SOYBEAN RESPONSE TO POTASSIUM RATES AND PLACEMENT [1/]

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Soils of northeast Missouri in heavy soybean producing counties have generally become depleted of available potassium. Reason for depletion can largely be pointed to soybean production and a general perception that soybeans do not respond to direct fertilizer application. With a significant portion of the soybean acres in east and northeast Missouri being tenant farmed, efficiency and utilization of direct fertilizer application by the current crop is even more important to the grower.

Band application of P and K fertilizer has been shown to be an effective placemant for corn, wheat, and sorghum. Limited data exists on soybean response to specific fertilizer placement techniques.

A field project was initiated to evaluate soybean response to potassium fertilizer application on farmer fields and further evaluate the influence of specific placement of the potassium fertilzer for improved uptake by the soybean crop.

Materials and Methods

Research was conducted from 1985-1988 on farmer cooperator fields in Northeast, Missouri. The fields chosen were low to medium in available soil potassium.

The studies from 1985-1987 were 17 treatments in a randomized complete block design with four replications. The 17 treatments include three rates of potassium (40, 80, and 160 pounds K_2O per acre) and three methods of application (broadcast, dribble, and knife) as preplant treatments. Additionally, a treatment of 9-30-80 with each method of application was also applied preplant. Two methods of application (dribble and knife) and two materials (0-0-80 and 9-30-80) were also included as a sidedress application
at V-3 growth stage. A check plot was also included to bring the treatment number to 17. In 1988 the experiment size was reduced to 15 treatments. Preplant treatments remained the same while sidedress treatments were eliminated. Check plots for dribble

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and knife treatments were added to the study to have a balanced design.

Preplant treatments were applied in April or May of each year and sidedress treatments were applied at the time of first tissue sampling which was at growth stage V-3. In 1985 a blanket coverage of 70 pounds P_2O_5 was applied as 0-44-0. In years 1986-1988 the plots received 70 pounds of P_2O_5 applied as 11-52-0.

The fertilizer source used for the studies was a 15 percent K_2O clear solution using soluble KCl. The rate of fluid application per acre was kept constant by varying the concentration of K_2O. The 9-30-80 treatment was formulated using a 10-34-0 solution, soluble potash, and water to result in the same rate of fluid applied to the plot area as was used for all other treatments.

Whole plant samples were obtained for nutrient analysis at growth stage V-3. Leaf samples were collected at R-2 growth stage for analysis. Yields were obtained by hand harvesting a minimum of a 75 ft^2 area of each plot.

Results and Discussion

Whole plant K contents at V-3 growth stage and leaf K at R-2 growth stage are given for main treatments in Table 1. Data is shown by year, pooling all locations within a given year. In all years, increasing the fertilizer K_2O rate increased plant K content significantly. Knife injected K_2O treatments resulted in significantly higher K content in all years. Dribble application tended to be intermediate with broadcast treatments lowest in K content.

Soybean yield response to K_20 application has not been as consistent as the results from K content in the plant (Table 2). Trends in yield response to increasing K_2O rate are evident over the check yield. In the years 1986-1988 knife injected K_2O was significantly higher than broadcast and dribble, respectively. Plant analysis and yield data suggest a potential for improved K efficiency and yield enhancement with precision placement of K_2O fertilizers in the active root zone of soybeans.

Conclusions

Soybeans do respond to placement of K within the root zone. Knife injected K tends to result in significantly higher K content in the plant and in yields than broadcast and surface dribble applications, respectively. Surface dribbling does not appear to be superior to broadcasting as far as yields but does show trends of superiority in K uptake by the plant. The small yield increases do show advantage to K placement. However, it is important for dealer and grower to evaluate returns versus application costs.

Table 1. Influence of K_2O rates and placement on soybean whole plant K at V-3 and leaf K at R-2 growth stages.

K Rate	Method of Application	Plant K at V-3				Leaf K at R-2			
		1985[1]	1986[2]	1987[3]	1988[4]	1985	1986	1987	1988
lbs/A		---------------	---------------	---------------	------%	-------	---------------	---------------	---------------
Check		1.22	1.26	1.35	0.87	1.00	1.54	1.52	1.19
40		1.39	1.39	1.58	1.00	1.13	1.65	1.65	1.30
80		1.53	1.50	1.60	1.12	1.26	1.73	1.70	1.43
160		1.65	1.64	1.83	1.19	1.32	1.85	1.82	1.50
$lsd_{.05}$		0.11	0.08	0.09	0.07	0.09	0.04	0.06	0.07
	Broadcast	1.50	1.40	1.58	0.93	1.15	1.69	1.68	1.23
	Dribble	1.50	1.46	1.69	0.96	1.14	1.73	1.70	1.32
	Knife injected	1.57	1.67	1.73	1.29	1.41	1.81	1.79	1.57
	$lsd_{.05}$	NS	0.08	0.09	0.05	0.09	0.04	0.06	0.06

[1]Data pooled from 4 locations, [2]Data pooled from 4 locations, [3]Data pooled from 3 locations, [4]Data pooled from 3 locations

Table 2. Influence of K_2O rates and Placement on soybean Grain Yield.

K Rate	Method of Application	Soybean Grain Yield			
		1985[1]	1986[2]	1987[3]	1988[4]
lbs/A		---------------	------bu/a	-------	---------------
Check		40.2	32.4	36.4	25.5
40		41.8	34.0	40.2	26.0
80		46.3	34.1	40.9	27.2
160		45.2	33.0	41.9	28.9
$lsd_{.05}$		2.6	NS	NS	2.1
	Broadcast	44.1	32.6	40.6	25.7
	Dribble	44.5	33.8	40.0	26.4
	Knife Injected	44.6	34.7	42.5	29.0
	$lsd_{.05}$	NS	1.5	2.0	1.6

[1]Data pooled from 2 locations, [2]Data pooled from 2 locations, [3]Data pooled from 3 locations, [4]Data pooled from 3 locations

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