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MPSG ANNUAL EXTENSION REPORT

PROJECT TITLE: Optimizing plant spatial arrangement and weed management for field bean production

PROJECT START DATE: 1 May 2015 **PROJECT END DATE: 30 April 2020**

DATE SUBMITTED: 20 February 2019

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.

This research will generate new information for optimum pant row spacing and densities for two market classes of dry bean using two varieties with different growth habits for each market class. The optimum spatial arrangment of field beans to maximize above and below ground resource capture is being determined. The specific objectives addressed to date include:

1) Determine optimum plant densities and row spacing combinations in type I and type III Navy and Pinto field beans.
2) Determine the speed of above-ground resource capture at optimized population densities.

Optimized planting densities and spatial arrangement is a fundamental requirement for yield maximization and more importantly biological protection of yield from pests and other hazards. Research has shown that optimized spatial arrangement of plants is often associated with yield increases of 10-30% and we would expect similar results from this work. This research is expected to increase revenue returns for bean producers and minimize the impact of biotic and abiotic stresses.

To address these objectives, 16 main field trials have been conducted since 2015 and in 2017 at the Carman Ian Morrison and Portage la Prairie research farms and in 2018, 4 more field experiments (two hand planted for ideal spatial arrangement and two lookig at the effect of weeds on spatial arrangememnt were added at to the study). Yield samples for 2018 hand planted and weedy trials are still being processed.

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 2015 to 2018, 16 field experiments were established at the Ian Morrison Research Farm at Carman and Portage la Prairie - 8 at each location. At each location, each field experiment focussed on one market class of field bean with two representative varieties that was established as a factorial RCBD with four replicates. The factors were row spacing (3 or 4 depending on year) and a range of bean target planting density were used in each study to detemine optimum plant densities for yield maximization in the following varieties:

Envoy	(Navy Type I)	T9905	(Navy Type II/III)
CDC Pintium	(Pinto Type I)	Windbreaker	(Pinto Type III)

Weeds were managed with pre-emergent and post-emergent herbicides and plots were managed to maintain a weed-free environment. In 2015 and 2016, mini-rhizotron tubes were installed between rows into select treatments at the Ian Morrison Research Farm in to observe root proliferation into the inter-row spaces throughout the growing season. In 2015, plots looked great at both locations throughout the growing season, however, in 2016 a hail event was observed at Portage la Prairie that affected bean yields. Pinto beans appeared to be more affected by the hail than navy beans in part because of stury location at the research farm and in part due to slight differences in developmental stage at that time.

Additional experiments were added in 2017 to investigate the response of the navy varieties under more weedy conditions and to better understand the the poor response to seeding densities among these varieties observed in 2015 and 2016, a hand planted experiment with three different patterns was added as well. Individual plant performance and plant stress response were determined in these studies. Data from the hand planted and weedy experiments is still being evaluated.

Preliminary Results

Over a number of the experimnets in this study, bean yield reponded more favourable to row spacing than to seeding density with the highest yields consistenly achieved at the most narrow row spacing (Fig. 1). The effect of increase in seeding density has been more subtle and less clear. Further in dpeth analysis of the data is required to better understand the effect of actual stand density on bena yields. A In both markect classes, average yield among all sites was about 1.8 times greater at the most narrow row spacing compared to the widest row spacing (30") which is a commonly used row width in field bean production. Increased yield in the narrow row spacing is likely due to earlier canopy closure and better season-long capture of sunlight. Analysis of imags captured throughout the growing season suggests this to hbe the case. The poor response to increasing pant densities contradicts a previous research conducted in Saskatchewan (e.g. Shirtlifee and Johnston 2002 CJPS 82:521-529) and reasons for the lack of a yield response to field bean densiteis are not yet clear. In 2015 and 2016, no consistent relationship between sclerotinia ratings and bean yield was observed indicating that sclerotinia was not the sole reason for the lack of respone in bean yield to plant densities. The first two years were more conducive to disease development than the 2017 and 2018 field seasons. The poor yield respone to density in 2018 may have been due to poor precipitation during key parts of the growing season.

Preiminary results from the hand-planted experiments conducted in 2017 and 2018 showed a more traditional response of yield to yields at higher densities. In this experiment, field beans were competing with neighboruring bean plants and a shade avoidance response (taller plants with fewer branches) was observed. T9905 and Envoy appear to differ at which spatial arrangement shade avoidance was first onbserved. Results from this study are providing valuable insights that help explain the results in the larger field trials.

Overall, the project continues to progress as expected and results continue to be very interesting. Optimal bean spatial arrangment for yield seems to be influenced principally by a number of factors in additoin to rows spacing and density.

APPENDIX

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

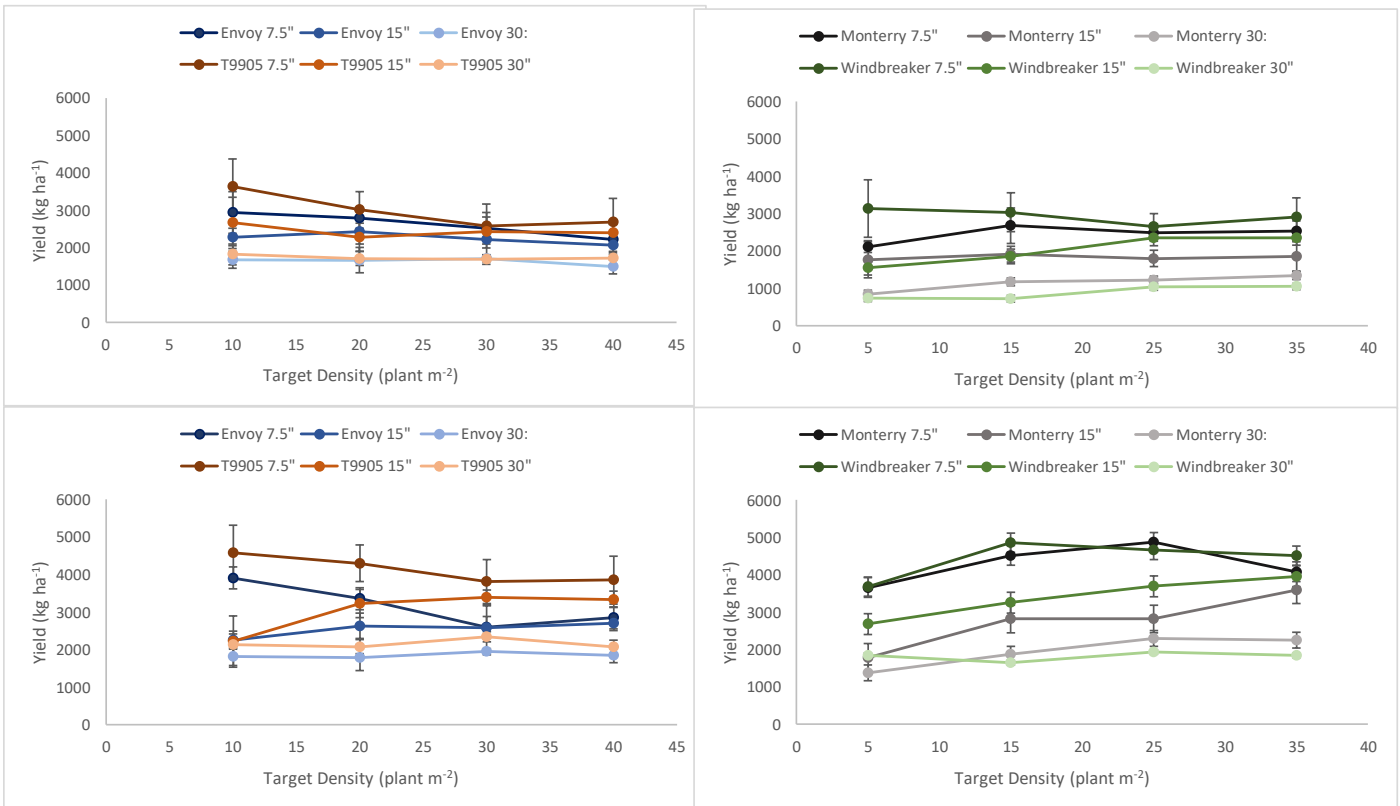

Figure 1. Navy (left) and Pinto (right) field bean yield response to row spacing and target densities obtained in 2018 at Carman (top) and Portage la Prairie (bottom). Standard errors of the means are indicated. With the exception of the Pinto bean experiment at Portage al Prairie, yield was relatively unresponsive to target density. As in past years, T9905 showed a trend in decreasing yield with increasing plant densities at the most narrow (7.5") row spacing. Comprehensive statistical analysis will follow to better understand the responses of bean yield to seeding densities.