Project 2010F008R

Solid-Seeded Dry Bean Agronomy Research in Southern Alberta

Funding Partners: Alberta Pulse Commission, Alberta Innovates Bio Solutions

Lead Researcher and Team:

This project was in the field for the 2010 through 2013 growing seasons. The project team experienced transitions during these years as members retired and were superseded by their replacements. Dr. Ross McKenzie initiated and led the project until his retirement in 2013. Doon Pauly coordinated field activities during the 2013 growing season and compiled the final report. Dr. Ron Howard, until he was nearing retirement, and later Dr. Michael Harding, coordinated the disease assessment aspects of the project. Brian Storozynsky was responsible for fungicide evaluations and Virginia Nelson assisted Brian with report preparation on their part of the project. Dr. Eric Bremer advised on experimental design and performed statistical analysis. Dr. Parthiba Balasubramanian advised the team on project design, treatments, and methodology, and performed bean quality assessments. Dr. Manjula Bandara provided expertise on research project design, field activities and was responsible for specific data collections on crop phenology and seed yield.

Background.

Dry bean growers are interested in solid-seeded bean production because of greater yield potential, reduced specialized equipment requirements, and improved soil quality compared to row-crop production. However, agronomic information on suitable bean types, optimum row spacing and plant populations, benefit of rhizobial inoculation, N fertilizer requirements, and management of fungicide applications for disease control, is not readily available for solid seeded bean production. This project was conducted to provide agronomic information to support solid seeded dry bean production.

Objective:

The major objectives of this project are to:

1. Determine the optimum row spacing and seeding rate for solid seeding beans using a representative Pinto cultivar and a representative Great Northern cultivar
2. Determine the optimum nutrient requirements using urea and ESN and including in-crop N applications with and without inoculant.
3. Determine optimum fungicide application practices for solid-seeded beans using Lance® (boscalid) with different nozzle types and water rate combinations.

What We Did:

The research project consisted of three experiments. Experiment 1 investigated the effects of seeding rates (10, 25, 40, and 55 plants m^{-2}) and row spacing (17.5, 35, and 70 cm) on the yield and quality of Winchester Pinto bean and AC Resolute Great Northern bean. Experiment 2 examined fertility effects on these same cultivars. Experiment 2 was comprised of 2 sub-experiments: Experiment 2a investigated the effect of rhizobium inoculants on dry bean yield and quality, and Experiment 2b looked at nitrogen product and rate effects on dry bean yield and quality. Experiment 3 (Exp 3) focused on white mould control in solid-seeded dry beans. Exp 3 changed substantially over the four years of the project. For 2010-2012 Exp 3 explored the effectiveness of different spray nozzle types and application water volumes with Lance® WDG (boscalid) fungicide, but for 2013 Exp 3 was modified to develop preliminary information on the efficacy of alternatives to Lance. Experiments 1, 2a, and 2b were performed as traditional small-plot research but Exp 3 was completed with considerably larger plots superimposed onto farm-seeded areas.

Key Results:

In this project, dry beans seeded on 17.5 and 35 cm row spacings produced 11% greater yield than beans grown on 70 cm row spacing, when all treatments were seeded at optimal seeding rates. To achieve this yield advantage, solid seeding required plant densities of about 40 plants m^{-2} compared to the optimal row crop density of 25 plants m^{-2} so the practice will involve increased seed expenses. Over the four years of this project, solid-seeded beans did not have greater white mould problems than row-cropped beans.

Fertility management continues to be an important production factor for dry beans, including solid-seeded dry beans. On average ESN produced 2% greater yield than urea, and inoculated treatments produced 4% greater yield than non-inoculated treatments. "Optimal N" for dry beans is about 100 kg N ha^{-1} of soil N to a depth of 60 cm plus fertilizer N. For most tested sites, that optimal N rate was about 90 kg N ha^{-1} from fertilizer and produced a 9% yield advantage over non-fertilized controls.

During the first three years of this project we could not determine if nozzle type or application water volume affected Lance® efficacy for white mould control. The last year of fungicide efficacy work indicated that Acapela®, Allegro®, Lance®, Luna® Privilege, and Propulse®, could all effectively limit white mould yield losses, perhaps protecting yield of up to 1000 kg ha^{-1}.

Take-home Message for the Industry:

Solid-seeding dry bean is a viable management practice under irrigated southern Alberta conditions. Solid-seeding bean will require slightly greater plant densities than row crop beans to attain yield advantages. Disease management and harvest management practices to support solid-seeding still need to be determined.

Value to the Industry

If the yield advantage of solid seeding or optimal N application is about 10% as was the case in this project, and if this same yield advantage could apply to farm-scale production, then the results of this project could potentially lead to increased gross revenues from dry bean production of about $3.3 million per year. With total project expenses of just under $640,000, the cost of the research relative to the potential value to the industry is small.