Optimum Placement of P for Reduced-Till Corn-Soybean Rotations

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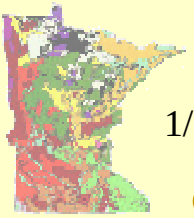
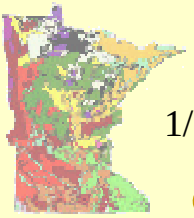


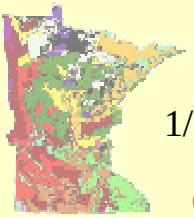
Situation

- Completed 6th year of corn (3 cycles) and 5th year of soybeans in this rotation
- Treatments studied include:
  - Soil test P level
    - Very low vs high (initially)
  - Tillage system
    - No-till, one-pass, strip-till, and chisel +
  - P placement
    - Starter, deep-band, and broadcast
- Measurements include:
  - Soil test P, grain yield, P concentration in grain, and economics calculations

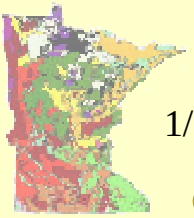


Results

- 6-yr corn and 5-yr soybean yield averages.
- Economic return to P
- Relationship between corn and soybean yield and soil test P
- 0–2 inch soil test P related to water quality



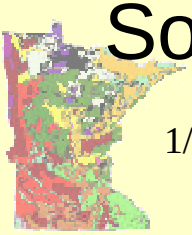
Yields



Corn yield on a LOW P-testing soil as affected by starter, deep-band, and broadcast P.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter	DB	Bdct.
		- -	Yield (bu/acre)		- -
No-till	No-till	97	140	--	--
F. Cult.	S. Disk	102	153	146	166
Strip-till	No-till	101	152	148	--
Chisel	Chisel	103	154	--	166
	Average:	101	150		

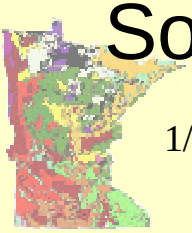
Soil Test P = (3 to 20) ppm Bray P_1 6-yr avg.



Soybean yield on a LOW P-testing soil as affected by the residual effects of starter, deep-band, and broadcast P applied to corn.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter	DB	Bdct.
		- - Yield (bu/acre) - -			
No-till	No-till	34	48	--	--
F. Cult.	S. Disk	36	49	49	53
Strip-till	No-till	37	50	48	--
Chisel	Chisel	32	50	--	53
	Average:	35	49		

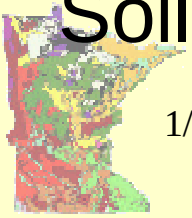
Soil Test P = (5 to 19) ppm Bray P_1 5-yr avg.



Corn yield on a HIGH P-testing soil as affected by starter, deep-band, and broadcast P.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter	DB	Bdct.
		- -	Yield (bu/acre)		- -
No-till	No-till	156	160	--	--
F. Cult.	S. Disk	161	168	165	176
Strip-till	No-till	164	168	165	--
Chisel	Chisel	165	170	--	176
	Average:	162	166		

Soil Test P = (10 to 27) ppm Bray P_1 6-yr avg.



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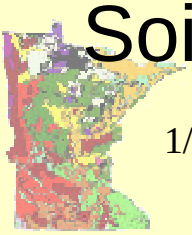
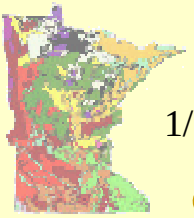
Soybean yield on a HIGH P-testing soil as affected by the residual effects of starter, deep-band, and broadcast P applied to corn.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter	DB	Bdct.
		- - Yield (bu/acre) - -			
No-till	No-till	50	52	--	--
F. Cult.	S. Disk	54	55	54	55
Strip-till	No-till	53	52	54	--
Chisel	Chisel	52	55	--	55
	Average:	52	54		

Soil Test P = (14 to 30) ppm Bray P_1 5-yr avg.



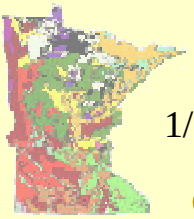
Economics



Economic return to P by corn as affected by STP level and rate and method of P application to corn.†

P		Soil Test P Level	
Rate	Method	VL-L	High
- lb P_2O_5/A/yr -		- - $/A/yr - -	
50 (40)	Starter	95	-5
50 (40)	Deep band	88	-12
100 (80)	Broadcast	120	+4

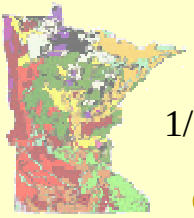
† Six site-years



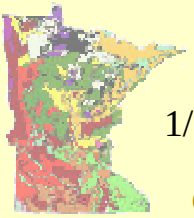
Economic return to P by soybeans as affected by STP level and rate and method of P application to corn.†

P		Soil Test P Level	
Rate	Method	VL-L	High
- lb P_2O_5/A/yr -		- - $/A/yr - -	
50 (40)	Starter	76	6
50 (40)	Deep band	63	4
100 (80)	Broadcast	100	10

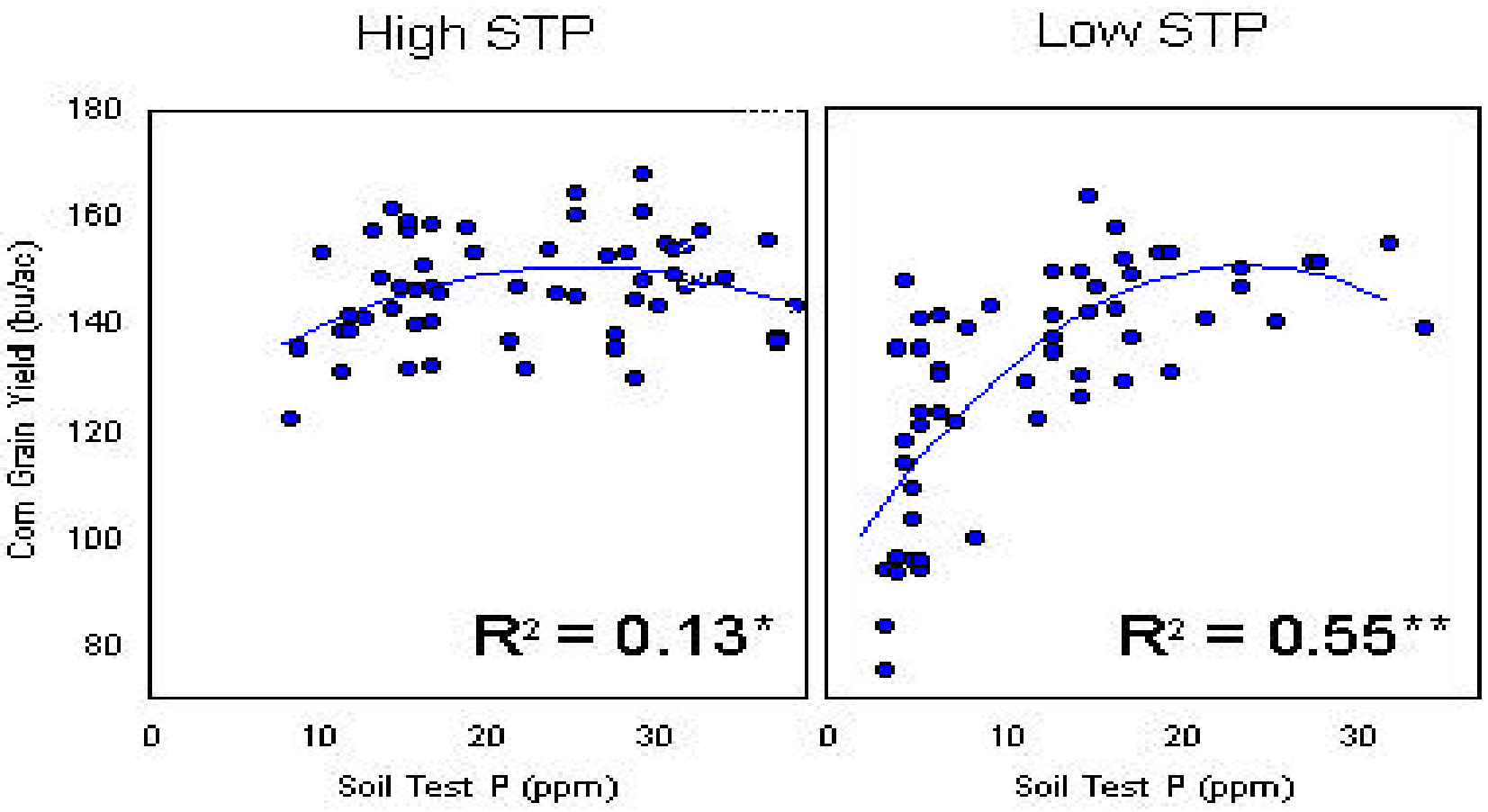
† Five site-years



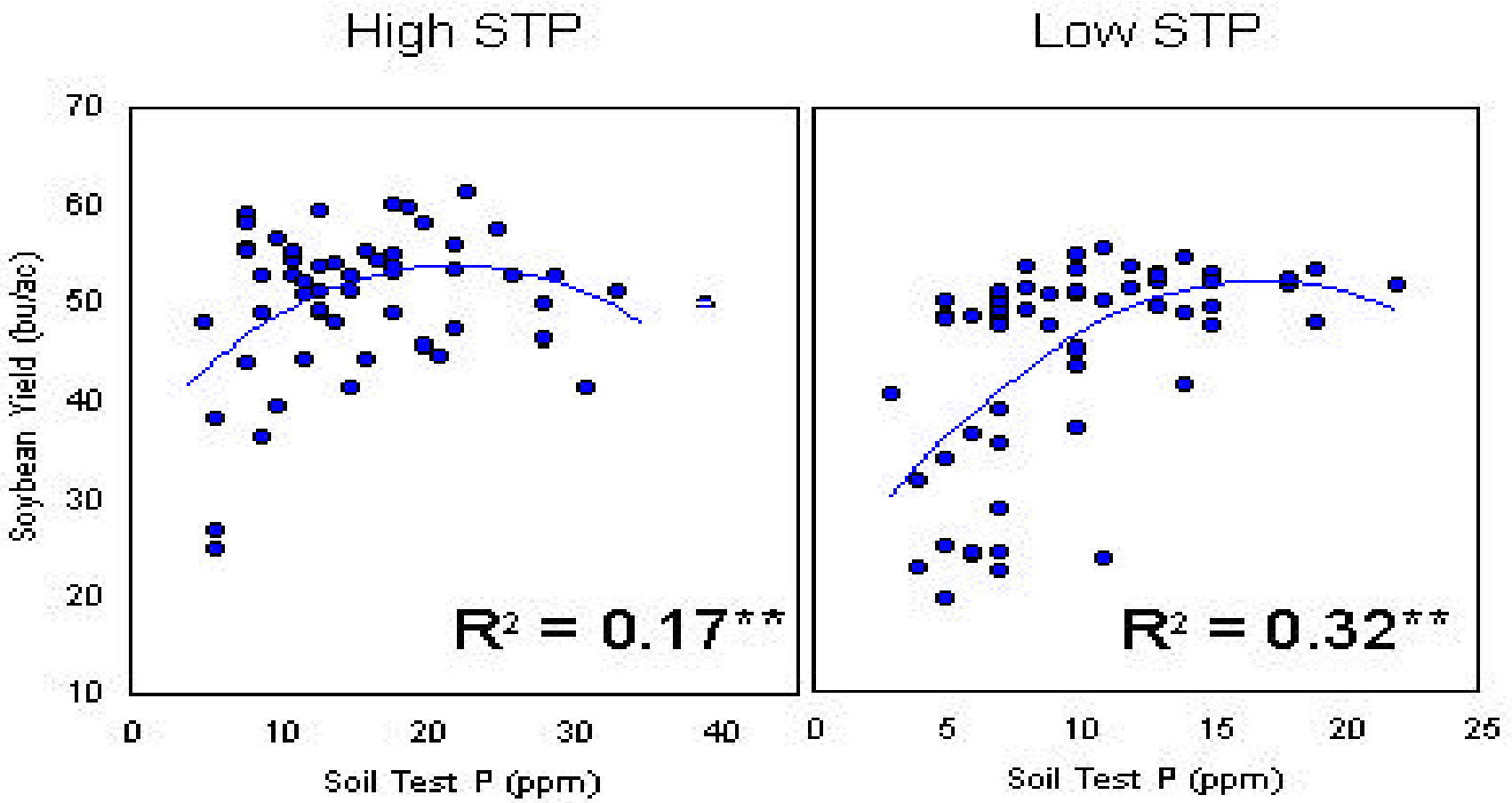
Relationship Between Corn and Soybean Yield and Soil Test P (STP)



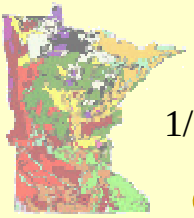
Relationship between soil test P and corn grain yield in 2001.



Relationship between soil test P and soybean seed yield in 2001.



0–2 Inch Soil Test P:
A Water Quality Perspective

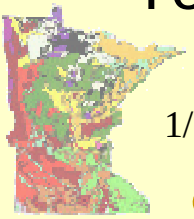


Soil test P (0–2 inch) on a LOW P-testing soil as affected by tillage and P placement.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter*	DB*	Bdct.**
		- - soil test P (ppm) - -			
No-till	No-till	5	14	--	--
F. Cult.	S. Disk	6	13	6	36
Strip-till	No-till	4	13	6	--
Chisel	Chisel	4	10	--	18

* Total of 150 lb P_2O_5/A applied 1997, 1999, and 2001. 2002

** Total of 300 lb P_2O_5/A applied 1997, 1999, and 2001.

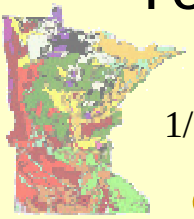


Soil test P (0–2 inch) on a HIGH P-testing soil as affected by tillage and P placement.

Tillage for		P Placement / Method			
Corn	Soybean	None	Starter*	DB*	Bdct.**
		- - soil test P (ppm) - -			
No-till	No-till	15	29	--	--
F. Cult.	S. Disk	12	26	18	50
Strip-till	No-till	12	24	17	--
Chisel	Chisel	15	21	--	35

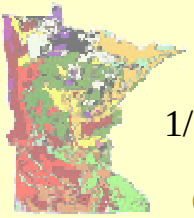
* Total of 120 lb P_2O_5/A applied 1997, 1999, and 2001. 2002

** Total of 240 lb P_2O_5/A applied 1997, 1999, and 2001.



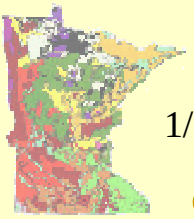
Conclusions

- For the 6-yr period, CORN yields were:
  - lower with no tillage
  - increased 51, 46, and 64 bu/A with the starter, deep-band, and broadcast placements of P, respectively, at the LOW P-testing site.
  - increased 4, 2, and 13 bu/A with the starter, deep-band, and broadcast placements of P, respectively, at the HIGH P-testing site.



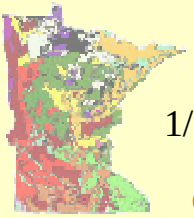
Conclusions

- For the 5-yr period, SOYBEAN yields were:
  - generally not affected by tillage
  - increased 14, 14, and 19 bu/A by residual P from the starter, deep-band, and broadcast placements, respectively, at the LOW P-testing site.
  - increased only 2-3 bu/A by residual P from all placement methods at the HIGH P-testing site.



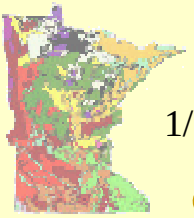
Conclusions cont.

- At the low P-testing site, economic return was greatest when P was broadcast, intermediate when placed in the seed furrow, and lowest when deep-banded.
- At the high P-testing site economic return to P across years did not occur regardless of placement method.
- Corn and soybean yields were highly correlated to STP on the low-testing site.

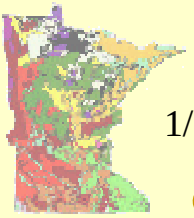


Conclusions cont.

- STP in the surface 2 inches was greatly influenced by P placement and slightly affected by tillage.
- The potential for P loss to surface water is least for the deep-band treatments, regardless of tillage, and greatest for broadcast P, especially in the one-pass tillage system.



- Financial support of this research by the Fluid Fertilizer Foundation, and Potash and Phosphate Institute–Foundation for Agronomic Research is greatly appreciated



THANK YOU

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