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MPSG ANNUAL EXTENSION REPORT

PROJECT TITLE: Defining pathogen-related soil quality targets for annual legumes to pursue through crop 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.

Soybean is currently the third most cultivated crop in Manitoba after canola and spring wheat with an acreage exceeded 2.3 million acres in 2017 (Statistics Canada). This means that soybean is growing more frequently in crop rotations across MB, which raises questions about increasing potential risks of diseases. For soybeans, information about proper rotation regimes under Manitoba conditions is very scarce. This project is an extension to another project started in 2017, with two locations, namely Carman and St. Adolph. In order to help farmers assess their disease risks better when cropping soybean, the objectives of this project were (i) to answer the question whether the frequency of soybean in the rotation increase the incidence/severity of important diseases that can reduce soybean yield; and (ii) to develop a tool that would help them to do better disease risk assessment. The latter could be in the form of a disease diagnosis or prevention tool.

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.

In this project, we took advantage of a rotation study set by Dr. Lawley in order to get access to settings with different rotations, where diseases may appear under different treatments, and with different intensities.

The crop rotations in place were as follows:
1- Continuous soybeans (soy-soy-soy-soy).
2-Soybeans every second year (corn-soy-corn-soy).
3-Soybeans every second year (canola-soy-canola-soy).
4-Soybeans every fourth year (wheat-canola-corn-soy).

The experiment was set up with a randomized complete block design with four replicates. Each location had 16 replicates. Cultivar (DKC 24-10 RY) was planted in both locations.

Fields were visited/scouted at different growing stages (V1 to R8). Ten plants were collected from each replicate (160 plants/visit) and transferred to Dr. Daayf's lab, Department of Plant Science, University of Manitoba, for further testing.
Plants were examined for diseases on roots, stems and leaves. Disease severity index of the most damaging disease was calculated using the formula: DSI = Σ [(class number) x (number of plants in each class)] / (total number per sample) (number of classes -1) ×100.

Pathogens were isolated from the roots, stems and foliage using conventional methods such as specific nutrient media. Infected plant parts were cut into small pieces (1-cm) and surface-sterilized by rinsing infected areas with 95% ethyl alcohol prior to isolations. Surface-sterilized pieces were placed on petri plates containing potato dextrose agar (PDA) and/or acidified potato dextrose agar (APDA) and incubated at 25C under 12-h light and dark intervals for identification purposes.

Confirming the pathogenicity of the isolated pathogens by following Koch's postulates were done in the greenhouse using pure cultures of the pathogens that were collected. This is a very important step to prove and verify the observed diseases and pathogenicity of isolated pathogens. Healthy soybean plants from the same cultivar as the one planted in the field were inoculated with the purified isolated pathogens. All inoculated plants were incubated at the greenhouse of Plant Science Department, University of Manitoba. Re-isolation from all replicated inoculations were conducted using the same techniques described above to complete Koch's postulates.

Root rots caused by *Fusarium* sp. Continued to be the most prevailing and damaging disease in the 2019 season but the severity of the disease was much lower than in 2017. The "continuous soybean" rotation had the highest root rot severity followed by the "canola/soybean" rotation, while the "corn/soybean" rotation had the lowest root rot severity in the two locations (Carman and St. Adolph) (Fig. 1). The highest root rot severity (35.8%) was observed on soybean plants collected from "continuous soybean" rotation from the St. Adolph location. The lowest root rot severity (10.4%) was observed on soybean plants collected from the "corn/soybean" rotation from St. Adolph location (Fig. 1). We are still working the identification of fungal strains we isolated but the preliminary results show that the number of *Fusarium spp* isolated in 2019 is significantly less than those isolated in 2017.
For the objective of developing a disease risk assessment tool, we have done disease assessments and isolation of pathogens, and we are working on pathogen identification. The next step should be to work on a detection/diagnosis tool.

APPENDIX

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

Table 1. Soybean frequency in crop rotation at Ian N. Morrison Research Farm, Carman and at Kelburn Farm, St. Adolph.

	Treatments	**2014** Year 1	**2015** Year 2	**2016** Year 3	**2017** Year 4	**2018** Year 5	**2019** Year 6	**2020** Year 7	**2021** Year 8
1	Continuous soybeans	Soybean	Soybean	Soybean	Soybean	Soybean	Soybean	Soybean	Soybean
2	Soybeans every second year (low carbon rotation crop)	Canola	Soybean	Canola	Soybean	Canola	Soybean	Canola	Soybean
3	Soybeans every second year (high carbon rotation crop)	Corn	Soybean	Corn	Soybean	Corn	Soybean	Corn	Soybean
4	Soybean every fourth year	Wheat	Canola	Corn	Soybean	Wheat	Canola	Corn	Soybean