

Optimizing Pea Production in Manitoba Rotations: Yield and Quality

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Introduction

- Over the past 5 years (2020-24), Manitoba's dry pea acreage has averaged ~185,000 acres, a 3-fold increase compared to ten years previous (2010-14).
- In the 1990's and early 2000's when pea area last reached 200,000 acres in Manitoba, rotations were dominated by cereals and oilseeds. Today, canola, wheat and soybean are Manitoba's top three crops.
- The objective of this study is to evaluate the performance of rotations that include pea and/or soybean in combination with wheat and canola.

Materials and Methods

In 2019, a field study was initiated on a Newdale clay loam soil north of Brandon, MB to assess five 3- and 4-year rotations (Table 1). Rotations with pea, soybean or both crops, and with pea grown 2 to 4 years apart were evaluated. Recommended varieties of glyphosate-tolerant soybean (S), yellow field pea, CWRS wheat (W) and Liberty-tolerant canola (C) were grown.

Table 1: Rotation treatments

3-year	canola - wheat - pea	CWP
	canola - wheat - soybean	CWS
4-year	soybean - canola - wheat - pea	SCWP
	soybean - wheat - canola - pea	SWCP
	pea - canola - pea - wheat	PCPW

*Soybean was not grown in the 2 years preceding pea to reflect pea contract requirements.

Appropriate stubble treatments were established in 2019, and rotation treatments assessed from 2020 through 2023. Treatments were arranged in a Randomized Complete Block Design (RCBD) with each phase of each rotation present in each year (Fig. 1).

Crops were direct-seeded into stubble using a ConservaPak seeder (9" rows). Generally-accepted management practices were employed. Fertilizer N rate was based on fall soil test N for wheat and canola; soybean and pea were inoculated only. Grain yield was determined by plot combine with straw chopped and returned. Percent protein in harvested seed was determined by NIR, test weight using an integrated module on the NIR, and seed weight by seed counter.

Figure 1. Rotation study (on right) located north of Brandon, MB at AAFC's Phillips Farm

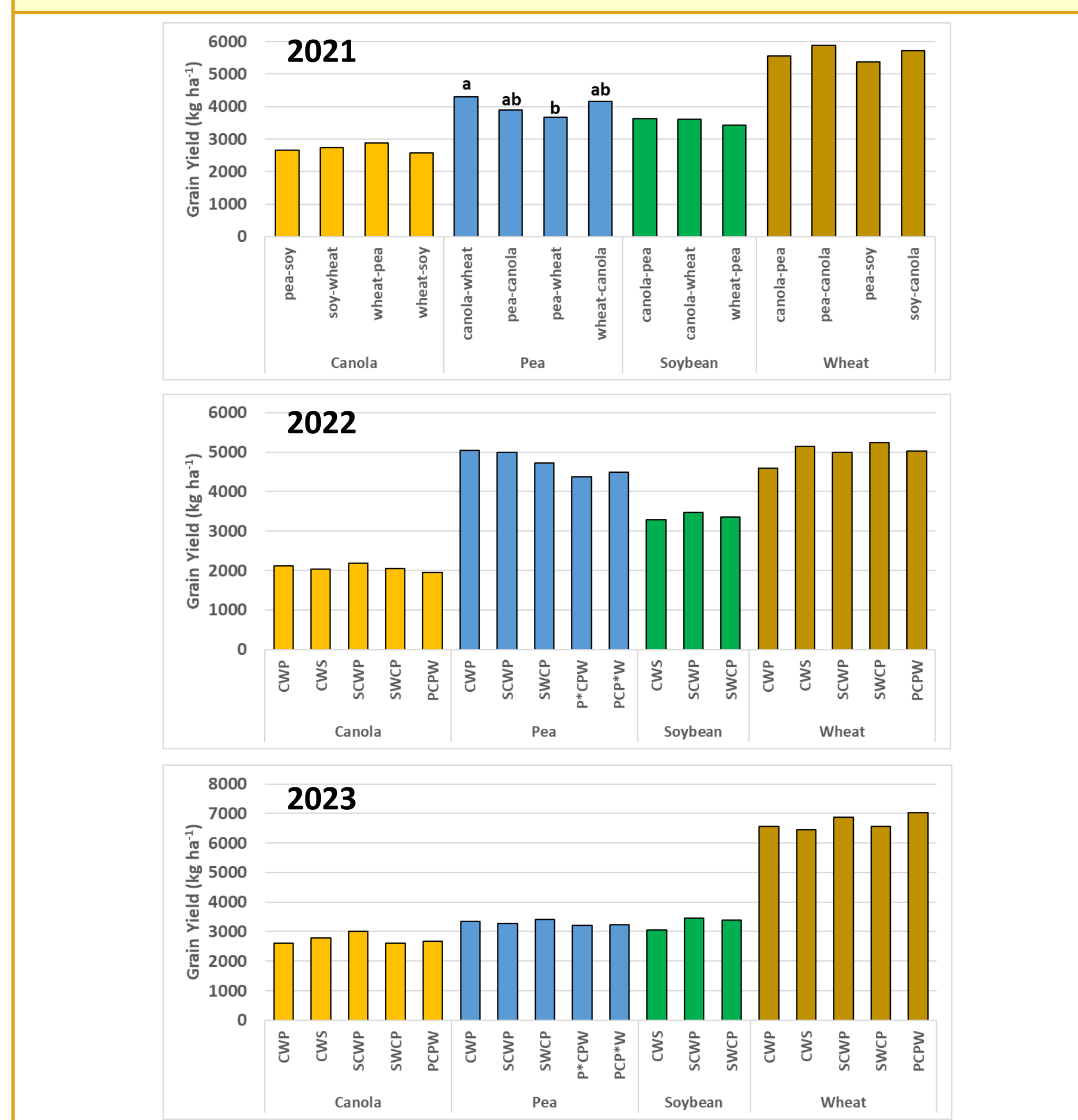


Results and Discussion

Yield

- Yield potential varied among years due at least in part to variable weather conditions (Fig. 2).
- Preceding crop sequence had no effect on yield in 2020, and did not affect the yield of any of soybean, canola or wheat from 2021 through 2023 (Fig. 2).
- The only case where preceding crop sequence affected pea yield was in 2021, with yield being higher after canola-wheat than pea-wheat (Fig. 2).

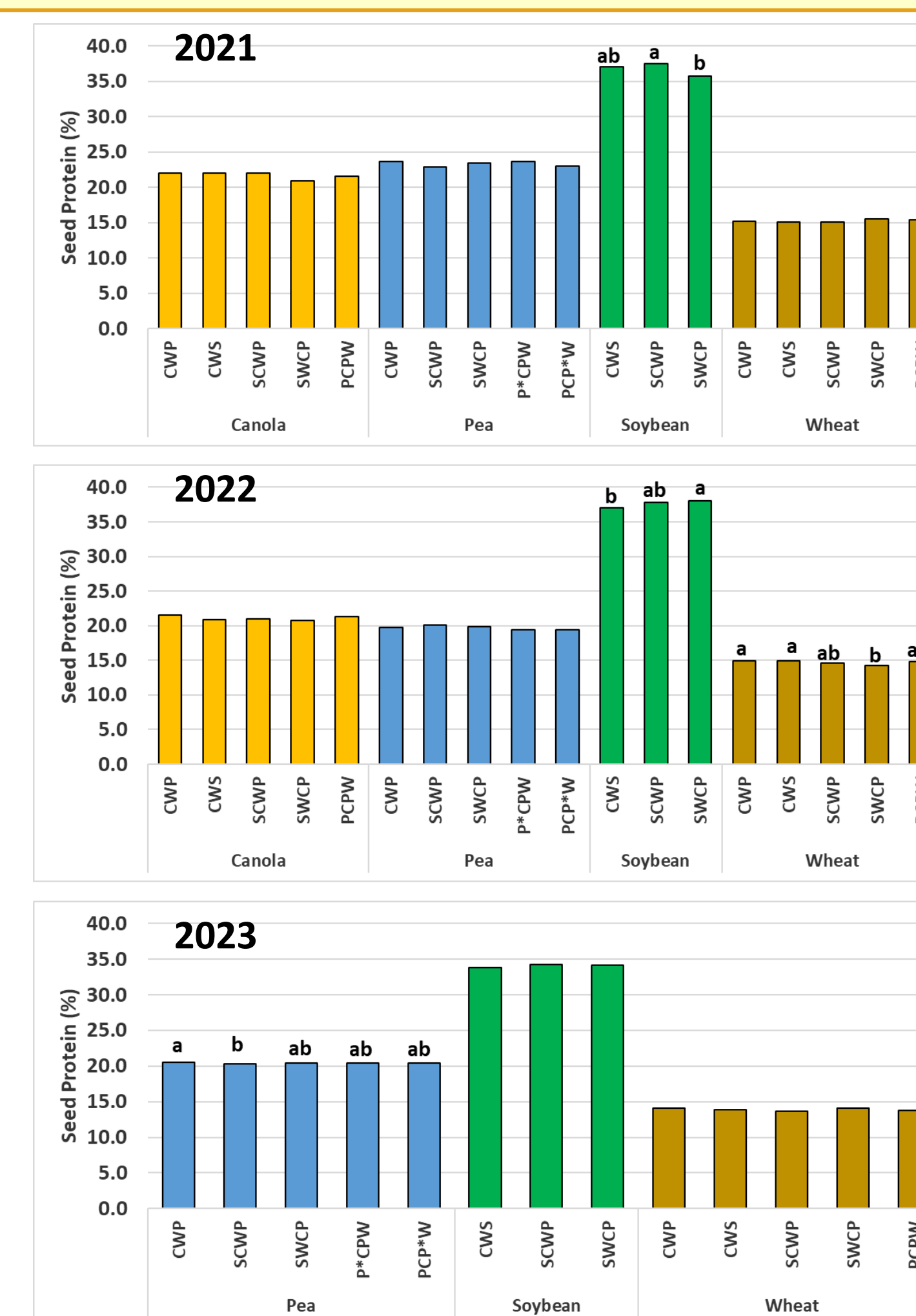
Figure 2. Yield of canola, pea, soybean and wheat as affected by preceding crop sequence (2021-2023)*



*Bars within a crop labelled with different letters are significantly different based on Tukey's test (P=0.05).

- While preceding crop sequence did not have a statistical effect on pea yield in 2022 or 2023, average pea yield in the PCPW rotation was numerically lower than the average of more diverse crop mixes in 2022 (Fig. 2). This trend was not as clear under lower yield potentials in 2023.
- Manitoba guidelines recommend a minimum 4 years between pea crops to manage disease.

Figure 3. Percent seed protein in canola, pea, soybean and wheat as affected by preceding crop (2021-2023)*



*Bars within a crop labelled with different letters are significantly different based on Tukey's test (P=0.05).

Grain quality

- Test weight:** Treatments rarely affected test weight (data not presented).
- Seed weight:** Seed weight was sometimes affected by preceding crop treatments (data not presented).
 - In 2022 and 2023, soybean seed weight tended to be higher where soybean immediately followed pea versus wheat.
 - In 2023 only, canola seed weight was higher for the CWP than the SWCP crop sequence, with other treatments being intermediate.
- Seed protein:** Over the period 2021 to 2023, percent protein averaged from 20-23% in pea, 34-38% in soybean, and 13.9-15.2% in wheat (Fig. 3).

- Treatments affected soybean seed protein in 2021 and 2022, but effects differed with year (Fig. 3).
- Very small but statistical differences in pea protein ($\leq 0.2\%$) were observed among treatments in 2023.
- In wheat in 2022, protein was ~15% in CWP and CWS versus 14.3% in SWCP although fertilizer N management in all treatments was the same.

Summary

- The period 2019 through 2023 represents the establishment phase of this rotation study. It was not until fall 2023 that all rotations had completed one full rotation cycle.
- As such, treatment differences observed to date were due to the effect of the preceding crop or crops, rather than due to rotation *per se*.
- While preliminary trends suggest that more diverse crop sequences may be beneficial for pea even in the shorter-term, additional years of data are required to confirm the performance of these rotations over time.
- Because effects of rotation on the plant-soil system often build up slowly over time, those rotations that perform well in the short-term are not guaranteed to be the most sustainable in the longer-term.
- This study is currently set to continue until 2026 to better understand long-term effects of rotation.

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