

Crop Sequence of Peas, Soybeans, Canola and Wheat

Preceding crop has had minimal effects on crop yield and quality to-date in the establishment phase of this rotation study. However, rotation effects often emerge slowly over time.

PEA ACRES HAVE been increasing in Manitoba and questions have arisen over how they fit in rotation with soybeans, the third most dominant crop of the province, next to canola and wheat. Soybeans and peas are primarily grown following spring wheat (27% and 30% of acres, respectively) and canola (22% and 35%, respectively).

Over three years (2019-2021), a crop sequence experiment was established north of Brandon investigating five rotation sequences with peas, soybeans, canola and wheat. The sequences evaluated were canola-wheat-pea, canola-wheat-soybean, soybean-canola-wheat-pea, soybean-wheat-canola-pea and pea-canola-pea-wheat. This experiment forms the basis for a longer-term crop rotation study that will be conducted through to the 2026 growing season for a total of eight years.

Crop yields were good to excellent in 2020 and 2021. Preceding crops had minimal effects on crop yield and quality in 2020 and 2021.

In 2020, average days to emergence ranged from 7-15 days depending on the crop. In most cases, preceding crop had no effect on plant stand. The exception was in peas, where plant stands were lower following canola versus wheat, on average.

In 2021, average days to emergence ranged from 13-14 days for canola, peas and wheat. Preceding crop history (i.e., the crop combination grown in 2019 and 2020) had no effect on yield, except in the case of field peas (Figure 1). Pea yields were greater following canola-wheat in rotation than pea-wheat, with other treatment yields intermediate. It is unclear at this time whether this trend will continue in the longer-term. Current guidelines recommend a minimum of four years between pea crops in the absence of *Aphanomyces* root rot.

Preceding crops had minimal effects on grain quality except in the case of soybeans. Seed weight was greater where soybeans followed peas, including canola-pea or wheat-pea preceding crop histories vs. canola-wheat. However, protein was 1.7% higher in soybeans that followed wheat-pea rather than canola-pea, with the inverse trend evident for percent oil.

In 2019, root rot disease was present in all pea plots and ranged in severity from 2.6-3.8, based on a scale of 0 (no disease) to 9 (death of plant). Similarly, root rot was observed in all soybean plots with disease severity ranging from 3.6-4.9. In 2020, root rot severity in pea plots ranged from 3.1-5.4 and root rot severity in soybean plots ranged from 2.3-3.2. In 2021, severity in pea plots ranged from 2.5-4.1 and in soybeans ranged from 2.8-5.2.

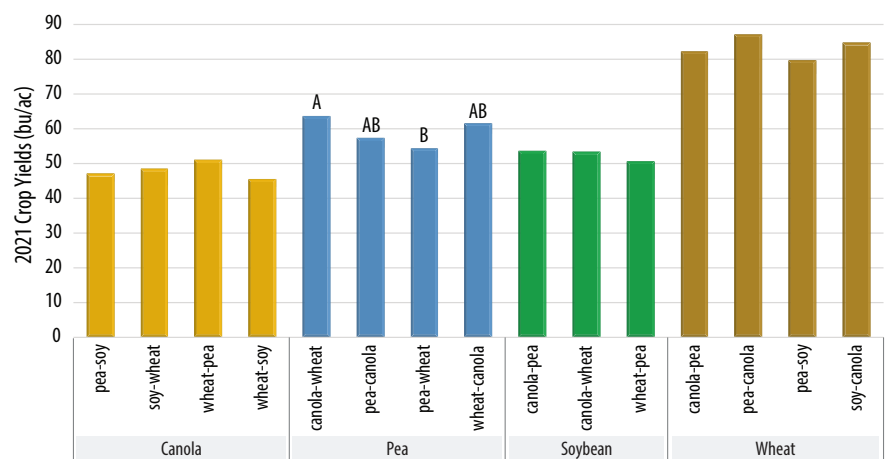
To confirm the visual disease assessment, 10 symptomatic roots were collected from each plot for fungal isolation and identification of *Fusarium* species. In 2019, *Fusarium avenaceum*, the most common *Fusarium* species that infects peas, was frequently isolated from the pea

plots. In contrast, *F. avenaceum* was not commonly found in the soybean plots. The predominant *Fusarium* species isolated from pea and soybean plots was *F. oxysporum*.

Crop sequence did not have a significant effect on root rot disease in peas and soybeans, nor on root nodulation. The year-to-year differences in root rot severities were due to varying moisture conditions.

At the conclusion of this study in 2021, not all crop sequences had completed a full cycle. While results so far indicate limited effects of preceding crop, this is not surprising since effects of rotations often emerge slowly over time with changes in the plant-soil system. The differences observed to date may not reflect the long-term trends that develop as rotations evolve and mature. This establishment phase has been important as it forms the foundation for a longer-term rotation study. Another five years of these crop sequences are planned to continue this study, allowing for two full cycles of each rotation to provide a more reliable assessment of the longer-term performance of the various rotations. ▶

Figure 1. Yields (bu/ac) of canola, peas, soybeans and wheat in 2021 following two years of crop sequences.



Within crop, means followed by different letters are significantly different at $p < 0.05$.

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DURATION 3 years