

EFFECT OF DATE OF PLANTING ON METHOD OF P PERFORMANCE FOR WINTER WHEAT

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ABSTRACT

Seed and knifed P (dual placement) have usually performed similarly on winter wheat (*Triticum aestivum* L.), but in some years seed applications have been found to be superior to knifed P. Three winter wheat experiments were established on low available P soils in southeast Nebraska to study the effect of date seeding on seed and knifed P (dual placement) performance. Three rates of P (11, 22, and 33 kg P ha⁻¹) were seed and knife applied on three seeding dates in 1987. Data indicated that the effectiveness of knifed P decreased as date of seeding is delayed compared to seed applied P. Therefore if seeding date is delayed, fertilizer P should be applied with the seed for maximum effectiveness.

OBJECTIVE

To determine if seeding date of winter wheat affects the performance of seed versus knifed P (dual placement) methods of P application.

METHODS AND MATERIALS

Three experiments were established in the fall of 1987 on low available P soils in Gage (1 location) and Saline County (2 locations) Nebraska. Soil P levels (Bray and Kurtz No. 1) were as follows for the 0-4, 0-8, and 8-12 and depths, respectively: Location 88-2 (Wymore sic) 9.4, 4.6, and 4.6 ppm; Location 88-6 (Eroded Crete Sic1) 9.9, 3.5, and 1.0 ppm; Location 88-7 (Crete sic1) 6.8, 3.0, and 1.2 ppm.

Experimental design involved three seeding dates, two P application methods (knife-dual placed N and P, and seed application) with 3 P rates (9, 18 and 27 kg P ha⁻¹) and a check plot. All plots received N as ammonia to equal a total of 80 kg N ha⁻¹ which included the N in 10-15-0 (N-P-K) liquid ammonium polyphosphate, which was the P source. Knife spacing was 30-cm applied to a depth of 15-cm one week prior to the first wheat seeding. Seed applied P was placed directly with the seed. Sixty-seven kg ha⁻¹ of Brule wheat was seeded in 30-cm spacing with a hoe type drill.

Plots were 2.4 meters wide by 12 meters long with 0.3 meters between wheat rows. Grain and straw yields were determined from two rows 3 meters in length. Stem counts were made from 60 cm of row. Seed counts and seed weights were determined from 10 heads selected at random. Grain and straw yields only are reported.

RESULTS AND DISCUSSION

Recent studies in Nebraska have indicated that method of P application can greatly affect P fertilizer efficiency as well as the amount of profit wheat producers can obtain from applying P. Sander et al (1990) reported that seed and knife application resulted in fertilizer P efficiencies of between 35 and

40% compared to only 5 percent for broadcast P applications on a low available P Pawnee clay loam in eastern Nebraska. Fiedler et al. (1989) showed that on low P soils seed application on winter wheat resulted in twice the profit from applied P compared to broadcast and that maximum profits from P fertilization occurred when seed applied P was applied at slightly higher rates of application compared to broadcast P. This finding was contrary to the usual P recommendation of reducing the P rate in half when seed applied compared to broadcast. Other research has shown that knifed P (dual placement) and seed applied P perform basically the same even on different low available P soils (Fig. 1).

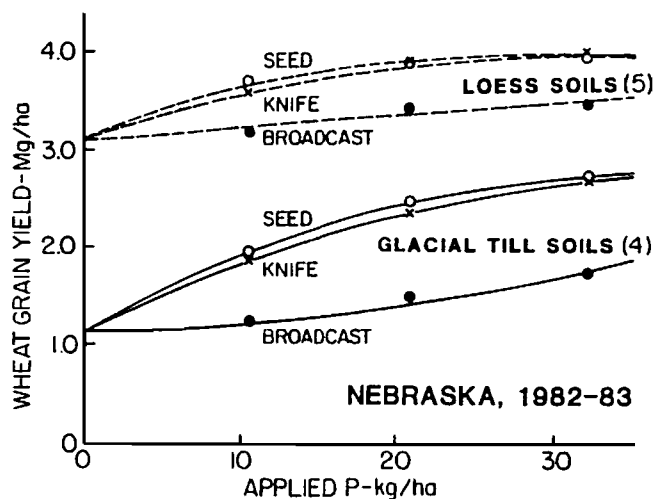


Fig. 1. Winter wheat yield as affected by different methods of applied P on five low P loess derived soils and four low P glacial till derived soils. (D.H. Sander and E.J. Penas, unpublished data.)

However, research has also shown that while knifed and seed applied P usually provide similar results (both much superior to broadcast P), results can vary from year to year. Table 1 shows data from two locations in Southwest Nebraska where seed applied P was significantly better than knifed

Table 1. Effect of method of P application on wheat grain wheat grain yields. 1986. (D.H. Sander, unpublished data).

Method of P Application	11	22	33	Mean
Hitchcock County 88-15, Mg ha ⁻¹				
Seed (Sd)	3.83	4.01	4.37	4.01
Knife Fall (KF)	3.16	3.29	2.89	3.09
No P	2.55			
Gosper County 86-17, Mg ha ⁻¹				
Seed (Sd)	3.43	3.83	3.76	3.70
Knife Fall (KF)	2.69	2.76	3.23	2.89
No P	2.69			

P for wheat grain yield. These results suggest that knife and seed applied P are not always equal in performance. Since knifed P is further from the seed, any factor that affects root growth in the fall would limit fall P uptake and therefore possibly influence performance of the two banding methods. Therefore three experiments were established in 1987 to study the effect of date of seeding on the performance of seed and knife methods of P application.

Grain yields were increased at all three locations with applied P although there was no grain increase past the first increment of P (10 lbs/ac) at location 88-7 in Saline County (Table 2 and 3).

Table 2. Effect of date of planting of winter wheat on P method of application performance. Southeast Nebraska, 1988.

Variable	Location					
	Gage Co. (88-2)		Saline Co. (88-6)		Saline Co. (88-7)	
	Grain	Straw	Grain	Straw	Grain	Straw
-----Mg ha ⁻¹ -----						
P Rate-Kg ha ⁻¹						
0	2.96	2.92	3.60	3.26	3.15	3.23
11	3.24	3.32	3.75	3.55	3.70	3.71
22	3.61	3.63	4.12	3.96	3.87	3.87
33	3.57	3.52	4.09	3.97	3.93	3.97
Date 1	3.60	3.84	4.12	4.25	4.06	4.30
2	3.81	3.75	4.10	3.76	3.89	3.80
3	3.03	2.90	3.75	3.49	3.55	3.45
Method						
Knife	3.31	3.34	3.80	3.73	3.71	3.78
Seed	3.65	3.64	4.17	3.92	3.96	3.92

Analysis of Variance

Date (D)	.02	.02	NS	NS	.04	.05
Method (M)	.01	.01	.01	.07	.10	NS
Rate (R)	.09	.01	.07	.10	NS	NS
D x M	NS	NS	.01	NS	.02	.11
D x R	NS	.05	NS	.02	NS	NS
M x R	.09	.09	NS	NS	NS	NS
D x M x R	NS	NS	.01	.02	.04	.01

Table 3. Interaction means of grain yield showing how method of P application performance is influenced by both rate of P application and date of seeding. Southeast NE, 1988.

Seeding Date	P Rate	(88-7)		(88-6)		(88-2)	
		Knife	Seed	Knife	Seed	Knife	Seed
Days after September 15	kg ha ⁻¹	Grain Yield - Mg ha ⁻¹					
6 (9-22-87)	0	3.85		3.81		3.20	
6	9	4.11	3.84	4.31	3.77	3.11	3.92
6	18	3.77	4.24	4.58	3.77	3.81	3.76
6	27	4.51	3.91	3.77	4.45	3.28	3.77
20 (10-6-87)	0	3.24		3.66		3.20	
20	9	3.64	3.77	3.91	3.91	3.29	3.78
20	18	3.71	4.11	3.64	4.65	4.06	4.11
20	27	3.91	4.18	4.04	4.51	3.47	4.10
33 (10-19-87)	0	2.34		3.34		2.48	
33	9	2.90	3.91	2.36	4.18	2.40	3.13
33	18	3.71	3.71	3.97	4.18	2.90	2.98
33	27	3.10	3.97	3.50	4.24	3.40	3.34

Date of seeding greatly influenced yield, with grain and straw yields declining severely as planting date was delayed. At two of the three locations, methods of P application significantly interacted with both date of seeding and rate of P application. Results indicate that seed application of P was more effective than knife application at later seeding dates. At optimum seeding dates, knife was equal to seed applications of P in terms of grain performance (Fig. 2). Knifing P performed well compared to seed application at the first planting date of September 22 which is near optimum for southeast Nebraska. Seed application was especially more effective at low rates of application at the Gage County location (88-2).

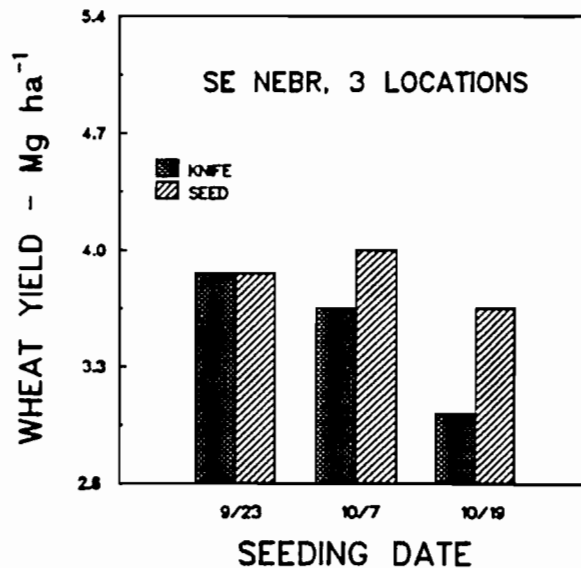


Fig. 2. Effect of seed date of wheat on seed and knife method of P application performance. 1988. Nebraska.

The data indicates that root growth to the knifed P band may be very important for performance of knifed P for winter wheat. It is known that applied P affects tillering and numbers of heads harvested (Sander et al., 1990). Delayed seeding may result in poor root interception of the knifed P band which limits knifed P effectiveness. If seeding dates are delayed past the optimum date, P fertilizers should be applied with the seed for maximum effectiveness.

LITERATURE

Fiedler, R.J., D.H. Sander, and G.A. Peterson. 1989. Fertilizer phosphorus recommendations for winter wheat in terms of method of phosphorus application, soil pH, and yield goal. SSSAJ 53:1282-1287.

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