Soybean Response to Sidedressed Liquid Potassium Fertilizer in Southeast Iowa

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Introduction

Previous Iowa research has assessed the corn and soybean grain yield response to different potassium (K) fertilizer placement methods using granulated potash fertilizer (0-0-62), including a long-term experiment at this farm. However, no study evaluated postemergence sidedressing K fertilizer, although postemergence nitrogen sidedressing for corn is a common practice. Therefore, a study was initiated at this farm in 2017 to evaluate the value of sidedressed liquid K fertilizer for corn and soybean grown in rotation.

Materials and Methods

The study consisted of two 2-yr trials with corn in the first year and soybean in the second. One trial began in 2017 and the other in 2018, both on areas with Mahaska silty clay loam soil. New treatments were applied to plots of two previous K trials that had useful management histories for this new study. There were four blocks in both trials, each with five large plots measuring 40 ft wide by 50 ft long. Four plots tested Low in K and one plot tested Very High due to different past K fertilization rates but all other management practices were similar. For the first year of both trials (corn), preplant K rates of 0, 45, 90, or 135 lb K_2O/acre (granulated potash 0-0-62) were broadcast in the spring before field cultivation to four low-testing plots of each block. No preplant K was applied to the high-testing plot of each block. After planting corn, each plot was divided into two subplots to apply sidedress liquid K fertilizer at 0 or 45 lb K_2O/acre (potassium acetate 0-0-24) at the V6 growth stage by injection to the center of each inter-row to a depth of 3 to 4 in.

For soybean (second year of both trials), no preplant K was applied and liquid K fertilizer at 45 lb K_2O/acre was sidedressed at the V6 growth stage to the same subplots it had been sidedressed the previous year. Upper soybean trifoliate leaves were sampled at the R2-R3 growth stage and were analyzed for K concentration. Soybean grain yield was adjusted to 13 percent moisture. Therefore, the second year with soybean of both trials evaluated the residual effects of broadcast K rates that had been applied for the previous corn crop with or without reapplying sidedressed K for soybean.

A previous report summarized the results for corn. In 2017, the preplant K rate of 135 lb K_2O/acre maximized yield, which was similar to the yield for the high-testing treatment. In 2018, the preplant rate of 90 lb K_2O/acre maximized yield, which was similar to yields for the 135-lb rate and the high-testing treatment. Sidedressed K at 45 K_2O/acre further increased corn ear-leaf K concentration in both years for most preplant rates. However, sidedressed K increased corn grain yield further only in 2017 when preplant rates of 0 and 45 lb K_2O/acre had been applied. Moreover, the yield increase from the 45-lb sidedressed rate when no preplant K had been applied for corn was much smaller than the increase from a similar preplant rate.

This report summarizes the results for soybean in 2018 and 2019.

Results and Discussion

Figure 1 shows in both trials there was a large soybean leaf K concentration response to broadcast K that had been applied to the previous corn crop. Leaf concentration increases were exponential up to the highest rate preplant K applied before corn and for the high-testing treatment. Sidedressed K increased leaf K concentrations further only for corn preplant rates of 0 and 45 lb K_2O/acre in both the 2018 and 2019 trials, and the increases were very small. A large soybean leaf K response to K fertilization has been observed before, even in high-testing soils, which is explained by a high limit for K uptake of vegetative tissues, even when fertilization does not increase yield.

Figure 2 shows soybean grain yield increased with increasing broadcast K applied for the previous corn crop. In 2018, the 90-lb rate that had been applied for corn maximized soybean yield, which was similar to yield for the 135-lb rate and the high-testing treatment. In 2019, the 135-lb rate that had been applied for corn maximized soybean yield, which was similar to yield for the high-testing treatment.

Additional soybean grain yield increases from sidedressing liquid K at 45 lb K_2O/acre were observed for the lowest K rates applied to the previous corn crop. In 2018, K sidedressing increased yield further when 0 or 45 lb K_2O/acre had been applied before corn. Higher rates applied before corn maximized soybean yield without a need for K sidedressing. In 2019, K sidedressing further increased soybean yield only when no K had been applied before corn. Soybean yield was the highest (and similar) for the 135-lb rate applied before corn and the high-testing treatment. In both years, 45 lb K_2O/acre applied before the previous corn crop increased soybean yield slightly more than a sidedressed similar rate.

Iowa State University (ISU) suggested 2-yr K application rates for the corn-soybean rotation applied once before corn are 220 and 156 lb K_2O/acre for soil-test categories Very Low and Low, respectively. A removal-based rate is suggested for soils testing Optimum, which would have been 135 lb K_2O/acre for these trials. Because soil-test K of the low-testing areas before corn of both trials was Low, 156 lb K_2O/acre should have been applied to avoid soybean yield loss in the second year, which is higher than the highest applied rate of 135 lb K_2O/acre. However, Figure 2 shows the residual K from 90 and 135 lb K_2O/acre applied to the previous corn maximized soybean yield in 2018 and 2019, respectively, without a need for additional sidedressed K application. These rates of 90 or 135 lb K_2O/acre also had maximized previous year corn yield in both trials without a need for sidedressed K fertilizer.

Conclusions

Results from low-testing plots of two trials with corn-soybean rotations showed broadcast K fertilizer rates applied only before corn were slightly lower than the rates for the 2-yr rotation suggested by ISU maximized grain yield of both crops without a need for supplemental K sidedressing. Additional K application by sidedressing liquid fertilizer further increased corn leaf K concentration for most preplant K rates, including those that maximized corn yield. However, additional sidedressed K further increased soybean leaf K concentration and grain yield of either crop only when K rates much lower than recommended had been applied before corn. Therefore, producers should sidedress liquid K fertilizer only as a rescue option when appropriate preplant rates were not applied.

Acknowledgements

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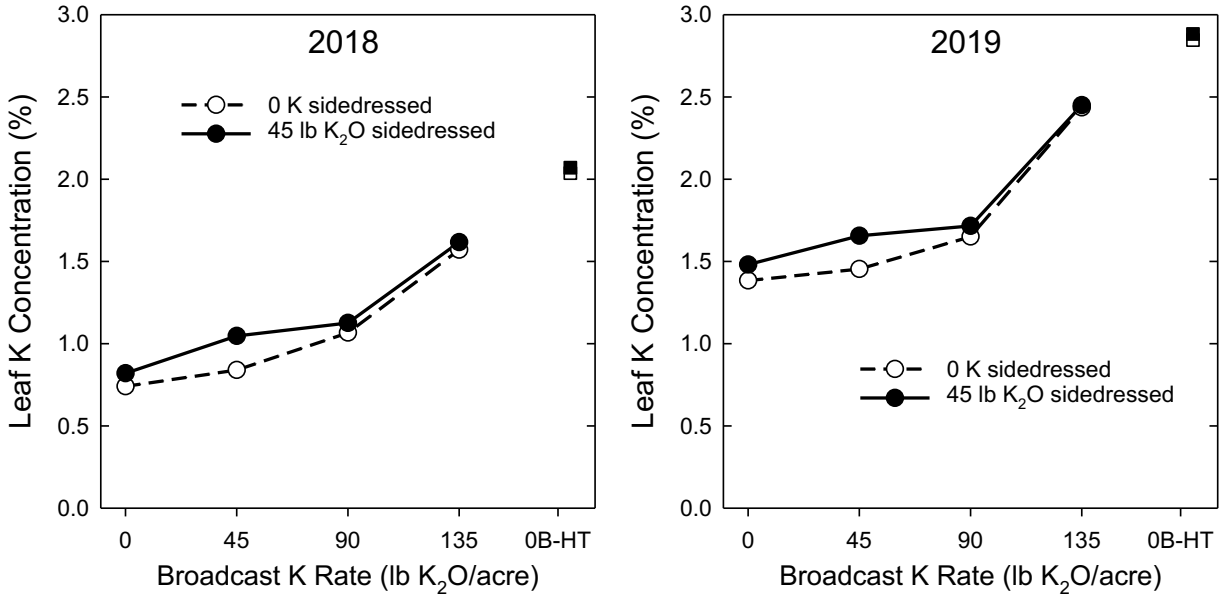

Figure 1. Soybean leaf K concentration responses in 2018 and 2019 to sidedressed liquid K fertilizer for broadcast rates of 0 to 135 lb K_2O/acre that had been applied to low-testing trial areas before the previous corn crop and for high-testing trial areas that received no preplant K (0B-HT).

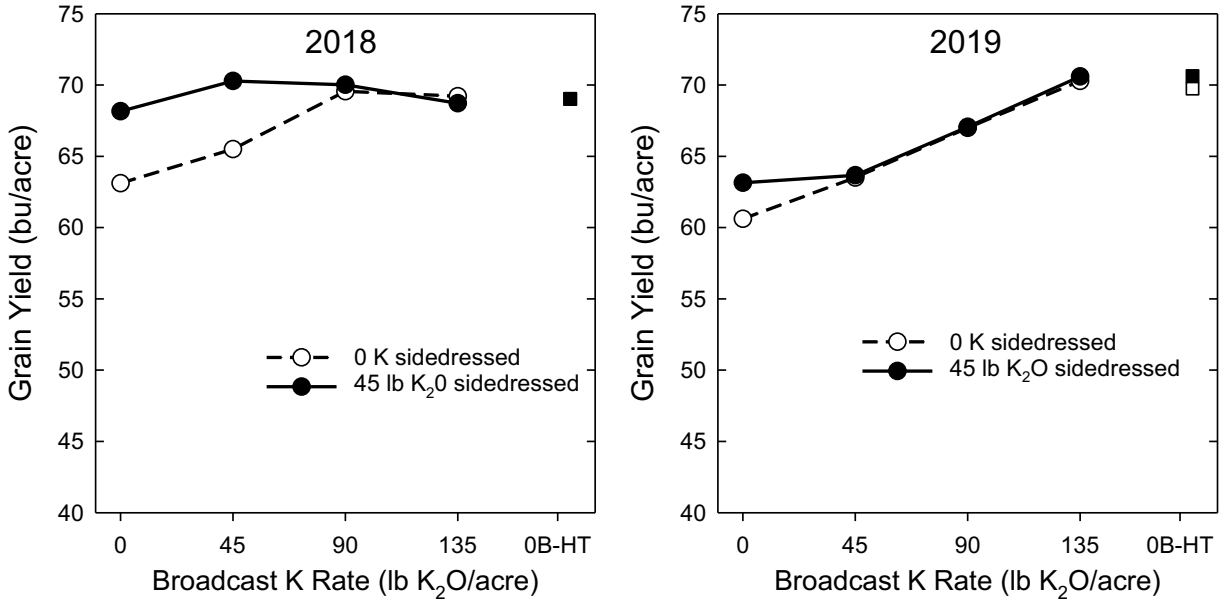

Figure 2. Soybean grain yield responses in 2018 and 2019 to sidedressed liquid K fertilizer for broadcast rates of 0 to 135 lb K_2O/acre that had been applied to low-testing trial areas before the previous corn crop and for high-testing trial areas that received no preplant K (0B-HT).