Effect of Sidedressed Liquid Potassium Fertilizer for Corn in Southeast Iowa

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Antonio Mallarino, professor
Louis Thompson, ag specialist
Department of Agronomy
Myron Rees, farm superintendent
Cody Schneider, ag specialist

Introduction

Previous or ongoing research at this Iowa State University (ISU) research farm and many other Iowa fields has been investigating the corn and soybean yield response to preplant potassium (K) placement methods or to starter K. The placement methods for the primary K application used granulated potash fertilizer broadcasted or deep-banded in the fall or early spring and also banded with planters equipped with attachments for application 2 in. beside and below the seeds (2 in. by 2 in. method). Starter research has evaluated granulated liquid K fertilizers applied to the seed furrow or with the 2 in. by 2 in. method. Post-planting sidedress application of nitrogen for corn is a common practice in the southeast region, and its effectiveness under some conditions has been demonstrated by Iowa research. However, no ISU study has evaluated the value of sidedress K application. Because of lower grain prices and more uncertain soil-testing results for K compared with phosphorus or pH, growers are asking if K sidedress could be of value to increase yield and perhaps reduce the overall K application rate. Therefore, the objectives of a study at this research farm was to evaluate how sidedressed liquid K fertilizer affects corn yield and K tissue concentrations when different rates of granulated fertilizer are applied before planting corn.

Materials and Methods

Two similar field trials with corn were conducted in 2017 and 2018. Both trials were on areas with Mahaska silt clay loam soil. Soybean was the previous crop. There were 10 treatments replicated four times at each trial. Eight treatments consisted of four broadcast K rates (granulated potash 0-0-62 fertilizer at 0, 45, 90, and 135 lb K_2O/acre) broadcast in the spring before disking each with or without sidedressed liquid K fertilizer (potassium acetate 0-0-24 at 45 lb K_2O/acre). The liquid K fertilizer was injected at the center of each inter-row at the V6 growth stage to a depth of 4 to 5 in. The two other treatments involved only sidedress K (with/without) for plots testing high in K due to a history of high K application rates.

Initial soil-test K (6-in. depth, ammonium-acetate test on dried samples) of plots that received the broadcast treatments and of high-testing plots that received no broadcast K, averaged 171 and 256 ppm for the 2017 trial and 180 and 367 ppm for the 2018 trial, respectively. According to interpretations in ISU Extension publication PM 1688, soil-test K levels of 161 to 200, 201 to 240, and higher than 240 ppm are classified as optimum, high, and very high, respectively. Corn Pioneer P1197AM was planted in 2017 and Pioneer P0574AMXT was planted in 2018, using a 30-in. spacing in both trials. The blades of corn ear leaves were sampled at the silking growth stage (R1) and were analyzed for total K concentration. Grain yield was adjusted to a 15 percent moisture content.

Results and Discussion

Figure 1 shows broadcast preplant K applications greatly increased the corn ear-leaf K concentration at both trials. A large ear-leaf

K response to K application, even in high-testing soils, has been observed before in Iowa because crop tissues have a high limit for K uptake, and K uptake increases even when fertilization does not increase yield. In 2017, the broadcast preplant 45-K rate resulted in a large leaf K increase. However, there was no additional increase from the 90-lb rate, but there was a large increase from the 135-lb rate. In 2018, all broadcast preplant rates greatly increased leaf K. The leaf K concentrations were even greater for the high-testing plots that received no preplant K. The leaf K increases from the sidedressed liquid fertilizer were smaller than increases from the preplant applications. It is noteworthy the preplant 45-lb rate increased leaf K more than a similar sidedressed K rate in both trials.

Figure 2 shows there was a moderate corn grain yield response to the broadcast preplant K treatments in 2017, but a very small response in 2018. In 2017, the broadcast preplant 45-K rate resulted in the greatest yield increase, which was similar to the 90-lb rate. An additional small apparent yield increase from the 135-lb rate was not statistically significant. In 2018, there were small yield increases by the broadcast preplant K applications that were statistically similar for rates of 45, 90, or 135 lb K_2O/acre. The initial soil-test K was optimum for both trials but slightly higher in 2018, which may explain the smaller increase. As the ISU Extension publication PM 1688 indicates, previous research at numerous trials showed a 25 percent probability of a yield response for the optimum category, for which removal-based fertilization is recommended. Yield for the high-testing plots of both trials that did not receive preplant fertilization was statistically similar to yield attained with the preplant broadcast rates. Previous research in Iowa fields showed a very low probability of a yield response to K fertilizer when soil-test K is in the very high category (1%).

The sidedressed liquid K fertilizer applications resulted in a small corn yield increase only in 2017, when the increase was statistically significant when no preplant K was applied and for the 45-lb preplant rate. The small additional yield increase from sidedressed K after applying preplant K rates greater than 45 lb K_2O/acre would not have offset the application costs. In 2017, the broadcast preplant application of 45 lb K_2O increased yield more (21 bu/ac) than the similar sidedressed K rate when no preplant K was applied (7 bu/ac). At this time, we do not have an explanation for the lack of yield response to sidedressed K in 2018, even when no preplant K was applied. Rainfall patterns for both years are being studied because these can affect both soil moisture, corn K uptake, and the effectiveness of K fertilization for preplant and sidedress applications.

Conclusions

The observed corn yield increases from broadcast preplant K application using granulated potash fertilizer in two trials having soils with optimum soil-test K showed the range of small yield responses expected in soils testing optimum in K and no yield response in high-testing soils. Liquid K fertilizer sidedressed by injection into the soil at the V6 growth stage resulted in additional small yield increases only in one year. A rate of 45 lb K_2O/acre increased yield by 21 bushels/acre, whereas a similar sidedressed K rate increased yield by 7 bushels/acre. The yield increases from sidedressed K fertilizer were smaller when preplant K fertilizer had been applied. Producers are encouraged to use preplant K fertilization because the results showed more effective than sidedressed K fertilizer.

Acknowledgements

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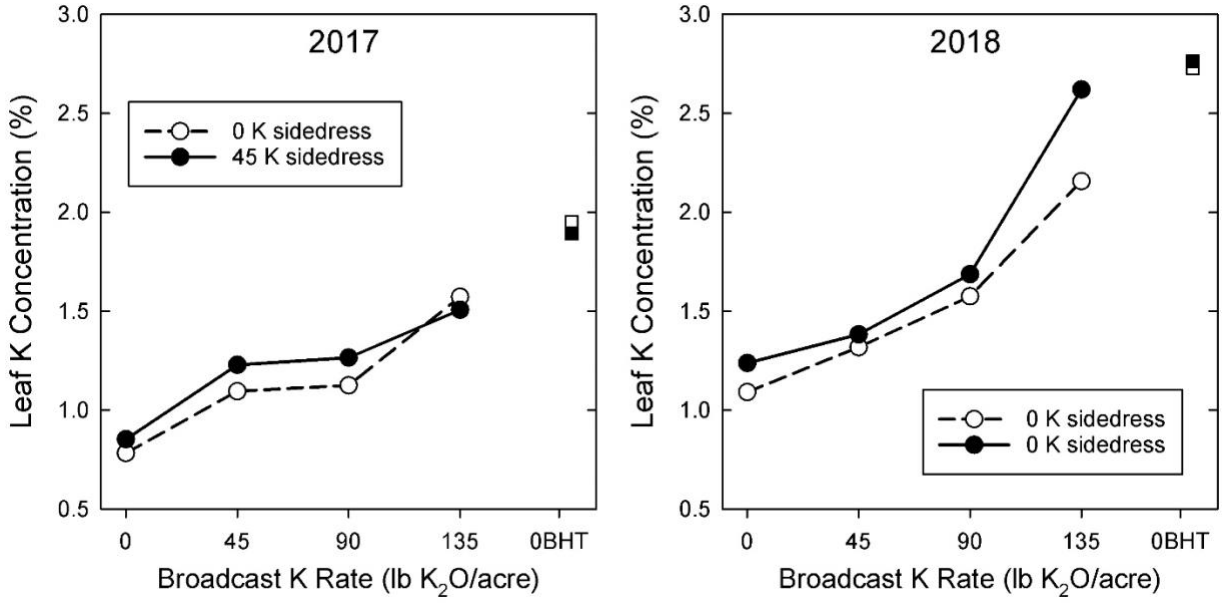

Figure 1. Corn ear-leaf K concentration response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in two trials, and response to only sidedressed K in plots of each trial testing higher in K (0BHT) due to a history of large K application rates.

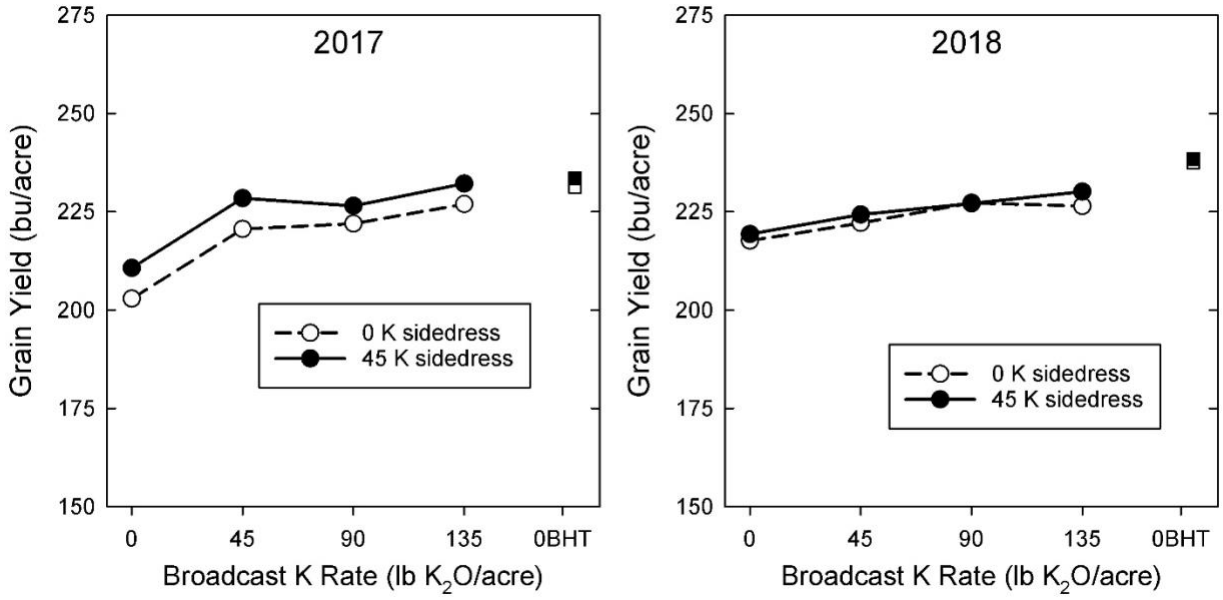

Figure 2. Corn grain yield response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in two trials, and response to only sidedressed K in plots of each trial testing higher in K (0BHT) due to a history of large K application rates.