

NEWS & VIEWS

A regional newsletter published by the
Potash & Phosphate Institute (PPI) and the
Potash & Phosphate Institute of Canada (PPIC)



Dr. Adrian Johnston,
Western Canada Director
April 2002

Field Pea Responses to Phosphorus Fertilization

Summary of Key Points

- While field peas fix most of their nitrogen (N), grain harvest removes large amounts of phosphorus (P).
- Soils testing less than 27 lb P/A (modified Kelowna procedure) were found to be the areas where grain yield response to P fertilization would be expected. Grain yield responses to P addition ranged from 8 to 33 percent, averaging 9.7 bu/A.
- Where responses to P were obtained, yield was usually optimized with applications of 30 lb P₂O₅/A.
- Balanced nutrient availability will ensure efficient use of soil water and growing season precipitation by field pea crops. Soil testing is the first step in managing soil and fertilizer nutrients for optimum yields.

FIELD PEAS (*Pisum sativum L.*) are well established as part of the crop rotation grown in many regions of the Prairie Provinces. In 2001, there were an estimated 3.4 million acres of field peas harvested in Alberta, Saskatchewan, and Manitoba. As a grain legume, field peas are capable of fixing the vast majority of their own N through their symbiotic relationship with rhizobium bacteria. Only on soils with low residual N levels (less than 20 lb N/A) has any response to starter N been found to be effective, and then only at fertilizer rates of less than 20 lb N/A. This N fixation capability reduces the cost of growing field pea as a stubble crop.

High yielding field pea crops remove more nutrients than just N from the soil. And while many of our soils in the Prairie Provinces are high in potassium (K), deficiencies of P are very common. Nutrient uptake and removal research has shown that a 50 bu/A crop takes up at least 38 lb P₂O₅/A, 123 lb K₂O/A, and 11 lb sulfur (S)/A. Of this plant uptake, removal from the field in the grain amounts to 0.62 lb P₂O₅/bu, 0.64 lb K₂O/bu, and 0.12 lb S/bu. Growing peas on fields with a deficiency in these nutrients may be limiting the yield potential of the crop.

Many farmers have started to depend on the soil bank account of P to supply their field pea crop needs. Where soil P levels have been maintained and not de-

pleted, this can result in little loss in pea yields. Building soil P supply ability is a result of a portion of the fertilizer P which is not used in the year of application becoming available for plant growth in future years. If the soil has a large bank account it is usually reflected in the soil test P levels – they are generally higher.

Given the importance of field peas to crop rotations in western Canada, and the P removed by the crop, extensive research has been conducted to evaluate the crop response to P fertilizer addition. One project in Alberta evaluated response to fertilizer P additions in 52 different trials involving all soil zones between 1995 and 1998. The results of the study were divided up, based on the background soil test P levels (**Figure 1**).

A total of 31 trial sites had soil test P levels that were less than 27 lb/A (modified Kelowna procedure), while the remaining 17 sites were higher. Only one of the trial sites with soil test P greater than 27 lb/A showed a positive yield response, indicating a sufficiency level of P at these high testing sites. For those soils testing below 27 lb P/A, a statistically significant response to added fertilizer P occurred at 17 of the 31 trials (54 percent). In these 17 trials, the yield increase ranged from 2.2 bu/A to 18.2 bu/A, with an average response of 17 percent (9.7 bu/A) over the unfertilized check. While the rates of P used in this

Co-authors:

Dr. Adrian Johnston, Western Canada Director
Potash & Phosphate Institute (PPI)/
Potash & Phosphate Institute of Canada (PPIC)
12-425 Pinehouse Drive
Saskatoon, Saskatchewan, Canada S7K 5K2
Telephone: (306) 956-0619
E-mail: ajohnston@ppi-ppic.org

Dr. Rigas Karamanos, Research Manager
Western Cooperative Fertilizer Ltd.
Box 2500
Calgary, Alberta, Canada T2P 2N1
Telephone: (403) 279-1120
E-mail: RE.Karamanos@WestcoAg.com

Dr. Ross McKenzie, Research Scientist
Alberta Agriculture, Food and
Rural Development
5401 – 1st Ave. South,
Lethbridge, Alberta, Canada T1J 4V1
Telephone: (403) 381-5842
E-mail: ross.mckenzie@gov.ab.ca

study ranged from 0 to 53 lb P₂O₅/A, maximum yield response was obtained with 27 lb P₂O₅/A applied either in the seed row or banded mid-row (Figure 1).

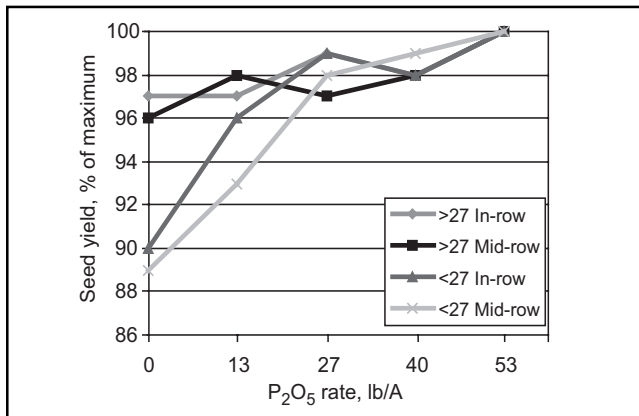


Figure 1. Effect of placement and rate of triple superphosphate (0-45-0) on field pea in Alberta. Total of 31 trials used for the average response in soils with less than 27 lb soil P/A; 17 trials used for the average response in soils with more than 27 lb soil P/A.

A second prairie-wide evaluation of pea crop response to fertilizer P additions found similar results to the above study. Over a period from 1995-98, 28 field trials were conducted in Alberta and Saskatchewan where pea response to increasing rates of P₂O₅ was determined, with the sites covering a range of soil test P levels. In this study, 64 percent (18 of 28) of trials responded to P. All of the responsive trial locations that had soil test levels of less than 10 lb P/A responded to P fertilizer addition. Two-thirds of these trials showed maximum yield with 30 lb P₂O₅/A and one-third at 45 lb P₂O₅/A. However, only 14 percent of those sites which had a soil test P level higher than 30 lb P/A showed a response to fertilizer addition, with yields maximized at the 30 lb P₂O₅/A rate.

Responsive trial results were plotted against P fertilizer rate and are shown in Figure 2. The range of crop responses indicates that large site-to-site variability in field pea yield response to P can be expected. This variability is common to most multi-location fertility trials and reflects the impact of historical management on the soil fertility of the sites. The one trend that does come through in these data is that as the P rate at which maximum yield was attained increases, so does the average grain yield. As a result, where soil P deficiencies are determined by soil test there is a good probability that field pea yield increases will be achieved with fertilizer P addition.

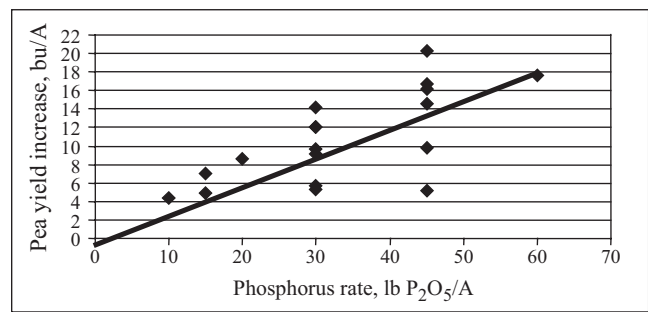


Figure 2. Side banded fertilizer P (0-45-0) application rates at which field pea yield increase over the unfertilized check reached a maximum yield—18 field trials in Alberta and Saskatchewan.

In response to the increased acreage of field pea production, and concern over crop response to P fertilization, Alberta Agriculture recently published new recommendations for P fertilization (Table 1). These recommendations support the increasing application rate of P fertilizer in soils testing less than 30 lb P/A in the top 6 in. Soils testing above this level receive a recommendation for maintenance application, in this case 15 lb P₂O₅/A, the amount removed in the grain of a 25 bu/A pea crop.

Table 1. Phosphate fertilizer recommendations for field pea for the major soil zones in Alberta.

| Soil test P, 0 to 6 in., lb/A | Brown and Dark Brown | Thin Black and Black | Gray Wooded | Irrigated |
|-------------------------------|--|----------------------|-------------|-----------|
| | ----- Recommended P ₂ O ₅ , lb/A ----- | | | |
| 0-10 | 30 | 40 | 30 | 40 |
| 10-20 | 20 | 30 | 25 | 30 |
| 20-30 | 15 | 20 | 20 | 20 |
| 30-60 | 15 | 15 | 15 | 15 |
| >60 | 0 | 0 | 0 | 0 |

Source: Alberta Agriculture, Food and Rural Development, 2002.

Maintaining soil P levels with fertilizer and manure addition is critical to sustaining the productive capacity of our soils. While crop response to P fertilizer addition may show site-to-site variability on any farm, the fact remains that soil P is being removed by crops and exported off the farm in grain sales. In order to efficiently manage soil water and growing season precipitation, farmers need to soil test and correct nutrient deficiencies. ■

For additional information on P and K, check the website at www.ppi-ppic.org