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Soil and Crop Responsesto Foliar-Applied Phosphorus

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Abstract
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Soil and Crop Responses to Foliar-Applied Phosphorus

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Introduction

This experiment was conducted to determine if phosphorus (P) fertilizer could be foliar applied to young corn and soybeans plants without injury and possibly with a yield advantage.

Materials and Methods

Two crop blocks with 16 corn plots and 16 soybean plots were laid out at the farm in May. A soil sample was collected from each plot before planting during the fourth week of May. The P source in the experiment was 10-34-0 , a liquid suspension fertilizer. Fifty-eight pounds of this material was diluted to 150 gallons and applied with appropriate Floodjet nozzles to deliver 25, 50, and 100 lb of P/acre to six rows spaced 30 in. apart and for a distance of 50 ft. Corn plants were approximately two to three ft tall and soybean plants were one ft tall when P was applied. Eight corn leaves were collected from each plot when silks were visible. The leaves were transported to Ames, dried, and ground prior to a complete nutrient analysis by the ISU Plant and Soil Analysis Laboratory. Four rows of corn and the six rows of each soybean plots were harvested by a combine equipped with a weighing tank and grain moisture meter. Cornstalk samples from the 6–18 in. above the ground were collected from six plants in each plot. These stalks were transported to Iowa State University where they were dried, ground, and analyzed for their nutrient contents. Following harvest, soil samples were collected from the upper 6-in. depth of each plot. All soil and cornstalk samples were analyzed by the ISU Soil and Plant Analysis Laboratory.

Results and Discussion

Soils. Measured soil and crop responses are shown in Table 1. Soil test P for these soils was considered optimal for both corn and soybeans with only a P maintenance rate of 55 to 40 lb P_2O_5 recommended for each crop, respectively. Soil test P after harvest increased soil test P for the check plot receiving no P decreased. The increase in soil test P was directly related to the amount of P applied.

Crops. Both crops were observed following foliar P application to determine if any injury occurred. Neither visible injury nor any other visible response was noted to plant leaves. Corn leaf analysis showed a slight increase in nitrogen content, but P contents remained unchanged by treatments. Grain yields of both crops were variable. No yield increase or decrease could be attributed to treatments. Cornstalk analysis provided a surprising outcome that found nitrate-nitrogen content to be much less than inorganic P content. This is unusual. Although nitrogen fertilizer had been applied, postharvest cornstalk analysis indicated that nitrogen was likely deficient. Nevertheless, the corn yields of 120 to 139 bushels/acre are considered good for corn planted in late May at the farm.

Acknowledgments

This study could not have been conducted without the assistance of the McNay Farm personnel.

Table 1. Soil and crop responses to foliar P treatments at ISU's McNay Farm.

	Spring	Fall	Yield		Corn leaf analysis		Cornstalk analysis	
Rate	Bray-1 P		Soybean	Corn	N	P	N	P
lb P/acre	ppm		bushels/acre		percent		ppm	
0	19	18	47.7	128	2.63	0.34	7	891
25	18	21	44.4	128	2.63	0.34	6	1,001
50	20	23	45.7	131	2.67	0.34	8	731
100	18	28	46.3	132	2.75	0.35	8	971
Simple statistics of eight replications								
Maximum	28	35	52.1	139	2.92	0.38	10	1,510
Minimum	13	12	38.3	120	2.40	0.32	5	398
Average	19	22	46.6	130	2.67	0.34	7	898
Stand. dev.	4	6	2.5	6	0.12	0.02	2	348