



Seed-placed phosphate outperforms foliar applications

CATEGORY [soils and fertility](#) | June 16, 2021

In this study, foliar phosphorus (P) application was unable to substitute for seed-placed P. Overall, foliar P had a marginal effect on grain yield, P uptake and seed nutritional value.

Generally, little research has been conducted in western Canada to assess the potential of foliar-applied phosphorus (P) in small grain crops. The objective of this study was to determine the effect of different proportions of soil- versus foliar-applied P on canola, hard red spring wheat, and green field pea.

The research was conducted on two adjacent fields, one used for the 2016 season and one for the 2017 season, in the Black soil zone near Pilger, Saskatchewan. The soil at the sites was classified as an Orthic Black Chernozem loam. The two fields had similar crop rotations over the previous decade, with little to no P fertilizer applied, and both were deficient in P at less than 7 PPM modified Kelowna extractable P.

The five treatments were: (C) control with no added P; 17.8 lbs. P_2O_5 /ac (20 kg/ha) seed-placed (SP); 13.4 lbs./ac (15 kg/ha) seed placed and 4.5 lbs./ac (5 kg/ha) foliar applied (F25); 9 lbs./ac (10 kg/ha)

seed placed and 9 lbs./ac (10 kg/ha) foliar applied (F50); and all 17.8 lbs./ac (20 kg/ha) foliar applied (F100).

The seed-placed P was MAP (11-52-0) fertilizer. The foliar P source used was monopotassium phosphate (KH_2PO_4) dissolved in water, with dimethicone (Xiameter) adjuvant added to promote foliar absorption.

Foliar application to canola was at the 5-8 leaf stage prior to bolting (BBCH 15-18), and prior to flag leaf emergence (BBCH 43) for the wheat. The foliar P treatments were applied to peas at the 6-9 node stage (BBCH 36-39).

Seed-placed MAP generally yielded the highest

Overall, yield response decreased as the proportion applied as seed-placed MAP decreased. Of the three crops, canola was the most responsive to P fertilization in terms of yield and P uptake response, followed by wheat and pea.

Seed-placed MAP produced significantly higher canola yield in 2016 at 88 bu/ac (4.966 t/ha) compared to foliar P yields around 39 bu/ac (2.18 t/ha). In 2017, canola yields were not significantly different between P applications, likely due to low yields around 30 bu/ac (1.7t/ha). The 100% foliar-applied P treatment in canola was able to maintain significantly higher yield than the unfertilized control in the absence of seed-placed MAP, indicating some uptake and response.

Pea yield with seed-placed MAP (27 bu/ac) was significantly higher than foliar P (about 20 bu/ac) in 2017, but was not significantly different in 2016.

Overall, wheat yield and P uptake were not significantly affected by treatment in both years with yields ranging from 21 to 28 bu/ac (1.417 to 1.909 t/ha).

Variable	Treatment	Canola		Pea		Wheat
		2016	2017	2016	2017	2016 and 2017
Grain P concentration (mg kg ⁻¹)	C	3138a	3900	2753	2226b	3279
	SP	2769b	3815	2825	2508a	3437
	F(25)	3080a	3938	2798	2516a	3319
	F(50)	2980ab	3904	2660	2548a	3499
	F(100)	2765b	3763	2755	2562a	3400
Grain P uptake (kg ha ⁻¹)	C	4.1b	10.7c	8.6	6.1b	4.3
	SP	13.8a	14.1ab	8.3	8.9a	6.6
	F(25)	6.3b	14.8a	8.9	6.8ab	4.8
	F(50)	6.2b	13.0a	9.3	5.8b	5.6
	F(100)	6.0b	11.9bc	7.4	7.3ab	5.1
Grain yield (kg ha ⁻¹)	C	1322c	1365b	3120ab	1373b	1286
	SP	4966a	1856a	2990ab	1795a	1909
	F(25)	2184b	1877a	3160ab	1335b	1417
	F(50)	2181b	1646ab	3500a	1159b	1567
	F(100)	2177b	1590ab	2281b	1417b	1508
Straw P concentration (mg kg ⁻¹)	C	236a	186	419	399	294b
	SP	150b	158	381	384	273b
	F(25)	204ab	154	405	409	364a
	F(50)	165ab	171	337	413	321ab
	F(100)	195ab	193	403	379	337ab
Straw P uptake (kg ha ⁻¹)	C	0.6b	0.9	2.8	1.3ab	1.0b
	SP	1.4a	1.1	2.3	1.5ab	1.4ab
	F(25)	0.9ab	1.0	2.5	1.8a	1.8a
	F(50)	1.1ab	1.0	2.4	1.2b	1.4ab
	F(100)	1.2a	1.0	2.3	1.4ab	1.4ab
Straw yield (kg ha ⁻¹)	C	3283c	2448b	3565	1723ab	2370
	SP	8117a	3387a	3416	2032ab	3266
	F(25)	5029b	3371a	3580	2266a	2477
	F(50)	4839b	2838ab	3700	1480b	2334
	F(100)	4263bc	2728ab	3114	1897ab	2859

Source: Froese et al. 2019

The results of this study suggest that the overall uptake of foliar P fertilizer applied to plant leaves at canopy closure was not high enough to have a major impact on the P uptake, yield and quality. However, there was some indication of foliar P uptake. As a result, more research is needed to evaluate the potential of different foliar P fertilizer compounds, adjuvants, fertilizer nutrient blends, and application timing on different crops. There may be greater potential for foliar P to be used as a supplement fertilizer treatment to be added on top of seed-placed P as opposed to splitting the application of a fixed recommended rate.

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S.Froese, J.T.Wiens, T.Warkentin, and J.J.Schoenau. Response of canola, wheat, and pea to foliar phosphorus fertilization at a phosphorus-deficient site in eastern Saskatchewan. *Canadian Journal of Plant Science*. **100**(6): 642-652. <https://doi.org/10.1139/cjps-2019-0276>