Yellow Pea Response to Preceding Crop, Residue Management, and P Fertilizer Placement

Project duration: 2020 – 2022
Objectives: Determine the effect of preceding crop, residue management and P fertility strategy, and their interactions, on pea establishment, weed community, disease incidence, yield, and seed quality
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Background (provided by Kristen MacMillan)
In Manitoba, 38% of pea acres are grown on wheat stubble and 20% on canola stubble [Manitoba Agricultural Services Corporation (MASC) 2010-2015]. The yield impact of preceding crop on pea yield is not currently known despite some obvious agronomic concerns. Crop rotation data from MASC (2010-2015) points to some of these risks by showing that the relative yield of pea grown on wheat stubble is 103% compared to 96% for peas grown on canola stubble. Canola is a non-mycorrhizal crop and a host to Sclerotinia white mould. Peas are also susceptible to white mould and are a mycorrhizal crop, therefore, may be negatively affected by reduced AMF populations and increased sclerotinia risk following canola stubble. Starter P is commonly recommended in fields with low soil test levels. We aim to investigate if there is an interaction between field pea response to P fertilizer and preceding stubble type arising from the mycorrhizal and non-mycorrhizal crops. Little research has been conducted on P fertilizer strategy in field pea and strategies vary widely among farmers. In an informal Twitter poll in August 2019, the majority of farmers apply P fertilizer as starter in the seed row (44%) followed by side band or mid placement (26%), seed row plus side band or mid row (14%) and none (16%). According to the 2015 fertilizer use survey, only 45% of western Canadian farmers are applying P, primarily in the seed row (44%) and at an average rate of 19 lbs P205/ac. Yield response to 25 kg ha-1 of starter P has been documented, but no work is currently available on P fertilizer placement. Overall, there are fewer agronomic risks associated with seeding peas into wheat stubble. Peas are also tolerant to early seeding into cool soil and present an opportunity for reduced or rotational no-till systems in regions of Manitoba where tillage is common practice.

Results
In 2020, spring wheat and canola crops were established on Site 1 (Year 1) to provide the residue treatments for the Site 1 (Year 2) pea test. In 2021, pea plots were established on Site 1 (Year 2), with differing methods of phosphorous application. Spring wheat and canola crops were also established on Site 2 (Year 1) to provide the residue treatments for the Site 2 (Year 2) pea test. Target spring wheat and canola seeding rates for both years are shown in Table 1. Treatments for Years 1 and 2 are shown in Table 2. Spring wheat, canola and pea yields for Site 1 (Year 1) and Site 2 (Year 1) are shown in Table 3.

Table 1: Targets

	Seeding Rate seeds/ft2	Live Plant Stand plants/ft2	Seed Survival %
Wheat	32	27	85
Canola	10	6	60

Table 2: Treatment Structure

Treatment No	Year 1	Residue	Year 2 (Pea)

	crop	Management	Phosphorus Application
1	Wheat	Tilled	None
2	Wheat	Tilled	Seed row
3	Wheat	Tilled	Side band
4	Wheat	Direct Seed	None
5	Wheat	Direct Seed	Seed row
6	Wheat	Direct Seed	Side band
7	Canola	Tilled	None
8	Canola	Tilled	Seed row
9	Canola	Tilled	Side band
10	Canola	Direct Seed	None
11	Canola	Direct Seed	Seed row
12	Canola	Direct Seed	Side band

Table 3: Average yield comparison (bu/ac) for wheat and canola (Site 1, Year 1; Site 2; Year 1)

Treatment	Site 1		Site 2
	(Year 1)	(Year 2)	(Year 1)
Canola	67.2	-	60.5
Wheat	88.3	-	49.0
Pea			
Canola, tilled – No added P	-	23.4	-
Canola, direct seed – No added P	-	23.9	-
Canola, tilled – Side band P	-	23.7	-
Canola, direct seed – Side band P	-	26.7	-
Canola, tilled – Seed row P	-	23.2	-
Canola, direct seed – Seed row P	-	22.9	-
Wheat, tilled – No added P	-	23.9	-
Wheat, direct seed – No added P	-	20.8	-
Wheat, tilled – Side band P	-	21.9	-
Wheat, direct seed – Side band P	-	25.0	-
Wheat, tilled – Seed row P	-	21.9	-
Wheat, direct seed – Seed row P	-	23.0	-

Materials and methods

Experimental Design: Rectangular Lattice

Varieties: Wheat – AAC Brandon; Canola – L233P; Pea – AC Carver

	Seeding date	Harvest date
Site 1 (Year 1)	May 19, 2020	Sept 22, 2020
Site 1 (Year 2)	May 10, 2021	Aug 31, 2021
Site 2 (Year 1)	May 19, 2021	Sept 20, 2021

Agronomic information

Previous year's crop: Barley silage (2020); Oat Silage (2021)

Soil Type: Erickson Clay Loam

Seedbed preparation: Vertical Tilled

Data collected	Date collected		
	Site 1 (Year 1)	Site 1 (Year 2)	Site 2 (Year 1)
Plant density	Jun 16	Jun 16	Jun 16
Disease risk at wheat flag leaf	Jun 24	-	Jun 6-15
Pea Root Rot Rating	-	Jun 16	-
Pea Shoot Symptoms Rating	-	Jul 6	-
Mycosphaerella Blight Rating	-	Jun 16	-
Disease risk at canola anthesis (20-50% bloom)	Jul 8-15	-	Jul 2
Days to Maturity Rating	-	Beginning of August	-
Height	Aug 15	-	early Aug
Lodging	Aug 15	Aug 18	Sep 20

Table 3: Site 1 (Year 1) fertility information

	Available	Wheat Added	Canola Added	Type
N	58 lb/ac	131 lb/ac	96 lb/ac	46-0-0
P	71 ppm	15 lb/ac	10 lb/ac	11-56-0-0
K	513 ppm	-	-	-

Table 4: Site 2 (Year 1) fertility information

	Available	Wheat Added	Canola Added	Type
N	120 lb/ac	69 lb/ac	55 lb/ac	46-0-0
P	48 ppm	20 lb/ac	20 lb/ac	11-56-0-0
K	674 ppm	-	-	-

Table 5: Site 2 (Year 1) Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 26	Liberty	0.54 ml/ac
In-crop	Jul 9	Decis	0.82 ml/ac

Table 6: Site 1 (Year 2) Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 19	Authority	118 ml/ac
In-crop	Jun 14	Viper (ADV)	400 ml/ac
		UAN 28%	810 ml/ac