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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 2018

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 will be 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 and below-resource space 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, 8 main field trials were established in 2015, 2016 and 2017 at the Ian Morrison research farm and at Portage la Prairie (one for each variety at each site) containing 20 treatments each (4 row spacings and 5 planting densities). In 2017 additional field experiments were added to explain some of the results obtained during the first 2 years of the study. Yield samples for 2017 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 and 2016, 8 field experiments were established at the Ian Morrison Research Farm at Carman and Portage la Prairie - 4 at each location. At each location, each field experiment focussed on one variety of field bean that was established as a factorial RCBD with four replicates. The factors were row spacing (7.5", 15", 22.5", and 30") and bean target planting density (30, 40, 50, 60, 70 plants m-2 for Pinto beans and 20, 30, 40, 50, 60 plants m-2 for Navy types). The varieties included:

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. Shortly after emergence, mini-rhizotron tubes were installed between rows into select treatments at the Ian Morrison Research Farm 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 these vrieties under more weedy conditions and to better understand the the poor response to seeding densities among all varieties, a hand planted experiment was added as well.

Preliminary Results

Over the first two years of the study 2015 and 2016, bean yield reponded more to row spacing than to seeding density (Figs. 1 and 2). Among all varieties and growth types, narrow row field beans yielded more than when planted at wider row spacing. . 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 (Fig. 2) and conversion to biomass, although the density data does not always support this. Over the first two years of the study, the effect of plant density on yield was surprisingly small. This contradicts a previous study 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 sobserved 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 field season and therefore the results for 2017 are highly anticipated. Yield samples for someof these are currently being processed and the data, unfortuantley, are not yet available and summarized.

Preiminary results from the hand-planted experiments initiated in 2017 showed geater 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. Initial results from this study are already providing valuable insights that willhelp explain our results during the 2015 aand 2016 field season.

Overall, the project continues to progress as expected and results continue to be most interesting. Optimal bean spatial arrangment for yield appears to be influenced by a number of factors.

APPENDIX

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

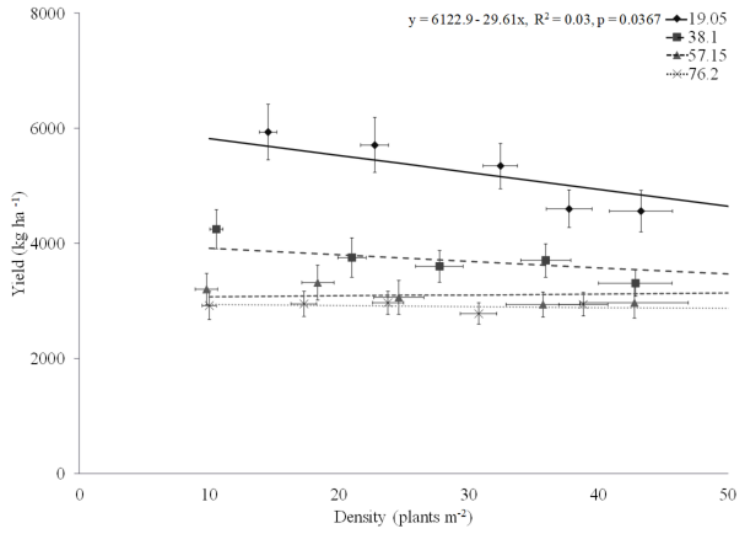

Fig. 1. Plant density effect for each row spacing for Pinto bean yield combined among varieties (WIndbreaker & Monterry) and site years (2015 & 2016).

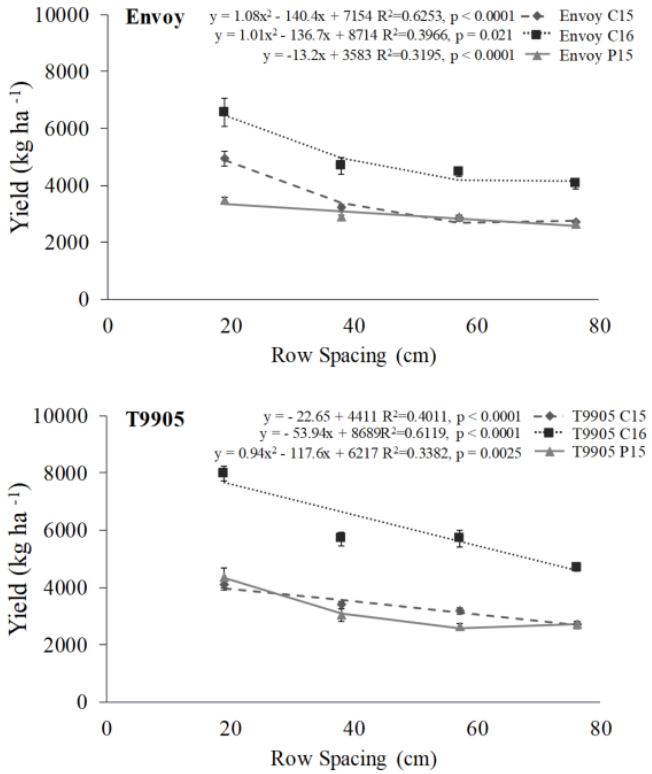

Fig. 2. Navy bean yields for Envoy (top) and T9905 (bottom) for each site year (P = Portage, C = Carman) in 2015 and 2016 as influenced by as influenced by target plant densities. Regression equations, coefficients of determination and p-values are provided.