Agronomic response of field pea to preceding crop, tillage strategy and phosphorus fertilization in Southern Manitoba

Brodie Erb, R. H. Gulden, J. Thiessen-Martens and K. P. MacMillan
Department of Plant Science, University of Manitoba

University of Manitoba

Introduction

Field pea (*Pisium sativum*) cultivation in Manitoba, dating back to 1908, reached its peak in 1998 at over 260,000 acres. Recent years have witnessed a resurgence, driven by initiatives like Protein Industries Canada and the growing global pea protein market. Despite this, management practices lack standardization and an increased interest warrants a research focus on agronomic practices. This study focuses on three key aspects: crop sequence, residue management, and phosphorus (P) fertilizer use and placement. Comparing tilled versus direct-seed wheat or canola stubble, with variations in P application, the research aims to establish best practices. Hypotheses include the potential benefits of wheat preceding peas, the possible advantage of direct seeding, and the impact of starter P applications. Addressing gaps in local knowledge, this research seeks to optimize field pea production in Manitoba, contributing to sustainable and efficient agricultural practices.

Materials & Methods

This experiment was performed at the Ian N. Morrison Research Farm (INMRF) in Carman, MB (49.50106, -98.02822) and the Parkland Crop Diversification Foundation (PCDF) in Roblin, MB (51.18268, -101.36249) in 2020-21, 2021-22 and 2022-23 (6 site years in total). Each experiment examined the (1) preceding crop (2 levels - wheat, canola), (2) residue management/tillage strategy (2 levels – direct seeded, tilled), and (3) starter-P (MAP) placement (3 levels – none, seed-placed, side-banded) in field pea production. The experimental design was a 3-way factorial arrangement (Table 1) of a randomized complete block design (RCBD) with 12 treatments (2x2x3) replicated four times.

Table 1. Treatment factors and levels

Trt	Preceding Crop	Residue Management	Starter-P Placement
1	Wheat	Tilled	None
2	Wheat	Tilled	Seed-placed
3	Wheat	Tilled	Side-banded (2”)
4	Wheat	Direct-seeded	None
5	Wheat	Direct-seeded	Seed-placed
6	Wheat	Direct-seeded	Side-banded (2”)
7	Canola	Tilled	None
8	Canola	Tilled	Seed-placed
9	Canola	Tilled	Side-banded (2”)
10	Canola	Direct-seeded	None
11	Canola	Direct-seeded	Seed-placed
12	Canola	Direct-seeded	Side-banded (2”)

Table 2. Site characterization

	Carman	Roblin
Soil textural class	Fine loamy	Clay loam
Mean daily temperature (May-Aug)	16.8-17.3°C (16.1°C)*	15.3-16.5°C (14.1°C)*
Mean precipitation (May-Aug)	126-265 mm (299 mm)*	150-345mm (273 mm)*
Soil phosphorus (ppm)	8-38	37-39
Soil pH	5.2-5.6	7.6

*Long term average

Materials & Methods

Each site-year included two growing seasons. The first year was seeded to either wheat (344 seeds/m^2) or canola (108 seeds/m^2) with both crops receiving 40 lb/ac P_2O_5 (crop removal rate) and managed as a commercial crop in a manner that would be typical for the area. Tilled plots were cultivated using a rototiller either in fall or spring prior to pea planting. In year two, AAC Carver field peas (100 seeds/m2) were planted between April 20 and May 10 using a Monoseed GP Planter (7.5” spacing) in Carman and a Fabro disc drill (9.4” spacing) in Roblin. Starter-P application was 15 lbs P_2O_5/ac as monoammonium phosphate and was either seed-placed or banded 2” away from the seed row. Throughout the growing season and post-harvest the following measurements were collected:

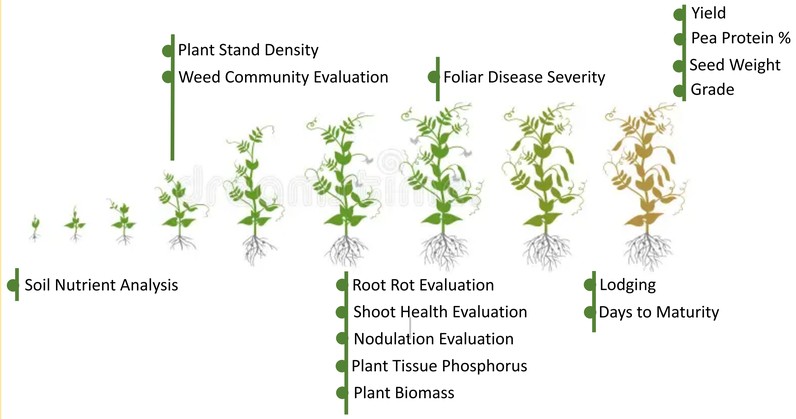

Figure 1. Experimental ratings and measurements of field peas throughout the growing season.

Preliminary data was analyzed in R using a two-way ANOVA followed by Tukey HSD post-hoc tests. Shapiro-Wilk normality test and Bartlett’s test were used to confirm normality and homogeneity respectively. Preceding crop, residue management and placement were fixed effects and blocking analyzed as a random effect.

Results & Discussion

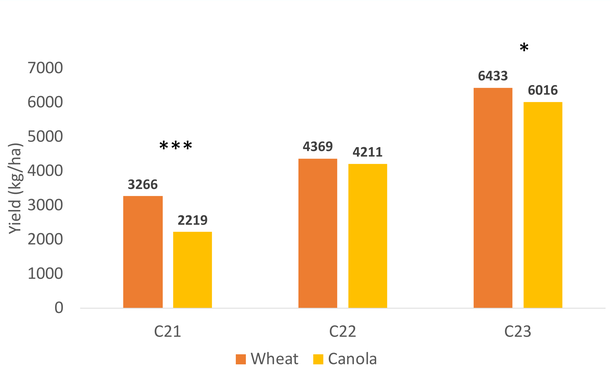

Figure 2. Field pea yield at Carman planted into wheat or canola stubble. Preceding residue has a significant impact on field pea yield at Carman in 2021 and 2023. Peas grown on wheat stubble had 38% and 7% higher yield in 2021 and 2023, respectively, compared to peas grown on canola stubble.

Results & Discussion

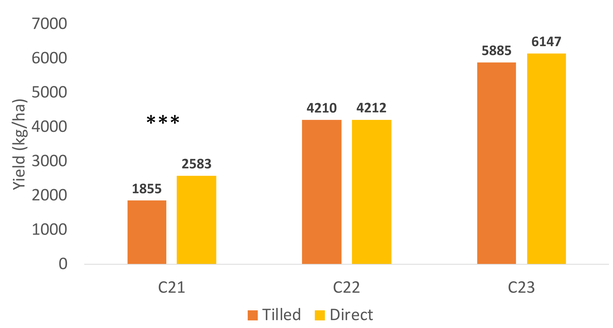

Figure 3. Effect of residue management on pea yield following canola at Carman. Residue management had a significant effect on pea yield in 2021 when planted into canola stubble. Direct-seeded peas yielded 33% higher than peas planted into tilled soil in this year. In 2022 and 2023 residue management in plots with canola residue had no significant effect on pea yield.

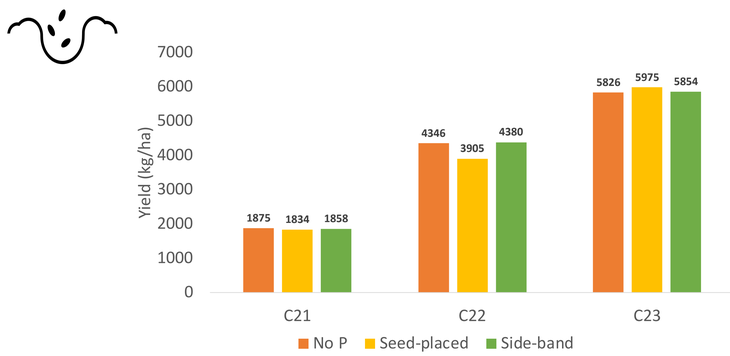

Figure 4. Effect of starter-P placement on field pea yield at Carman in tilled canola plots. Because canola is a non-mycorrhizal crop this interaction was of particular interest. Phosphorus fertilizer (MAP) placement had no significant effect on pea yield in tilled canola plots for all three years tested at Carman.

Preliminary Conclusions

Observations from preliminary analysis of individual site-years at Carman:

- Preceding residue appears to have the most important effect on field pea yield. In 2 out of 3 years at Carman, pea yield had a significant increase when following wheat compared to canola.
- Residue management affected pea yield in 1 out of 3 years at Carman.
- The effect of starter-P application method requires further investigation of the 3-way interaction among other management factors.
- Further investigation will be conducted into the other ratings and measurements as well as growing season conditions and how they relate to the three factors tested on field pea yield.

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