NEWS & VIEWS

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Phosphorus Pays — Don't Seed Without It!

FARM CRISIS!…low prices and high input costs. The media have done a great job drawing attention to the current farm crisis. That's all we've heard, all winter, and rightfully so. The squeeze is on, and farmers are caught in the middle. They're faced with difficult decisions and searching for ways to make their operations more profitable.

During times like these, there is always the temptation to cut back on fertilizer. It seems like a simple solution, but farming is a complicated business and cutting back on fertilizer could have major effects on profitability.

Profit, simply defined, is gross income (crop price x total yield) minus the cost of production. Producers have little control over crop price, but they can influence yield and cost of production. Reducing costs is always attractive, but it needs to be done wisely or profits suffer. It may be unwise to cut costs that cause yields to decrease. High yields are essential to lower the unit cost of production.

In prairie soils, adequate nitrogen (N) is essential for high yields, as is phosphorus (P). But, when we are contemplating cutting input costs, P is often the first to go. That's because crop response to P is usually not as dramatic as the response to N. And, response to P is not always as consistent as it is with N; that is, it varies from year to year.

So what's the answer? Can we afford to cut back on P? Maybe. If soil P levels have been built to a high level, it may be okay for some producers to reduce their P rates. However, P should never be eliminated entirely. Applying a small amount of P at seeding (starter P) is a proven practice in the Canadian prairies.

Starter Phosphorus

Researchers at the Semiarid Prairie Agricultural Research Centre in Swift Current, Saskatchewan, have been evaluating seed-placed P since 1967 in two fallow-wheat-wheat (F-W-W) rotations in their Brown soils. One rotation receives N + P and the other only N. Annual P application rates have been 20 lb P_2O_5/A, and N has been applied according to soil test recommendations.

Results show the response to P has been quite variable but, on average P has increased spring wheat yields by about 14 percent. When seeded on stubble, average yields increased by about 2 bu/A. When seeded on fallow they increased by just over 4 bu/A (**Figure 1**). However, increases were as high as 16 bu/A for fallow wheat and 9 bu/A for stubble wheat. There were also a few years when added P was accompanied by small yield decreases. Fertilizer can have a negative impact when it gets the crop off to a great start, but later there isn't enough water to support the initial vigorous growth.

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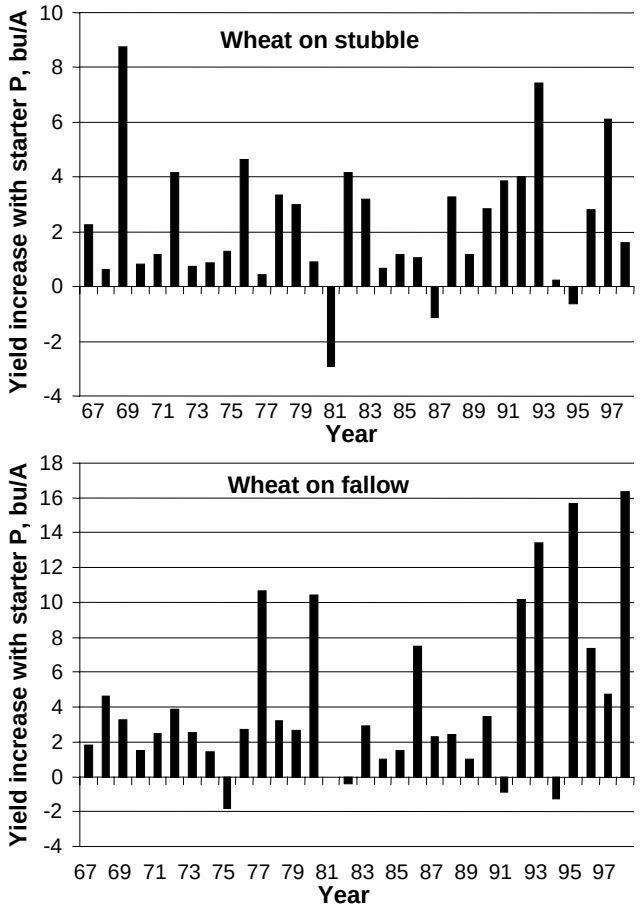

Figure 1. Spring wheat response to annual applications of 20 lb P_2O_5/A in a fallow-wheat-wheat rotation for wheat seeded on fallow and stubble at Swift Current, SK 1967-1998.

It's interesting to note that some of the best responses to starter P have been in the 1990s. This has occurred despite increasing soil P levels (**Figure 2**). In 1967 when the study began, soil test P was 17 lb/A. In 1998, after 32 years of cropping without P fertilizer, the soil test levels declined about 3 lb/A. Apparently, soil organic matter has been releasing enough P to meet crop demand in the N only rotation. In contrast, where small applications of starter P have been applied annually, soil test P levels have more than doubled to about 45 lb/A.

Why do prairie soils still respond to seed-placed P, even though soil test levels are gradually increasing? We call this the *pop-up* effect and there are several reasons for it. Wet spring conditions inhibit root growth, reduce P uptake and translocation within the plant, and slow the movement of P to plant roots. Weather conditions during the growing season also have a major effect on response to P. When conditions are ideal and the crop is growing vigorously, it takes advantage of higher soil fertility and responds accordingly.

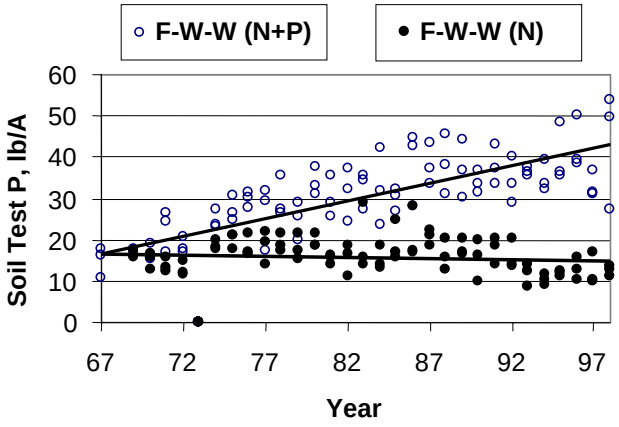

Figure 2. Soil test P changes in a fallow-wheat-wheat rotation in response to annual applications of 20 lb P_2O_5/A at Swift Current, SK, 1967-1998.

How Profitable is Starter Phosphorus?

Starter P increases crop yields, and the increase appears to occur regardless of soil test levels. But is it economic… does it pay to spend the extra dollars when soil test levels are getting higher? A simple economic analysis shows that starter P is profitable, but returns must be considered on a long-term basis.

Historic wheat prices and P costs were used to calculate a net return to annual additions of 20 lb P_2O_5/A in the long-term F-W-W rotations at Swift Current. Results are shown in **Table 1**. Net returns to starter P in fallow-wheat ranged from a loss of $9.66/A to a profit of $81.73/A. Averaged over the 32-year period, starter P returned $12.06/A/year above the cost of P fertilizer. The stubble wheat was more variable and not as profitable. Its net returns to applied P over the 32 years averaged $3.04/A year and ranged from a loss of $22.52/A to a profit of $22.94/A.

The drier conditions in stubble wheat resulted in a lower yield response and lower returns to seed-placed P. When averaged over the 32 years, stubble wheat returned about $1.65 for every dollar invested in P fertilizer. However, the extra soil moisture in the fallow wheat more than doubled the returns to P compared to stubble wheat. It averaged about $3.65 for every dollar invested in P fertilizer.

Starter P pays in most years, especially when wheat is grown on fallow. Over time it's a good investment that can pay large dividends.

Table 1. Yield increase, gross return, and net return to annual additions of P fertilizer (20 lb P_2O_5/A) at Swift Current, Saskatchewan.

			Fallow wheat			Stubble wheat		
Year	Wheat[†] $/bu	P_2O_5[‡] $/lb	Yield Increase, bu/A	Gross Return, $/A	Net Return, $/A	Yield Increase, bu/A	Gross Return, $/A	Net Return, $/A
67	1.62	0.08	1.81	2.93	1.33	2.26	3.66	2.06
68	1.51	0.08	4.63	6.99	5.39	0.63	0.95	-0.65
69	1.49	0.08	3.29	4.90	3.30	8.77	13.07	11.47
70	1.48	0.07	1.47	2.18	0.78	0.81	1.20	-0.20
71	1.41	0.08	2.47	3.48	1.88	1.18	1.66	0.06
72	1.96	0.08	3.90	7.64	6.04	4.15	8.13	6.53
73	4.38	0.09	2.55	11.17	9.37	0.76	3.33	1.53
74	4.25	0.09	1.42	6.04	4.24	0.88	3.74	1.94
75	3.74	0.15	-1.78	-6.66	-9.66	1.27	4.75	1.75
76	2.94	0.18	2.71	7.97	4.37	4.62	13.58	9.98
77	3.01	0.15	10.68	32.15	29.15	0.45	1.35	-1.65
78	4.09	0.16	3.22	13.17	9.97	3.35	13.70	10.50
79	5.07	0.20	2.67	13.54	9.54	3.00	15.21	11.21
80	5.74	0.24	10.43	59.87	55.07	0.90	5.17	0.37
81	5.11	0.38	0.00	0.00	-7.60	-2.92	-14.92	-22.52
82	4.91	0.34	-0.42	-2.06	-8.86	4.15	20.38	13.58
83	4.93	0.27	2.90	14.30	8.90	3.20	15.78	10.38
84	4.66	0.29	1.00	4.66	-1.14	0.67	3.12	-2.68
85	3.98	0.30	1.52	6.05	0.05	1.18	4.70	-1.30
86	3.16	0.29	7.47	23.61	17.81	1.07	3.38	-2.42
87	3.26	0.24	2.29	7.47	2.67	-1.12	-3.65	-8.45
88	4.93	0.25	2.41	11.88	6.88	3.27	16.12	11.12
89	4.19	0.26	1.00	4.19	-1.01	1.17	4.90	-0.30
90	3.12	0.27	3.45	10.76	5.36	2.84	8.86	3.46
91	3.08	0.27	-0.87	-2.68	-8.08	3.84	11.83	6.43
92	3.68	0.28	10.18	37.46	31.86	4.02	14.79	9.19
93	3.82	0.27	13.41	51.23	45.83	7.42	28.34	22.94
94	4.66	0.32	-1.22	-5.69	-12.09	0.22	1.03	-5.37
95	5.71	0.39	15.68	89.53	81.73	-0.62	-3.54	-11.34
96	4.37	0.42	7.35	32.12	23.72	2.81	12.28	3.88
97	3.87	0.36	4.71	18.23	11.03	6.13	23.72	16.52
98	3.99	0.35	16.35	65.24	58.24	1.60	6.38	-0.62
Mean	3.69	0.23	4.27	16.61	12.06	2.25	7.59	3.04

[†] Canadian Wheat Board final price basis, Saskatoon, SK. Prices for 1967-71 were adjusted using freight and primary tariffs for 1972.
[‡] Westco spring fertilizer price surveys (unpublished data) and Statistics Canada.

Summary

Applying small applications of starter P in spring wheat systems can be highly profitable in the Canadian prairies, especially if soil moisture is good and yield potential is high. In times of economic stress, farmers who have maintained their soil P levels in the high range have some flexibility. They may reduce P levels in one growing season with minimal economic loss. However, eliminating seed-placed P may increase the risk of lost profits. Regardless of soil test level, applying some P at seeding is a management option that can boost producer profits. This is especially true for wheat grown on fallow. ■

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