Soybean Yield and Leaf Potassium Responses to Sidedressed Liquid Potassium Fertilizer in Southern Iowa

RFR-A19107

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Introduction

Previous Iowa State University (ISU) research has assessed the corn and soybean grain yield response to potassium (K) fertilizer placement methods using granulated potash fertilizer (0-0-62). However, no study had evaluated K sidedressing, although postemergence sidedressing of nitrogen for corn is a common practice. Mainly because of low grain prices, farmers and crop consultants have been asking if K sidedress could be of value to increase corn and soybean yield and perhaps reduce the preplant K application rate. Therefore, a study was initiated at this farm in 2017 to evaluate the value of sidedressed liquid K fertilizer for corn and a following soybean crop. Last year a report summarized the results of corn trials conducted in 2017 and 2018 at this farm. This report summarizes results for soybean trials conducted in 2018 and 2019.

Materials and Methods

The study was conducted in two fields with histories of corn-soybean rotations managed with chisel-plow/disk tillage. One study (east field) was on Haig silt loam soil. The other study (west field) was on Grundy silty clay loam soil. Two similar trials with corn were established in 2017 at the east field, and two similar trials with corn were established in 2018 at the west field. The two trials at each field were adjacent to each other and had similar management histories, except from 2009 until 2013 grain was harvested in one trial and both grain and residue were harvested in the other. There were four replications (blocks) in each trial, each with five plots measuring 40 ft wide by 60 ft long. In each block of each trial, soil of four plots tested borderline between Very Low and Low in K and one plot tested Very High due to different past K fertilization.

Corn was planted in the first year of all trials, and 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.

A previous report summarized the results for corn. There were large corn ear-leaf tissue K concentration and grain yield increases from preplant K fertilization and smaller increases from sidedressed liquid K fertilizer. Preplant K rates of 90 or 135 lb K_2O/acre maximized corn yield, and sidedressed K at 45 lb K_2O/acre increased yield only for preplant K rates of 0 and 45 lb K_2O/acre.

Soybean was planted in the second year of the four 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 that had been sidedressed for corn. Therefore, the second soybean year evaluated the residual effects of broadcast K rates applied for the previous corn crop with or without reapplying sidedressed K for soybean. 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.

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

Results and Discussion

Before planting corn, soil-test K at both the east field (2017) and west field (2018) was only slightly lower for trials with a history of both grain and residue harvest than for trials harvested only for grain. Differences became smaller before the second-year soybean crop. Therefore, the results shown are averages of the two adjacent trials conducted at the east field in 2018 and the west field in 2019.

Figure 1 shows in both years there was a large soybean leaf K concentration response to broadcast K that had been applied to the previous corn crop. Leaf K increases were almost linear to the highest preplant K rate and beyond to the high-testing treatment. Liquid sidedressed K increased leaf K by an approximately similar amount in both years for all corn preplant rates, but did not increase yield for the high-testing treatment. The residual effect of the 45-lb preplant rate applied before corn on leaf K was greater than the increase by a similar sidedressed K rate applied to both corn and soybean.

Figure 2 shows the maximum soybean grain yield was slightly lower in 2018 than in 2019 (63 and 72 bu/ac, respectively), but yield increases from K were greater in 2018. Yield increases over the not fertilized control were 16 bushels/acre in 2018 and 4 bushels/acre in 2019. A similar yield difference between fields was observed for the previous year corn crop, and probably is due to the different soils and previous management. Research has shown yield response to P could be proportionally greater when soil conditions limit yield more severely. Yield for the high-testing treatment was slightly higher than for K rates applied to low-testing areas before the previous year corn crop, but the difference (3 bu/ac) was statistically significant only in 2018. Small soybean yield increases in both fields by additional sidedressed K were statistically significant (3-4 bu/ac) for the two lowest rates applied before corn (0 and 45 lb K_2O/ac), but were smaller (0.5-2 bu/ac) and not significant for the two highest K rates applied before corn and the high-testing treatment. A 45-lb K rate applied before the previous year corn resulted in a larger soybean yield increase than a similar sidedressed K rate in 2018, but the opposite was the case in 2019, when all increases were very small.

A soybean yield difference larger than 3 bushels/acre was expected between the high-testing treatment and the highest rate applied before the previous year corn (135 lb K_2O/ac). This is because initial soil-test K of corn plots receiving broadcast K was Very Low or Low, and ISU suggested 2-year rates for corn-soybean rotations applied once before corn are 220 and 156 lb K_2O/acre, respectively.

Conclusions

Broadcast K fertilizer rates of 45, 90, and135 lb K_2O/acre applied to soil testing Very Low to Low in K before corn greatly increased second-year soybean yield. Yet the maximum yield attained was only 3 bushels/acre or less than for the high-testing treatment even when rates were lower than 2-year rates before corn suggested by ISU. Additional sidedressed liquid K application further increased soybean yield only when 0 or 45 lb K_2O/acre was applied before the previous year corn crop. Therefore, producers should sidedress liquid K fertilizer only as a rescue option when appropriate preplant K rates were not applied.

Acknowledgements

Thanks for financial support by DuPont-Pioneer (now Corteva) and the Fluid Fertilizer Foundation, and in-kind support by Nachurs and the ISU College of Agriculture and Life Sciences.

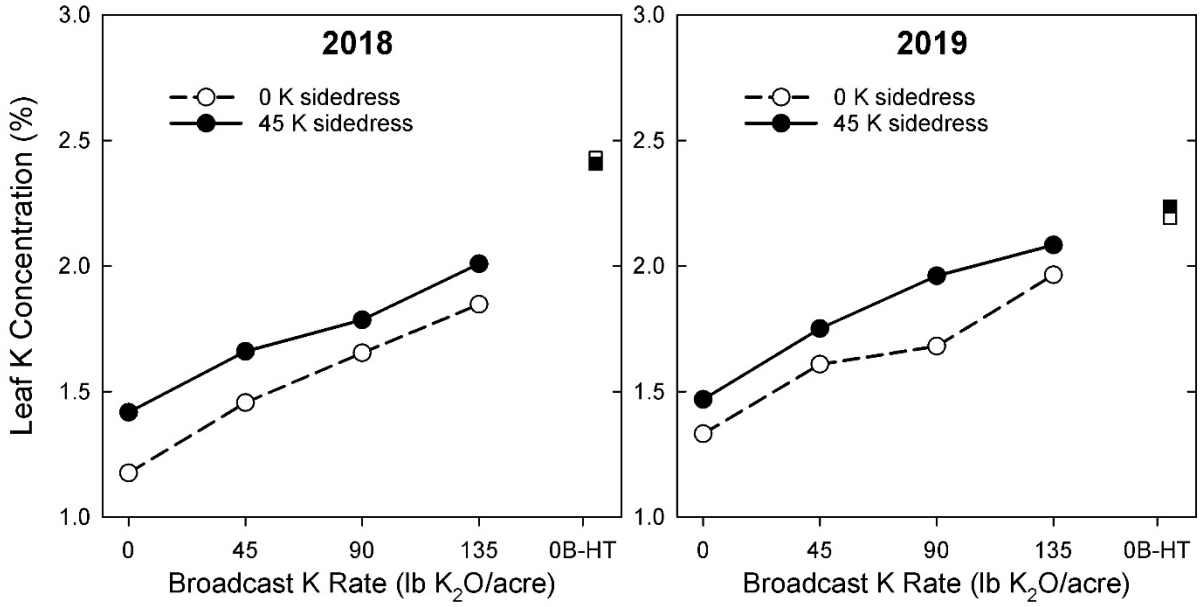

Figure 1. Soybean leaf K concentration responses in 2018 and 2019 to sidedressed liquid K fertilizer for broadcast rates of 0 to 135 lb K_2O/acre that had been applied to low-testing trial areas before the previous corn crop and for high-testing trial areas that received no preplant K (0B-HT).

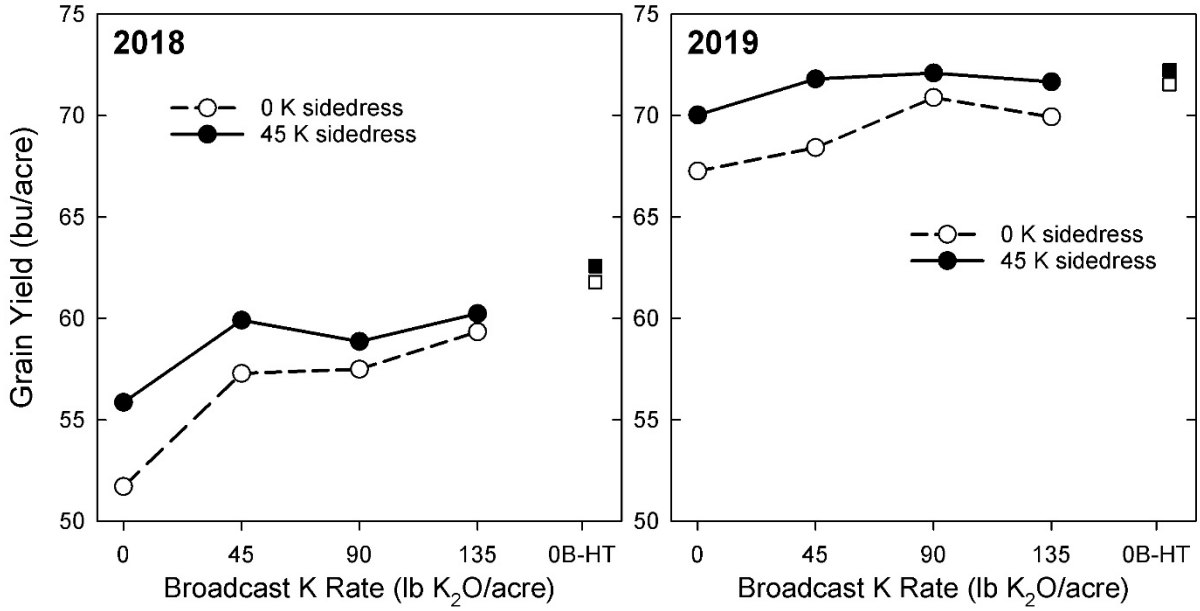

Figure 2. Soybean grain yield responses in 2018 and 2019 to sidedressed liquid K fertilizer for broadcast rates of 0 to 135 lb K_2O/acre that had been applied to low-testing trial areas before the previous corn crop and for high-testing trial areas that received no preplant K (0B-HT).