### Investigators
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### Study Sponsors
Saskatchewan Pulse Growers and Manitoba Pulse Growers

### Type of Study
Agronomy

### Objectives
Within the different soil/climatic zones of eastern Canada, determine:

1. which individual agronomic inputs contribute most to field pea seed yield
2. which combination produces the highest seed yield and economic return and
3. how plant population, leaf and stem disease, crop maturity, grain yield and quality are affected by input interactions

### Why Study Needed
The effect on field pea yield of combining many different agronomic factors is unknown. It is important for Saskatchewan field pea producers to know which agronomic factors have the largest effect on harvestable yield and which agronomic factors provide the best economic rate of return. This project will help combine previous research in field pea agronomy and allow field pea producers to make informed decisions before employing certain agronomic practices. It could also provide insight into the factors that are currently limiting the yield potential of field pea.

### Hypothesis
Yield responses to individual inputs are often measured in research or on-farm trials, however, it is less well understood how the combination of multiple inputs can interact and affect yields. The project will determine if combining some of the practices have negative, positive, or no impact.

### Study Design
Field trials were conducted in 2012-2014 at the Agri-ARM sites located at Scott, Swift Current, Melfort and Indian Head, Saskatchewan and a fifth site, Minto, Manitoba, was added.
in 2014. Due to excess moisture in 2013, the trial at Melfort was terminated; therefore data was collected from only twelve site years.

Treatments used in this study started with an “empty” input package (seeding rate of 60 seeds/m² with liquid inoculant) and the effects of additional inputs such as high seeding rate (120 seeds/m²), foliar fungicide, seed treatment, granular inoculant (instead of liquid inoculant) or 30 lbs N/ac starter fertilizer both alone and in various combinations were measured. The “full” input package received all five of the additional inputs.

A semi-leafless yellow pea variety (CDC Meadow) was direct seeded into spring wheat, barley or canola stubble between mid-May and early June. Liquid inoculant and seed treatment were applied to the seed prior to seeding. Granular inoculant was applied in the seed-row at recommended rates based on row spacing unique to the seeder used at each location. Starter N fertilizer was applied away from the seed, in the side- or mid-row band. Phosphorus fertilizer was applied according to soil test recommendations, either in the seed row (if rates were <15lbs P₂O₅/ac) or in the side or mid-row (if rates were >15lbs P₂O₅/ac).

Foliar fungicide treatments of Headline EC were applied when peas reached the 10% flower stage. An application of Priaxor DS was applied 10-14 days after the first fungicide application. Herbicides and desiccants were used as required at all sites.

Several factors were assessed for each treatment including plant density, disease severity, maturity, seed yield and seed quality. The net return was determined for each treatment.

**Findings**

Plant density was increased from an average of 56 to 102 and 52 to 89 plants/m² with low to high seeding rates at high and low yielding sites, respectively. This range of densities is outside the traditionally recommended plant density, so it is difficult to assess if current recommendations provide the crop with plant density high enough to maximize yield potential. Granular inoculant and seed treatment also increased plant density, but to a much lower extent than seeding rate.

Disease levels were generally higher with higher seeding rates early and later in the growing season, and lower with fungicide later in the season, regardless of environment. Granular inoculant decreased disease levels when averaged across high yielding site years. Maturity was affected by seeding rate and starter N only; generally, the higher seeding rate decreased maturity and starter N fertilizer increased maturity.

Averaged across high yielding sites, seed yield generally increased and yield variability decreased with each additional input added to the input package. Higher seeding rates, fungicides and granular inoculant were the three inputs which consistently increased seed yields and economic return at these sites, especially when applied in combination. In contrast, the addition of seed treatment or starter N fertilizer did not consistently improve yields or economic returns. Under poor growing conditions, such as those encountered at Indian Head and Swift Current, seed yields were more variable and input interactions were generally not additive.

The overall response to higher seeding rate and fungicide was significant; however, the high cost of the fungicide resulted in those treatments having the lowest economic return.
Averaged across low yielding sites, either using higher seeding rate or applying fungicide, maximized yield and economic return. All farmers are recommended to use seeding rates that target the recommended plant population to maximize yield potential. Under situations where the farmer targets relatively high yields, we recommend also using a granular inoculant to ensure nodulation. If the crop develops a thick canopy and/or disease develops, adding a foliar fungicide will protect and maintain the yield potential of the crop. A yield response is not expected when using starter nitrogen fertilizer, except when there are other limitations that restrict yield potential and nitrogen fixation. Seed treatments did not result in consistent yield improvements in field peas and the reasons for this should be further investigated.

**Significance of Study**

This study provides Saskatchewan field pea producers with information on which agronomic inputs have the largest effect on harvestable yield and which provide the best economic rate of return. The results also provide information on the effects of combining different agronomic inputs. This information will allow field pea producers to make informed decisions when deciding which inputs to apply.

**Publications, Presentations, Educational Materials Produced**

This research has been presented at several extension events and conferences including the Scott Field Day (July 2012, 2014, Scott SK), the IHARF Crop Management Field Day (July 2013, 2014, Indian Head SK), the Agri-ARM Research Update (January 2013, Saskatoon SK), the Regional Pulse Workshop (February 2013, 2014, North Battleford SK) and the ASA, CSSA and SSSA International Annual Meetings (November 2014, Long Beach CA).

**Value to Producers**

Yield responses to individual inputs are often measured in research or on-farm trials, however, it is less well understood how the combination of multiple inputs can interact and affect yields. Farmers need to determine not only which inputs will have the largest impact on harvestable yield but also provide the best economic return. For example, this study showed that higher seeding rates, fungicides and granular inoculant were the three inputs which consistently increased seed yields and economic return at these sites, especially when applied all in combination.