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MPSG ANNUAL EXTENSION REPORT

PROJECT TITLE: **Economic and environmental value of growing both pea and soybean in rotation**

PROJECT START DATE: 1 April 2019 **PROJECT END DATE: 31 March 2022**

DATE SUBMITTED: 31 January 2020

PART 1: PRINCIPAL RESEARCHER

PRINCIPAL

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PART 2: EXECUTIVE SUMMARY

Outline the project objectives, their relevancy to pulse and soybean farmers, and a summary of the project to date, including methods and preliminary results.

Cropping systems in Manitoba are changing, creating a need for new information as to how best to optimize productivity while reducing production risk. While Manitoba rotations were once dominated by cereals and to a lesser extent canola, the three highest-acreage crops grown today are canola, wheat, and soybean, with dry pea acreage expected to increase in response to demand from new processing facilities in Manitoba.

The overall objective of this study is to determine the effect of growing field pea and/or soybean in rotation on the performance of cropping systems in western Manitoba. Goals over the initial 3-year phase of the study are: 1) to determine the short-term effect of crop sequence on disease, nutrient dynamics, and crop yield and quality; and 2) to generate a reliable, research-based dataset of production and economic information for a range of crop rotations to assess the profitability and production risk associated with each rotation. By generating information regarding the relative performance of a range of cropping systems, this study aims to provide producers with a means to reduce production and economic risk while diversifying their farming operations.

In 2019, a randomized, replicated field study was initiated on a Newdale clay loam soil north of Brandon, MB. Rotations consisted of five rotations of pea (P), soybean (S), canola (C), and/or wheat (W) as follows: CWP, CWS, SCWP, SWCP, PCPW, with each phase of each rotation present in each year. Baseline soil, disease, weed, and crop yield and quality data were collected during the 2019 growing season, and appropriate stubble treatments established for the initiation of rotation treatments in 2020.

PART 3: PROJECT ACTIVITIES AND PRELIMINARY RESULTS

Outline project activities, preliminary results, any deviations from the original project and communication activities. You may include graphs/tables/pictures in the Appendix.

Project activities: A cropping systems study was initiated in spring 2019 on a Newdale clay loam soil north of Brandon, MB (Figure 1). Treatments were arranged in a randomized complete block design with four replicates, with treatments consisting of five rotations, ranging in duration from three to four years in length, and with each rotation including pea and/or soybean as follows: canola-wheat-pea (CWP), canola-wheat-soybean (CWS), soybean-canola-wheat-pea (SCWP), soybean-wheat-canola-pea (SWCP), and pea-canola-pea-wheat (PCPW). Each phase of each rotation is present in each year for a total of 18 treatments, which will allow effects of year and rotation to be separated from one another.

Plots (3.65 x 12 m) were direct seeded using a ConservaPak air seeder with 9" row spacing. Recommended cultivars of yellow field pea, glyphosate-tolerant soybean, CWRS wheat, and Liberty-tolerant canola (pod shatter resistant) were seeded on May 8, 29, 10 and 21, respectively. Commercially-treated seed was sourced to emulate farm conditions. Seeding rates were adjusted for germination to achieve 50, 100, 400 and 105 seeds m^{-2} for soybean, pea, wheat and canola, respectively. Soybean and peas were inoculated with commercial Rhizobia. Fertilizer N rates were based on soil testing, fertilizer P rates were based on P removal as per provincial guidelines, and fertilizer S was applied to canola at a standard rate of 20 kg S/ha to avoid deficiency. A conservative approach to nutrient application is being employed in an effort to meet crop requirements but avoid significant nutrient accumulations over the course of the study. Generally-accepted agronomic practices were used with respect to seeding, pest, and harvest management. Peas, wheat, canola and soybean were harvested by plot combine on August 21, September 9, September 17 and October 7, respectively.

In 2019, plant stand, weed populations, lodging, crop biomass at harvest, and grain yield and quality were determined. To assess disease, twenty plants were dug from each pea and soybean plot in late July, washed and rated for the presence and severity of root rot. In the laboratory, root tissue was surface disinfected and processed for *Fusarium* spp. that are currently causing disease in economic crops in Manitoba including pea and soybean. This data will be used to determine the relative frequency and incidence of *Fusarium* spp. to test for differences among rotations. In addition, soil samples were collected in spring 2019 to determine baseline soil characteristics. Soil and plant samples were also collected at the end of the season and submitted to a laboratory for nutrient analysis, which is ongoing.

Preliminary findings: Growing season conditions were variable in 2019, characterized by dry early-season conditions, two significant rainfall events from localized storms in July, dry conditions for most of August, and a wet fall that included early snowfall. Because 2019 marked the first year of this study, all plots were established on the same stubble in an area that had been uniformly managed previously; therefore average data are presented for each crop in this report.

Despite dry spring conditions, plant stands were within recommended levels for all crops, with average days to emergence ranging from 11 to 14 days depending upon the crop (Table 1). Lack of weed emergence due to dry spring conditions, together with rainfall after herbicide applications were completed, contributed to weed pressure in-crop in 2019. Root rot disease was present in all pea plots examined and ranged in severity from 3.1 to 3.5, 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 4.2 to 4.3. To confirm the visual disease identification, 10 symptomatic roots were collected from each crop for fungal isolation and identification of Fusarium species. *Fusarium avenaceum* was frequently isolated from the plants removed from the pea plots; this Fusarium species is known to be a predominant member of the Fusarium root rot complex of pea in western Canada. In contrast, *Fusarium avenaceum* was not common to the soybean tissue excised from diseased roots and examined microscopically and morphologically in the laboratory. Analyses using droplet digital PCR (ddPCR), a molecular technique, are ongoing to detect the pathogens and quantify the pathogen load. Crop yield and quality reflected the general trends and growing season conditions of the region, with field pea faring comparatively better than soybean in terms of yield under the drier conditions experienced in 2019 (Table 1).

APPENDIX

Include up to 1 page of tables, graphs, pictures.

Table 1. Crop growth, yield and quality measurements for canola, pea, soybean and wheat at Brandon in 2019.

Crop	Days to emergence	Plant density (plants m^{-2})	Yield[1] kg ha^{-1}	Seed weight g per 1000 seeds	Test weight kg hL^{-1}	Protein content %	Oil content %
Canola	12	54	1997	2.65	66	19	48
Pea	14	80	4986	245	83	23	---
Soybean	14	40	1575	132	71	38	17
Wheat	11	257	2986	30	78	14	---

[1]Average yields were 35, 74, 23 and 44 bu/ac for canola, pea, soybean and wheat, respectively.

Field trial at Brandon, August 15, 2019

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