MANITOBA/SASKATCHEWAN

Effects of Row Spacing, Seeding Rate and Seed-placed Phosphorus on Wheat and Barley in the Canadian Prairies

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The general belief with spring cereals is that in order to maximize grain yields, narrow rows should be employed. However, we have found that when using a zero tillage production system, grain yields were similar for row spacings ranging from 4 to 12 inches. More recently, we have found that yields of barley and spring wheat were not affected under a conventional tillage fallow system with row spacings ranging also from 4 to 12 inches. The higher yields reported with narrow row spacings may be related to the amounts and placement of P fertilizer.

Studies in the thin black soil zone of Manitoba and Saskatchewan emphasize the importance of phosphorus (P) nutrition for enhancing crop establishment, reducing root diseases and increasing grain yields in wheat and barley.

Field studies were conducted to evaluate the effects of row spacing, seeding rate and seed-placed P on plant development, dry matter production, root diseases and grain yield in wheat and barley. We also wanted to determine if the response to P can be altered with changes in row spacing and/or seeding rate.

TABLE 1. Seed-placed P increases plant development of wheat and barley.

Seed-placed P_2O_5 rate, lb/A	Haun stage	
	Barley	Wheat
0	3.8	3.2
20	4.1	3.4
40	4.1	3.4

Averaged over 4 site-years.

Spring wheat and barley were grown at two locations near Brandon, Manitoba (Newdale clay loam) and Indian Head, Saskatchewan (Indian Head heavy clay) in 1993 and 1994. Three row spacings (4, 8 and 12 inches), three seeding rates (1, 2 and 3 bu/A) and three rates of P_2O_5 (0, 20 and 40 lb/A as monoammonium phosphate) were studied.

Plant Development

Row spacing had no effect on plant development in either wheat or barley, as measured by Haun stage. A Haun stage unit of 3.5 means there are three fully expanded leaves with the fourth being half the length of the third leaf. Increasing seeding rate tended to decrease plant development, but results were significant in only one of the four site-years. In all cases, seed-placed P increased Haun stage values (**Table 1**). In other words, the P caused quicker emergence, thus supporting the concept of the "pop-up" effect which is commonly observed in the northern Great Plains.

Root Diseases

The severity of root rot was expressed as the number of plants with greater than 50 percent of the sub-crown internode showing lesions and discoloration. Increasing the rate of seeding and adding

P fertilizer and increasing row spacing all decreased the severity of root rot in wheat and barley.

Above Ground Dry Matter Production and Grain Yield

In both wheat and barley, increasing the row spacing decreased total above ground dry matter at anthesis (**Table 2**). The largest decrease was from 4 to 8 inches, with little difference between 8 and 12 inches. As a rule, as row spacing increased, fewer plants and heads were established and produced, explaining in part the lower dry matter accumulation. Both seeding rate and seed-placed P increased dry matter production.

An interesting interaction between seeding rate and P fertilization was observed in about 25 percent of the trials, but the nature of the interaction varied with crop. In barley, response to applied P decreased as seed rate increased, with no response occurring at the highest seeding rate. However, unlike barley, the maximum yield in spring wheat occurred at the highest seeding and P application rates (**Table 3**). It appears that higher seeding rates will compensate for lower P application rates up to a point until available P supplies are exhausted, at which time additional P is required to maximize yields.

SPRING WHEAT in 12-inch row spacing.

Row spacing had no effect on grain production. The 12-inch spacing did not decrease grain yields of wheat and barley relative to the 4- and 8-inch spacings. Increasing seeding rate and seed-placed P improved grain yields of both wheat and barley. Barley responded to applied P in all site-years and wheat in three of the four site-years. Use of seed-placed P fertilizer at wide row spacings resulted in a higher concentration of P in the seed row. However, this did not improve the response to P (data not shown).

Summary

This study showed wider row spacings will not result in yield losses, increased root disease or delayed plant development. In fact, wide row spacings were shown to reduce the frequency of root diseases and "take-all" in wheat. Wider rows reduced dry matter production, but higher seeding rates increased dry matter production and tended to improve the response to applied P. Seed-placed P fertilizer hastened plant emergence and plant

TABLE 2. Row spacing, seeding rate and seed-placed P affected total above ground dry matter production at anthesis and grain production.

	Dry matter, lb/A		Grain yield, bu/A	
	Barley	Wheat	Barley	Wheat
Row spacing, inches				
4	3,833	4,856	71	37
8	3,446	4,335	74	39
12	3,394	4,290	73	39
Seeding rate, bu/A				
1	3,362	4,240	68	36
2	3,610	4,728	74	39
3	3,681	4,877	77	40
Seed-placed P_2O_5, lb/A				
0	2,983	3,966	66	37
16	3,610	4,728	75	39
32	4,039	4,789	77	40

Averaged over 3 site-years

development, reduced root disease, and increased dry matter production and grain yields, thus reinforcing the importance of starter P.

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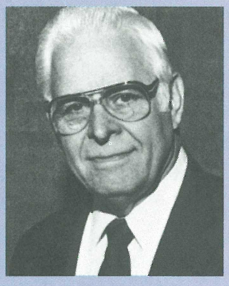
TABLE 3. Seeding rate and seed-placed P interact to maximize spring wheat yields (Brandon, MB, 1994).

Seeding rate, bu/A	Applied P_2O_5, lb/A		
	0	20	40
	Grain yield, bu/A		
1	31	38	38
2	36	43	43



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