PRINCE EDWARD ISLAND

Phosphorus Needs of Processing Potato Varieties

By S. Moorehead, R. Coffin, and B. Douglas

Potato producers in PEI grow approximately 110,000 acres of the crop each year. While yields of this rainfed crop are not as high as in irrigated production in the West, high quality has led to renown for PEI potatoes. Nearly one half of the potato crop is processed, mainly for the production of French fries.

Producers typically apply 200 to 240 lb/A of P_2O_5 to potato crops. Since this is considerably more than the amount of P removed by the crop, soil tests are showing increasing levels of the nutrient in fields which have been used for potato production. Industry personnel have questioned whether the increased soil test levels would allow adjustment of rates of P applications and what the impact might be on the yield and processing quality of the different varieties. There are also questions on the impact of soil pH on optimum rate of P. Soils in PEI are typically acidic and high in iron (Fe), but producers apply lime to varying extents. There has been a dearth of local data collection in recent years to measure yield responses to levels of nutrients in soil (soil test/yield response calibration).

Phosphorus (P) is important for producing the large potato tubers desired for processing. Recent research in Prince Edward Island (PEI) has confirmed the high P needs of Russet Burbank, the most important processing variety, and has indicated that potato P needs may be variety-specific.

The most popular variety for processing has been Russet Burbank, but it is a challenge to grow since it often requires a longer growing season than the PEI climate provides. In recent years the earlier maturing variety Shepody has become more popular. While it does not maintain its processing qualities in storage for as long a time as Russet Burbank, almost half of the processing crop is currently the Shepody variety.

To address the above questions, research on P needs was conducted from 1992 through 1994 and in 1997. The studies differed from year to year in the number of rates applied, but used similar production practices.

The most detailed study was conducted at two sites in 1997. Site A had clay loam soil with a relatively high pH of 6.0 to 6.2 and a Mehlich-III soil test level of 171 parts per million (ppm) P. Site B, located 10 miles away, had sandy loam soil at a lower pH of 5.5 to 5.7 with

TABLE 1. Yield responses to applied P in 1992 and 1993 (mean of two years). Soil test P was 123 and 106 ppm.

P_2O_5 applied, lb/A	Marketable yield, cwt/A	
	Shepody	Russet Burbank
0	243	209
135	248	236
difference	6	27

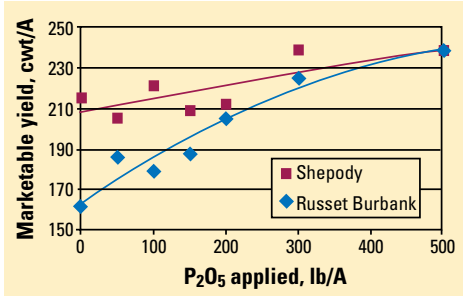

Figure 1. Yield responses to seven rates of applied P in 1994. Soil test P was 149 ppm.

a soil test level of 138 ppm P. Both sites followed a typical 3-year rotation (potatoes, barley, mixed hay).

At each site, four rates of P_2O_5 were applied (0, 65, 240, and 500 lb/A) to the two varieties, on limed (1 ton/A) and non-limed plots. All fertilizer was banded at planting. The sole source of P at the 65 and 240 lb rate was diammonium phosphate (DAP). A mixture of DAP and triple superphosphate (TSP) was used for the 500 lb rate. Nitrogen (N) rate was 150 lb/A, and potassium (K) rate was 240 lb/A K_2O. Ammonium nitrate [$(NH_4)NO_3$] was used to supplement N requirements from DAP. All K was provided from potassium chloride (KCl).

Results in 1992 and 1993 indicated that the Shepody variety was less responsive to applied P than Russet Burbank (**Table 1**). This was confirmed in 1994 (**Figure 1**), though both responded to some extent at the highest two rates.

In 1997, there was a surprising response to lime in both the lower and higher pH sites. In fact, results from the two sites were so similar that they were averaged together, as shown in **Figure 2**. Again, Russet Burbank responded more to P than did Shepody. Applying lime appeared to slightly enhance the P response for Russet Burbank, but it diminished the small response that Shepody showed in the non-limed treatment. On the low pH site, at about 75 days after planting, the pH within the hill had declined to 4.5 where no lime was added and to 4.8 even where lime was added. The pH dynamics may have influenced the availability of applied P.

Lime and P had no effect on specific gravity, the incidence of scab nor fry color when fried in mid November and mid February. Shepody tubers contained higher levels of P than Russet Burbank, 0.27 percent versus 0.22 percent, but lower levels of calcium (Ca), 164 ppm versus 222 ppm. Lime applications did not alter Ca levels in the low pH field, but increased Ca by 42 ppm in the high pH field.

Although soil test interpretations have changed over time, these soils were generally in the range considered to be medium to high in P. These experiments have confirmed the high P requirement of Russet Burbank grown on such soils. In addition, the lesser response of

Potatoes produced in Prince Edward Island have variety-specific P needs.

Shepody indicates that P needs for the potato crop may be variety dependent. For this reason, further research on potato P needs is important, and we are optimistic that a better crop can be produced using variety specific nutrient management. BC

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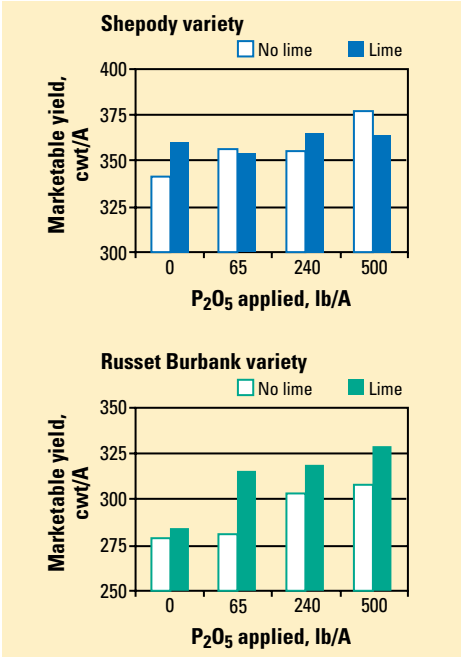

Figure 2. Yield responses to four rates of applied P in 1997, with and without lime application. Mean of two sites. Soil test P was 138 to 171 ppm P.