

Legacy Phosphorus Effect on Soybean Yield

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INTRODUCTION

Data that formed the basis for our phosphorus (P) recommendations in our soybean NebGuide was collected long ago (pre-1985). Since then many practices have changed including reduced tillage, variety selection, herbicide tolerance, and maturity length. Many in industry question the 12 ppm Bray critical level.



Probability (%) of yield

Bray P-1 Soil Test (ppm)

Conceptual probability of yield increase with phosphoru rtilization according to soil phosphorus concentration

ncrease with P fertilization

RESULTS

PPST trial: P rate and placement trial

Effect of P rate and placement on soil P levels and								
corn and soybean yields (PPST).								
Applied Treatments		Mehlich 3P Corn yield		Soybean yield				
Nitrogen	Р	P_2O_5	11-Mar-16	2013-2015	2016			
kg ha ⁻¹	Placement	lbs ac ⁻¹	mg kg ⁻¹	Mg ha ⁻¹	Mg ha ⁻¹			
170	Starter	34	11.8	8.7	3.7			
170	Starter	68	25.0	9.9	4.1			
170	Broadcast	34	12.3	8.8	3.6			
170	Broadcast	68	32.5	9.1	3.9			
170	Knife	34	24.5	10.0	4.1			
170	Knife	68	41.0	10.3	4.1			
0	Starter	34	12.5	4.4	3.9			
170	None	0	5.3	5.0	2.1			
	Pr > F		0.0002	<.0001	<.0001			
	CV (%)		44	16	12			
	LSD 0.05		13	1.9	0.7			
	Starter		18.4	9.3	3.9			
	Broadcast		22.4	8.9	3.7			
	Knife		32.8	10.1	4.1			
	No P, N		5.3	5.0	2.1			
	$34 P_2 O_5$		16	9.1	3.8			
	$68 P_2 O_5$		33	9.7	4.0			



Phosphorn	ıs Soil Test	P2O5 to Apply
Bray-1 or Iehlich-3	Olsen	
(ppi	n)	(pounds per acre)
0 - 4	0 - 3	65
6 - 8	4 - 5	40
) - 12	6 - 8	20
> 12	> 8	0

The following equation provides an alternative to using table values: P₂O₅ (lb/acre) = (15- Bray-1 P (ppm)) x 6, if Bray-1 P (ppm) < 15

OBJECTIVES

The objectives of this study were to use three corn phosphorus (P) studies to correlate soil P levels with soybean yields. Some English units used for ease of comparing to recommendation material.

1. Provide data to determine, if under present cultural practices, University of Nebraska P recommendations are current for soybeans.

2. If not, provide initial data for further research.

METHODS

Soils found at Haskell Agricultural Laboratory where experiments

TILL-ST trial: Tillage x Soiltest Target

	Mahliah 2D	Com	Corrboo
	Menlich SP	Corn	Soydea
	4-Nov-16	2014-2015	2016
Treatments	mg kg ⁻¹	Mg ha ⁻¹	Mg ha ⁻
UNL Rec	15.8	10.5	4.83
Bray 25	26.0	10.1	4.86
Bray 35	33.6	10.6	5.06
Check	6.2	9.4	4.39
Removal	23.0	11.1	4.99
LSD 0.05	6.5	1.1	0.43
Pr>F	Pr>F	Pr>F	Pr>F
Till	0.101	0.016	0.283
P trt	<.0001	0.052	0.013
Till*P trt	0.713	0.804	0.966
CV%	34	10.7	8.9

0	10	20	30	40	50	60	70
			Meh	lich 3P			
• 34 Start	er (S) • 68S	• 34 Broadcast (B)	■ 68B	• 34 Knife (K)	● 68K ● 3	4S No N ● No N,	No P





are sited	are sited. (NRCS)					
6860	Crofton silt loam, 8-17% slopes	Fine-silty, mixed, superactive, calcareous, mesic Udic Ustorthents				
6750	Nora silt loam, 11-17% slopes	Fine-silty, mixed, superactive, mesic Udic Haplustolls				
6768	Nora silty clay loam, 6-11% slopes					

The Three Corn Studies

- P Placement x P rate (PPST; 2000 2015)
- Knife, Broadcast, Starter (mostly No-Till; soybean 2006)

P rates: 0, 34, and 68 lbs P_2O_5 ac⁻¹

- Tillage x Soiltest Target (TILL-ST; 2011-2015)
- Target soiltest levels (UNL-15 Bray, 25 Bray, 35 Bray, None, Removal)
- Tillage; Disked and No-till (No tillage) impact)
- Same treatments on same plots: (Milander et al. Poster 930)

STTS trial: Target Soiltest Strategy

Effect of P application strategy and P application on corn and soybean yields (STTS).

	P_2O_5	Mehlich 3P	Corn Yields	Soybeans
	2016	10-Mar-16	2014-2015	2016
Treatments	Applied lbs ac ⁻¹	mg kg ⁻¹	Mg ha ⁻¹	Mg ha ⁻¹
P applied at Removal	44	25	10.3	5.18
No added P	0	8	8.8	4.62
Bray 15	18	22	9.5	4.98
Bray 30	23	28	10.0	5.04
Brav 45	27	44	10.6	5 10

CONCLUSIONS

- Research is too limited to conclude that the critical level is sufficient for most situations since these were rainfed experiments in one site and one year. However,
 - ANOVA for all three studies shows only the check vs others is significant with soybean yield reduced with under 10 mg kg⁻¹ Mehlich 3P.
- The data does not present evidence that the critical level (12 mg kg⁻¹) is wrong.











about maximum for these studies.