Early season phosphorus nutrition is critical for optimum crop yield. Researchers at Agriculture and Agri-Food Canada conducted a three-year multi-site field study to assess the impact of phosphorus fertilizer applied with and without phosphate-solubilizing inoculant Penicillium bilaii on the growth, phosphorus uptake, yield and quality of canola. Under the conditions of this study, inoculation with P. bilaii had limited effects, while P fertilizer application generally resulted in comparatively more consistent and marked increases in early-season P uptake, yield, and seed P concentration and content.

Early season phosphorus (P) nutrition is critical for optimum crop yield, therefore placement of starter P fertilizer in or near the seed row is important to ensuring that the plant is able to access this P early in the growing season. Canola is an effective scavenger of both soil and fertilizer P, employing several strategies to enhance uptake. Canola may effectively use soil P where soil test P levels are moderate to high, but may also be highly responsive to P fertilizer application where soil test P levels are low.

Researchers at Agriculture and Agri-Food Canada in Brandon, Manitoba conducted a three-year multi-site field study from 2010 through 2012 to assess the impact of phosphorus fertilizer applied with and without phosphate-solubilizing inoculant Penicillium bilaii on the growth, phosphorus uptake, yield and quality of Brassica napus canola. Replicated field experiments were conducted at various locations in Manitoba and Saskatchewan, typically at sites considered to have low to moderate soil test P levels. All sites were rainfed with the exception of one irrigated site at Outlook, Saskatchewan.

Soil testing and analysis was conducted in the spring. The plots were seeded to canola hybrid Invigor 5440 and included two inoculant treatments (no P. bilaii; recommended rate of P. bilaii) and eight P fertilizer treatments (0, 10, 20, 30, 40 kg/ha P₂O₅ side-banded; 10, 20 kg/ha P₂O₅ seed-placed; 40 kg/ha P₂O₅ with half seed-placed and half side-banded in the form of monoammonium phosphate. At one Saskatchewan site only, P fertilizer was mid-row rather than side-banded due to the equipment available. Blanket applications of N, K and/or S were applied as required to ensure adequate nutrient levels for crop production. The irrigated site had the same treatments, but received 62.5 mm of irrigation water over the growing season.
Various factors were evaluated including plant density, early season biomass, days to flowering, percent color change of seeds at swathing, seed yield and quality. Researchers also determined the P concentration in early season biomass samples and seed samples. The impact of *P. bilaii* inoculant, P fertilizer treatment and their interaction was assessed.

The results of the study showed positive yield responses to P fertilizer application in two-thirds of site-years for rainfed sites. Yield responses to P fertilizer were generally larger and more frequent where soil test P levels were lower. Inoculation with *P. bilaii* had limited effects on yield. Inoculation tended to increase yield in 1 of 9 site-years, and decreased yield in 1 of 9 site-years. In both of these site-years, canola had responded positively to P fertilizer, and the average yield difference between inoculated and uninoculated treatments was 7%. No inoculant × P fertilizer interactions were observed, indicating that effects of inoculation on yield were similar regardless of P fertilizer treatment.

The concentrations of P in harvested seed and P removal in harvested seed often increased with P fertilizer application, but not with inoculation. Regardless of treatment, plant stands were within recommended levels. However, in 8 of 9 site-years, inoculated treatments had lower plant stands than uninoculated treatments, and in 4 of 9 site-years, lower plant stands were associated with seed-placed monoammonium phosphate.

Overall, under the conditions of this study, inoculation with *P. bilaii* had limited effects on early-season plant P uptake, seed yield, and seed P concentration and content for canola. Phosphorus fertilizer application generally resulted in comparatively more consistent and marked increases in early-season P uptake, yield, and seed P concentration and content.
Figure 1. Effect of P Fertilizer Rate.

Figure 2. Yield Responses to P Fertilizer.