August, which are critical growth periods for full-season corn hybrids, are relatively common in the Central Plains region. A strategy gaining popularity in central and eastern Kansas is adoption of a corn/wheat rotation cropping system that plants early-maturing corn in late March or early April, thereby allowing the crop to pass through its critical growth stages prior to typical droughty periods. By May and June, the two months with highest average rainfall in Kansas. the early-planted corn has grown enough to use these rains to complete its critical growth stages (silking, pollination, and early grain fill) before the typical hot and dry conditions of summer. Granted, early-maturing corn has a lower yield potential compared to full-season corn, but it does allow corn production where it was nonexistent previously. More consistent yield potential also can be expected, plus it makes the corn/wheat rotation possible.

To discover more about the effects of fertilization on each of the crops in the rotation system, studies were initiated in 1994 at our experimental fields near Rossville and Norway, Kansas. Objectives were to determine:

- effects of high starter P rates on early growth, stand count, and grain yield of early-maturing corn planted early
- effects of S rates and sources on yield and plant tissue composition of early-maturing corn
- effects of fresh and residual P on wheat planted after early-maturing corn.

Corn yield up

Rainfall during the growing season was adequate and corn stand was good early in the season at both sites. There the similarity ends.

Rossville. Phosphate applied at 30 lbs/A produced significantly higher dry matter yields at the V6 stage than areas where no P was applied. Phosphate-applied rates of 60 and 90 lbs/A produced significantly higher dry matter yields than the 30 lbs/A rate.

As shown in Figure 1, phosphate applied at 30 lbs/A produced a corn grain yield 18 percent higher than areas where no P was applied. However, upping rates to 60 and 90 lbs/A produced no significant differences from the grain yield produced by the 30 lbs/A rate.

Similar responses were seen in stover yield. The 30 lbs/A rate produced yields 12 percent higher than areas with no P, but the 60 and 90 lbs/A rates produced no significant differences in yield from the 30 lbs/A rate.

There were no differences in stand count, above-ground dry matter (V6) yield, grain yield, and stover yield due to sulfur rate or source.

Norway. There were no significant differences in stand count, above-ground dry matter (V6) yield, grain yield, and stover yield due to P rates, S rate, or S source. The above-ground dry matter (V6) yield and grain yield increased with increasing P rate, but the increases were not statistically significant. Accounting must be made here for the fact the Norway site tested high in available P. whereas the Rossville site tested low.

Residual P helps

The prospect of planting wheat following early-maturing corn planted early shows considerable promise. The possibility of adding all of the necessary P at corn planting also offers some advantages. Since many growers

are unwilling or unable to apply fertilizer when planting wheat, the research reported here shows that P applied at corn planting can benefit the subsequent crop. The expected mid-September harvesting time for early-maturing corn should leave plenty of time for wheat planting.

Rossville. When phosphate was applied at 60 lbs/A at wheat planting, wheat grain yield was 8 percent higher than areas where no P was applied (Figure 2). Test weight was 1 percent higher. Grain yields were also signifi-cantly higher where there was residual P. Interaction between P applied at wheat planting and residual P was significant for above-ground dry matter (boot stage) yield and wheat grain moisture. Without P applied at wheat plant-ing, above-ground dry matter yield increased as residual P increased. This effect was not present when P was applied at wheat planting. Similarly, there was a residual P effect in grain moisture when no P was applied at planting and no effect when P was used.

Norway. Wheat grain yield was 9 percent greater with P at wheat planting than in residual P areas; similarly, above-ground dry matter was 19 percent greater. Effects of residual P rate on grain yield, grain moisture, and test weight were variable.

Dr. Ashraf is a graduate, Dr. Pierzynski is associate professor, Dr. Gordon is assistant professor; and Dr. Lamond is professor in the Department of Agronomy at Kansas State University.

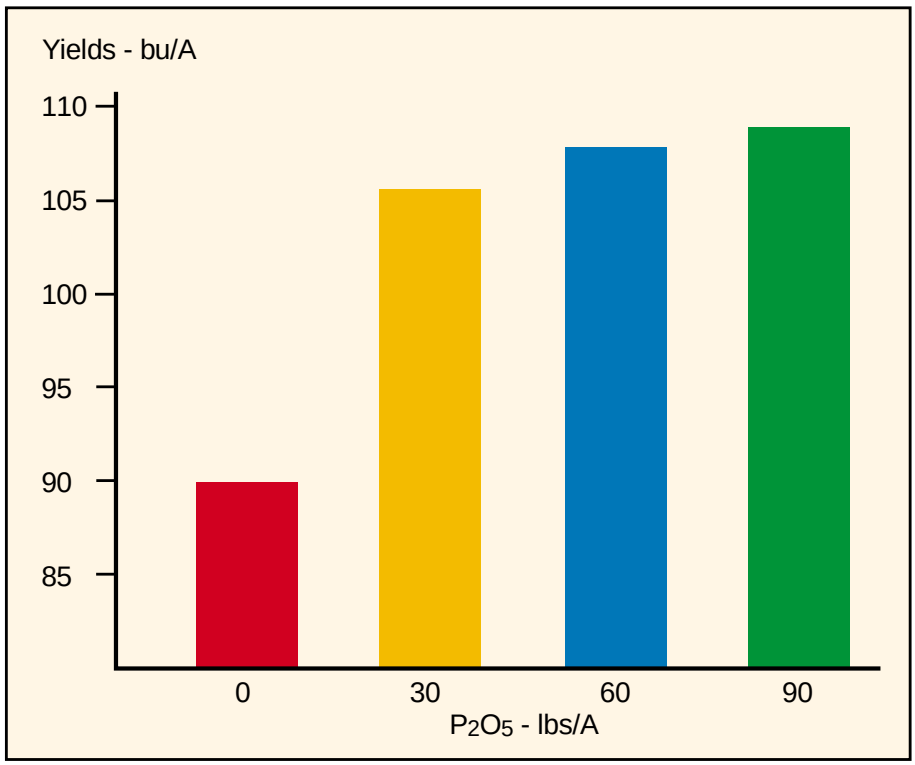
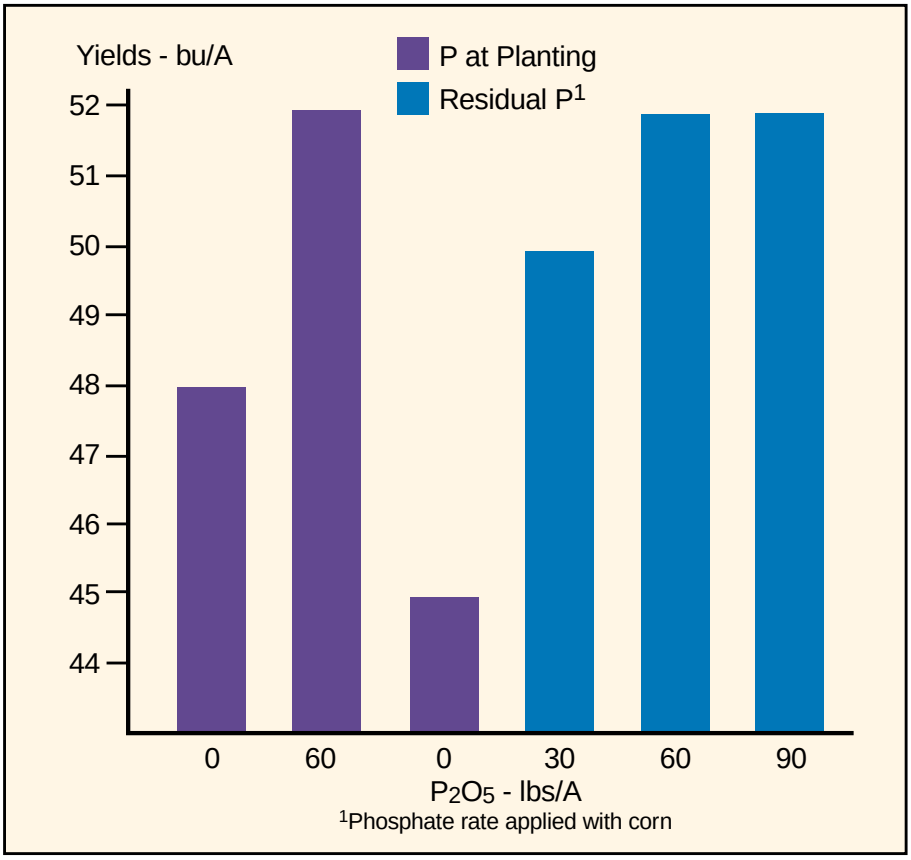


Figure 1. Effect of P on grain yield of early-matuing corn, Rossville, Ashraf et al., 1994.



Fugure 2. Effect of P and residual P on grain yield of winter wheat, Rossville, Ashraf et al., 1994.