

P and K Fertility on Bottomland Soils¹

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Most of the bottomland soils of western Kentucky are important areas for corn and soybean production. They consist of the Belknap, Karnak, Melvin, Sadler, Stendal and Waverly soil series that are somewhat poorly to poorly drained.

A phosphorus and potassium study was initiated on the Belknap soil in Webster County. Soybeans and corn were alternated during the 4 year study. The P study consisted of 5 rates (0, 50, 100, 150 and 200 lbs P_2O_5 /acre) broadcast in 1980 and 1981. Plots did not receive additional fertilizer P during 1982 and 1983. K was broadcast at 120 lbs K_2O /acre in 1980 and 1982 over entire P study area.

Treatments in the K study consisted of annual applications of 5 rates (0, 60, 120, 180 and 240 lbs K_2O /acre) for each of the four years. A broadcast P application of 90 lbs P_2O_5 /acre was applied in 1980.

Table 1 presents soybean and corn yields obtained during each of the 4 years. Increasing P rates did not affect yields during the 4 years. Yields were not affected with added K during the first rotation sequence. However, both soybean and corn yields were increased by 60 or more lbs K_2O /acre during the second sequence.

Table 1. Annual soybean and corn yields from P and K study on Belknap silt loam.

P_2O_5 Rate lb/ac	Soybeans	Corn	Soybeans	Corn
	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
	-----bu/ac-----			
0	48	155	37	116
50	47	168	42	122
100	44	147	47	113
150	48	154	44	126
200	48	159	37	139
K_2O Rate lb/ac	Soybeans	Corn	Soybeans	Corn
	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
	-----bu/ac-----			
0	44	138	36	80
60	46	154	41	119
120	47	156	43	126
180	46	157	42	126
240	46	164	41	125
LSD .05	NS	NS	2.1	13

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Table 2 contains the soil test P each year of the study. Following a preliminary analysis of the Bray-Kurtz P1 data and a lack of yield response, the Mehlich III extractant was selected to study the soil for increased P extraction. The Mehlich III method extracted about 1.4 times as much P as the Bray-Kurtz P1 and the relationship was linear ($r=0.978$).

Table 2. Annual soil test P as measured by Bray-Kurtz P1 and Mehlich III extractants, Belknap silt loam.

P ₂ O ₅ Rate lb/ac	Soybeans <u>1980</u>		Corn <u>1981</u>		Soybeans <u>1982</u>		Corn <u>1983</u>	
	-----bu/ac-----							
	P1	M	P1	M	P1	M	P1	M
0	22	34	18	32	12	21	13	24
50	31	46	30	52	19	33	18	30
100	33	46	39	61	25	40	20	32
150	34	50	57	83	32	48	26	39
200	55	77	75	118	51	76	37	55

Soil test K values (Table 3) suggested that 4 years of 240 lbs K₂O/acre annually minus crop removal were required to raise the soil test K above 250 lbs K/acre.

Table 3. Annual soil test K, Belknap silt loam.

K ₂ O Rate lb/ac	Soybeans <u>1980</u>	Corn <u>1981</u>	Soybeans <u>1982</u>	Corn <u>1983</u>
	-----bu/ac-----			
0	96	79	88	95
60	107	94	106	114
120	108	107	136	153
180	125	149	162	182
240	148	184	218	274

Relative soybean yields versus soil test P indicated that near maximum yields occurred at soil test P values of 27 and 40, respectively, for the Bray-Kurtz P1 and Mehlich III extractants. Soil test P values for near maximum corn yields occurred at soil test P values of 27 and 43, respectively, for Bray-Kurtz P1 and Mehlich III extractants.

Relative crop yields versus soil test K indicated that near maximum yields were obtained at soil test K values of 105 and 141 for soybeans and corn, respectively, with the normal, neutral ammonium acetate extraction method.

In order to determine if this soil was supplying significant quantities of P and K from below the surface layer, the profile was sampled to 36 inches in the check plots of both studies. The data in

Table 4 suggested that both P and K levels decreased below the surface layer of 0-6 inches.

Table 4. Soil test P and K from Belknap soil profile.

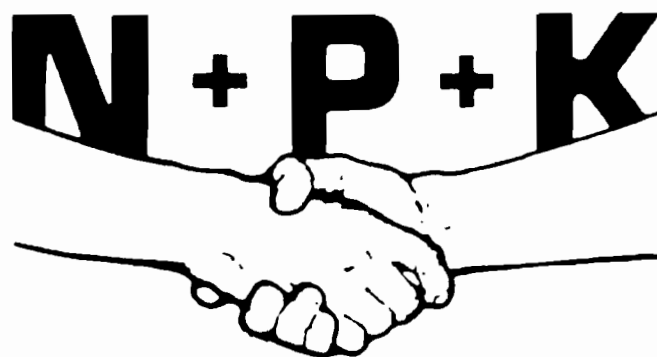
<u>Depth</u> in	<u>P study</u>		<u>K study</u>	
	<u>P</u>	<u>K</u>	<u>P</u>	<u>K</u>
	-----ppm-----			
0-6	10	55	12	49
6-12	4	29	4	32
12-24	3	29	3	32
24-36	3	36	3	33

Nutrient concentration data in both soybeans and corn indicated no response from added P with a range of 0.46-0.56% P for soybean trifoliates and 0.25-0.36% P for corn ear leaves.

The relationship between relative soybean yields and trifoliolate K % indicated differences in the variety grown each of the 2 years. Essex and Mitchell varieties reached near maximum yields at K percentages of 1.79 and 2.56, respectively, in the trifoliates.

Near maximum corn yields were obtained with an ear leaf K percentage of 2.07. K percentages were affected significantly with K fertilization during both years that corn was grown.

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