**MPSG ANNUAL EXTENSION REPORT**

**Sustainable Soybean Cropping Systems for Western Manitoba**

**PROJECT TITLE:**

|  |  |
| --- | --- |
| **PROJECT START DATE: 1 April 2017** | **PROJECT END DATE: 31 March 2022** |

**DATE SUBMITTED: 21 February 2019**

***PART 1: PRINCIPAL RESEARCHER***

**PRINCIPAL**

|  |  |
| --- | --- |
| **NAME:** | Ramona Mohr |
| **POSITION:** | Research Scientist |
| **INSTITUTION:** | AAFC-Brandon |
| **EMAIL:** | ramona.mohr@agr.gc.ca |
| **PHONE:** | 204-578-6556 |

PART 2: EXECUTIVE SUMMARY

Soybeans have become an integral part of the cropping mix on Manitoba farms, with soybean seeded acreage expanding to a record 2.3 million acres in 2017. Because the acreage has grown so rapidly, relatively little information is available regarding the longer-term effects of including soybean in current cropping systems. A better understanding of the effects of crop rotation on factors including crop productivity, root rot severity, and economic risk and returns may help growers identify those rotations that optimize agronomic and economic performance in the longer-term.

In 2014, a randomized, replicated study consisting of five rotations of soybean(S), canola(C) and wheat (W) as follows - SC, SW, SWC, SCW, SSW - was established north of Brandon, MB to determine the effect of rotation length and crop sequence on root rot, yield and quality, nutrient cycling, and on economics for individual crops and the entire rotation over time. The 2018 crop year marked the fifth year after establishment of rotation treatments. In 2018, rotation had no effect on yield and little effect on grain quality for soybean, wheat or canola, although differences in plant stand occurred. Soybean root rot was associated with all treatments in all plots, with a trend toward increased root rot severity in tighter and stacked soybean rotations in 2018.

Given that rotation treatments were initiated only in 2014, and that effects of rotation often occur over time as differences in factors such as pests and soil quality arise, it is not necessarily surprising to see limited differences among rotations in terms of disease severity, crop yield and quality at this point in the current study.

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

***PART 3: PROJECT ACTIVITIES AND PRELIMINARY RESULTS***

Project activities:

A soybean-based cropping systems study was initiated in spring 2014 on a Newdale clay loam soil north of Brandon, MB. Rotation treatments have been in place for five field seasons (2014-18, inclusive), with 2014 and 2015 considered stubble establishment years, and 2018 considered the third year of the established rotation treatments.

Treatments are arranged in a randomized complete block design with four replicates, with treatments consisting of five rotations, ranging in duration from two to three years in length: soybean-canola (SC); soybean-wheat (SW); soybean-wheat-canola (SWC); soybean-canola-wheat (SCW); soybean-soybean-wheat (SSW). Each phase of each rotation is present in each year for a total of 13 treatments, which allows the effects of year and rotation to be separated from one another. Individual plots measure 3.65 x 10 m, and all crops are direct seeded using a ConservaPak air seeder with 9" row spacing. Recommended cultivars of hard red spring wheat, Liberty-tolerant canola, and glyphosate-tolerant soybean are being grown. Fertilizer N rates are based on annual soil testing, fertilizer P rates are based on P removal as per provincial guidelines, and fertilizer S is applied to canola only at a standard rate of 20 kg S/ha to avoid deficiency. Generally-accepted agronomic practices are employed with respect to seeding, weed management and harvest management. Soybean are inoculated with commercial Rhizobia, but not seed treatment to allow assessment of soybean root rot.

In 2018, information collected included plant stand, crop biomass, and grain yield and quality. To assess soybean root rot levels, 60 soybean plants per treatment were pulled, washed and rated (0=healthy to 9=death of plant). In addition, soil and plant samples were collected and submitted to a laboratory for nutrient analysis, which is ongoing.

Preliminary findings:

Spring 2018 was characterized by dry surface soil conditions and a lack of rainfall, which likely contributed at least in part to the overall variability observed in crop establishment. While rotation had a significant effect on plant stand for both canola and wheat, it is unclear the degree to which rotation itself versus soil moisture conditions may have influenced stand establishment (Table 1). It is interesting to note, however, that for both wheat and canola, plant density was numerically higher following soybean than following other crops in rotation.

Soybean root rot was associated with all treatments and observed in all plots. Root rot severity was rated on a scale of 0 (healthy) to 9 (death of plant), with a mean (over all treatments) of 5.0 in 2018 compared with 4.5 in 2017 and 3.6 in 2016. Soybean root rot severity increased with each year of the study. In 2018, a trend of increased root rot severity in the soybean-canola and soybean-wheat rotations compared with the more diverse rotation of soybean-wheat-canola was evident. The stacked rotations of soybean-soybean-wheat also produced higher root rot ratings than the rotations with soybean, canola and wheat. This suggests that the tight rotations and stacked soybean rotations may not be the best options for rotation. With rotation studies, differences in disease are generally not apparent until a number of years of the study have passed. It remains to be seen whether this trend continues in 2019.

As in 2017, in 2018 rotation had no significant effect on the yield of soybean, canola or wheat despite differences in plant density. These results differed from 2016 where canola yields were higher where canola followed wheat-soybean than canola-soybean, with canola after soybean-wheat being intermediate. Rotation had no effect on test weight, seed weight or % oil in 2018. However, % protein in wheat was higher in 2 of 3 cases where wheat followed soybean, with SWC=SSW>SW (Table 1). Wheat following canola in the SCW rotation had a similar % protein to the SW rotation. These results contrast with 2017, where wheat in the SW rotation had a higher % protein than all other rotations.

Given that effects of rotation often occur over time as differences in factors such as pests and soil quality arise, it is not necessarily surprising to see limited differences among rotations in disease severity and crop yield and quality in the current study given that crop rotations treatments have been in place for only five years to date.

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

***APPENDIX***

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



Acknowledgements:

Collaborating researchers on this project are Ramona Mohr, Debbie McLaren and Mohammad Khakbazan (Agriculture and Agri-Food Canada, Brandon Research and Development Centre). Our thanks to the technical staff, field operations staff, and students at AAFC-Brandon for their contributions to this project. This research was supported by the Manitoba Pulse and Soybean Growers, Western Grains Research Foundation, and Agriculture and Agri-Food Canada.