NEWS & VIEWS

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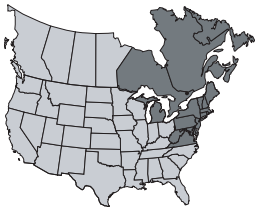

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High-Priced Potash: Can I Cut Back?

POTASH PRICES have risen significantly. Crop prices haven't. What management response is agronomically and economically sound? The answer is not simple. Cutting back rates has long-term consequences.

Price Ratios

The economics of fertilizer use are impacted by the ratio of the price of fertilizer to that of the crop. Price ratios[1] of potash with alfalfa hay, corn (grain), and soybeans have varied over the past 15 years, and the recent increase has been steep (**Figure 1**).

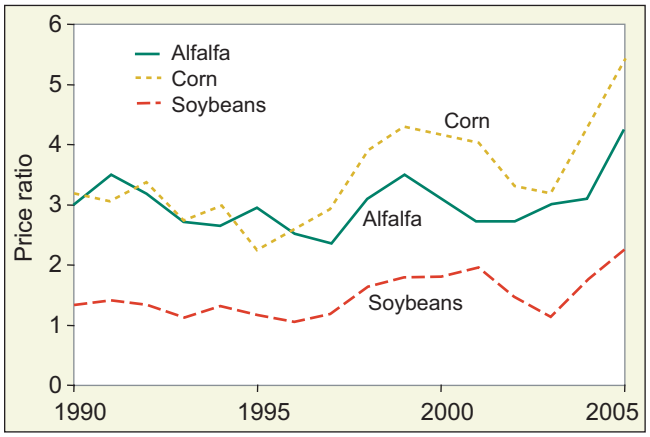

Figure 1. Trends in price ratios over the past 15 years.

Crop and potash prices associated with these ratios are shown in **Table 1**. These price ratios reflect the situation for most producers in Canada and the U.S.[2] Let's examine how this new high in price ratios impacts practical management of potash for your crops and soils.

Table 1. Crop prices and potash prices associated with maximum and minimum price ratios over the past 15 years.

Crop	Crop price, $/unit	Potash price, $/lb of K_2O	Price ratio[1]
Alfalfa, ton	107	0.127	2.4
	96	0.204	4.2
Corn, bu	3.24	0.129	2.2
	2.10	0.204	5.4
Soybeans, bu	7.35	0.128	1.0
	5.38	0.204	2.3

The Soil Reserve

Potash (also known as potassium, or K) stays in the soil much longer than nitrogen (N), and has residual value. When price fluctuations are temporary, it's quite possible to cut back one year, provided the soil reserve is restored again within a few years. However, the world situation for energy has changed, and it appears that its prices—and prices for all fertilizers—may remain fundamentally higher than in the past. The cost of restoring lost soil fertility in the future has become an important factor to consider.

Price does not change what the crop removes from the soil. The soil does not generate K, and plants do not take it from the air. Inevitably, what is taken out must someday be replaced.

Crop response to K depends a lot on the soil reserve—the amount of available (exchangeable) K—which shows up in your soil test. But responses vary considerably at any given soil test level, because weather and many other uncontrollable factors wield enormous sway. Data from Ontario, for example, show that corn responds more than 80% of the time when soil test K is low, but still responds about 35% of the time when the soil test is high or very high.

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[1] Pounds of crop equal in value to one pound of K_2O.

[2] Crop price data were from U.S. Department of Agriculture, National Agricultural Statistics Service. April 2005. Historical Track Records >http://www.usda.gov/nass/pubs/trackrec/croptr05.pdf<. Crop price data for 2005 were estimated as average of price received in the past 5 years. Potash prices were obtained from USDA-NASS Agricultural Prices, 29 April 2005.

It has long been considered sound agronomy to apply enough K to balance crop removal, even when soils test high, to eliminate chances of yield loss as well as maintain soil fertility. When K fertilizer was inexpensive, this strategy was not controversial. However, the recently increased price ratios raise a question: How high a soil test level is it profitable to maintain? **Let's look at three examples from Ontario to see what the data on crop responses have to say.**

Examples from Ontario

If you consider only how this year's crop will respond, a rise in price ratio decreases the optimum (most economic) rate. At a certain point, it declines to zero, in which case the soil is considered "non-responsive" (the crop may still respond to applied K, but not enough to pay for any rate you might apply).

The average optimum rate—across responsive and non-responsive sites—is not very meaningful for practical management. It is more practical to consider the frequencies at which profitable responses occur, regarding them as odds of crop response, and then consider whether the appropriate rate should fall short of, match, or exceed the amount the crop removes from the soil.

The following examples for alfalfa, corn, and soybeans are based on data from all publicly available reports on K response trials conducted in Ontario over the past few decades. Data were available from 53, 96, and 128 site-years for the three crops, respectively.

In each site-year, a replicated experiment with multiple rates of applied K was conducted and yields were measured. Quadratic and Mitscherlich response curves were fit to the yield data to determine the most economic rate (at which the incremental value of the yield increase equals that of the applied fertilizer) for each of three price ratios. The three price ratios chosen were based on the minimum, mean, and maximum values over the past 15 years, as shown in **Figure 1**.

Alfalfa removes a lot of K—50 to 60 lb K_2O per ton—and responds strongly to it as well. **Figure 2A** shows how alfalfa responds profitably all of the time at lower soil test levels, even with the recent high price ratios. Another way to think of it: without K being applied, yield loss is quite certain.

In the soil test range of 80 to 150 parts per million (ppm)…considered "medium" in Ontario…K applications were profitable 76% of the time at historical price ratios; they would still be 67% of the time at today's higher ratio. Response frequency in this range is still considerable for all price ratios. For most situations, it would be wise not to let soil test levels decline from this range. Applying enough to balance removal is a sensible management alternative, regardless of price ratio. Even with a soil test of 100 ppm,

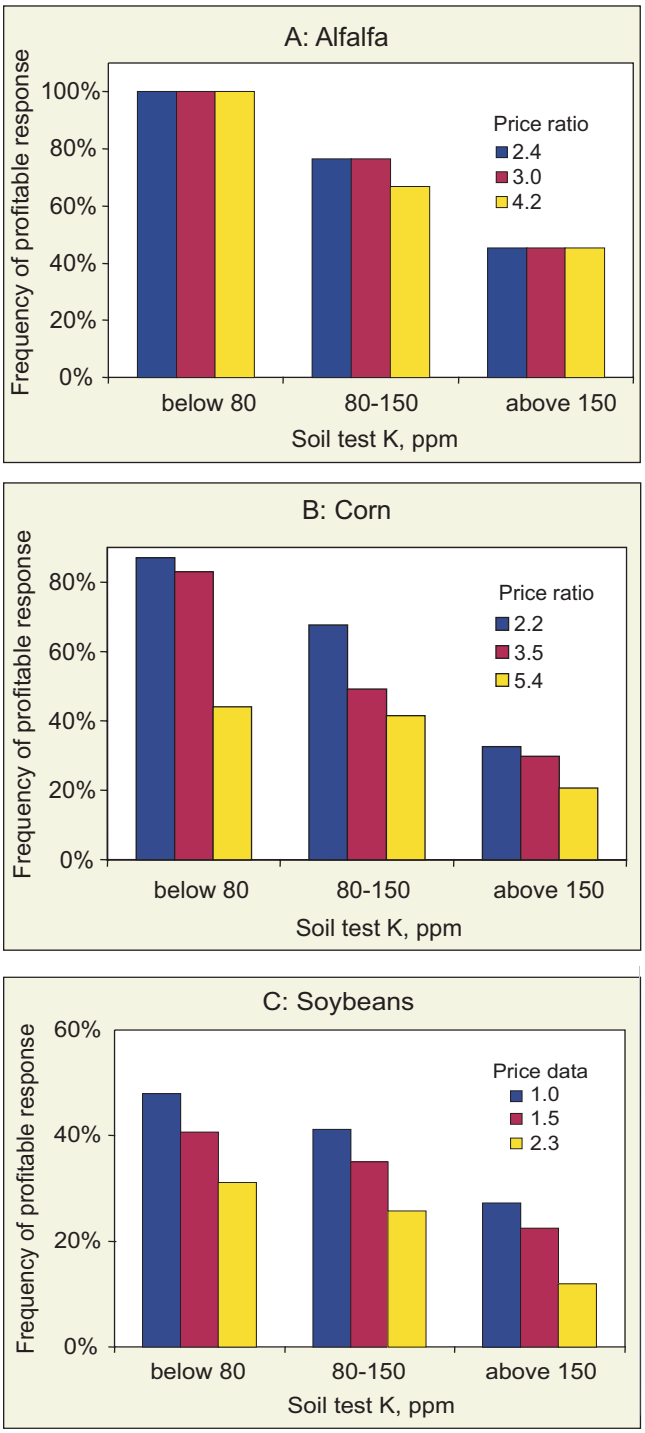
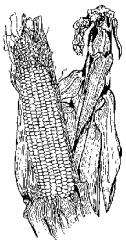


Figure 2. Chances of a profitable response to applied K decrease with increasing soil test K and increasing price ratio.

alfalfa has been shown to yield as much as 50% more with K than without.

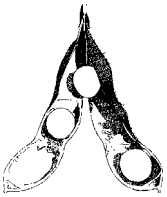
When soil tests move into the high range, the odds of alfalfa response remain 45% even at the recent high price ratio. Rates balancing part of crop removal are still justified, and attention still needs to be paid to the declining soil test level that inevitably results.



Corn also responds strongly to applied K. While it removes less—0.27 lb of K_2O per bushel of grain—it needs to take up five times that amount into the plant.

Figure 2B shows that when soil test K is 150 ppm or lower, corn responds profitably to applied K quite frequently at low to average price ratios. But at the new high ratio, the frequency declines to 40%—which is still a substantial risk of losing yield. Rates that make sense for this soil test range need to be determined locally, but in most instances a rate replacing crop removal would be a minimum.

With soil tests in the high range, response frequency does not decline below 20%. Even in this range, it makes sense to include at least some K in the starter, and to continue monitoring soil test levels. Yield increases of more than 10% have been documented at soil test levels as high as 170 ppm.



Soybeans at typical yields remove almost twice as much K from the soil as corn—1.3 lb of K_2O per bushel. But, at least in Ontario, soybeans have not responded to applied K as frequently as alfalfa or corn (see **Figure 2C**).

Price ratio makes the biggest impact when soils have been built to high levels of fertility. But note that response frequency does not decline to zero. It is worthwhile to maintain soil K at good levels for soybeans.

Conclusion

When soil tests decline, the most economic rate becomes highly sensitive to small changes in soil test level. Detecting such small changes requires a level of precision not attainable with currently recommended soil sampling and testing procedures. The chances of K deficiency increase, and the impact of missing an application becomes very large.

Specific rate recommendations are best given by crop advisers using region-specific data and local expertise. Soils outside of (and within) Ontario may show different odds of response.

What I hope the analysis above provides, however, is an example of how rate reduction decisions impact those odds. Similar reasoning can be used for other nutrients with residual value in the soil, such as phosphorus (P).

Whatever the crop being grown, the price ratio does not alter the amount of K removal from the soil. Higher price ratios increase the profitability of sound soil testing to identify fields and areas within fields where rates below removal may be justified for one or several years. But in the long term, nutrients removed by crops will need to be replaced.

How can you manage for profit in the face of high-priced potash? You need to thoroughly account for the K:

- In the soil reserve;
- Applied as manures and composts;
- Removed by harvested crops.

Using sound recommendations considering all three, your crop management plans will have the greatest chance of being sustainably profitable. ■

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Looking for More?

For additional information and tools related to decision-making on fertilization and cost concerns, visit our website at >**www.ppi-ppic.org**<.

An article titled "Nourishing the 2006 Crop…Will We Get It Done?" by PPI Senior Vice President and North American Program Director Dr. Paul Fixen addresses the current concerns about fertilizer prices and cost cutting. There is also a folder at the website called "Fertilizer Economics for 2006… Tools for Management", which has information on various regions and cropping systems.