Dry Bean Inoculant Trials

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New Trial Type in 2023!

Why are these trials important?

Improving Biological Nitrogen Fixation for Dry Beans

Dry beans are relatively poor nitrogen-fixers, producing less than 45% of their N requirement, on average. As a result, dry beans are typically fertilized like a non-legume crop. In the field, however, we often observe pink nodules on dry bean roots, indicating that active N-fixation is occurring. There has also been little effect of different nitrogen fertilizer rates applied on dry bean yield, leading to questions of if we should re-evaluate the contribution of biological N fixation to dry bean yield.

Inoculation with effective rhizobia has the potential to improve dry bean N-fixation and reduce N fertilizer use. Commercial inoculants are not widely available, and what products are available are often in peat formulations, which has limited their use on some farms.

Evaluating Available Inoculant Products

Since 2019, available dry bean inoculant products have been evaluated in small-plot trials conducted by the Applied Soybean and Pulse Agronomy lab, led by Kristen MacMillan, MPSG-UM Agronomist-in-Residence at the University of Manitoba. From 2019-2021, BOS self-adhering peat inoculant and Primo GX2 granular inoculant (later re-formulated and named N Charge) were tested at Carman and Melita in pinto, navy and black beans.

The Primo GX2/N Charge inoculant resulted in better nodulation and a yield advantage at Melita in 2020 and 2021 when compared to untreated dry beans and the BOS peat inoculant. At Carman, nodulation was lower overall, and nodulation and yield were the same for untreated dry beans and inoculant products tested. In 2022, four inoculant products were tested and had no effect on yield at Carman, Melita and Portage.

These research trials have continued with additional products that have become available and are now testing inoculants in combination with different nitrogen rates.

One on-farm trial in 2019 compared BOS peat inoculant in T9905 navy beans to untreated beans. There was no effect on nodulation or yield at the field-scale. On-farm trials will continue with interested farmers.

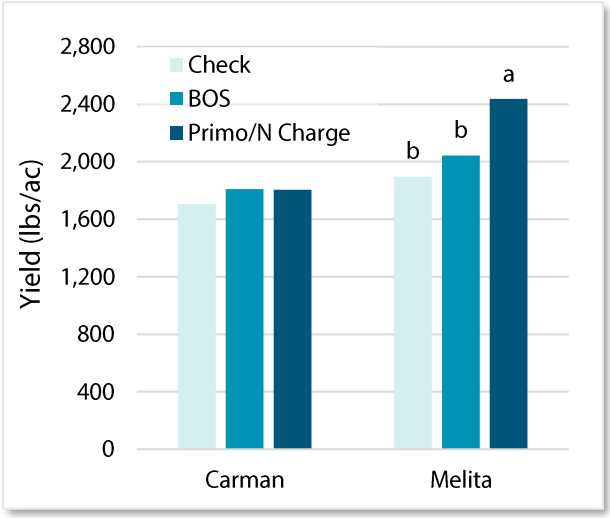

Figure 1. Average pinto, navy and black bean yield response to inoculant products at Carman (2019-21) and Melita (2020-21). Different letters above bars indicate statistically different yields at $p < 0.05$.

Developing an Effective Inoculant for Dry Beans

Since active nodules have been observed in the field, a research project led by Dr. Ivan Oresnik, University of Manitoba, and Dr. George DiCenzo, Queen's University, was initiated in 2023 to isolate strains of native rhizobia from soils collected from fields with dry bean history. This research aims to identify which of those rhizobia strains are most effective at fixing nitrogen, forming nodules consistently with dry beans and are competitive over time in the soil microbiome. From this, they hope to create an effective inoculant for dry beans that is readily adaptable to Manitoba soils. To support this research, MPSG staff collected soils from 40 dry bean fields in 2023. More than 200 strains of rhizobia have been isolated from those soils to-date.

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Dry Bean Inoculant Trials

Evaluating inoculant products on-farm

2023 Results

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Trial Information:

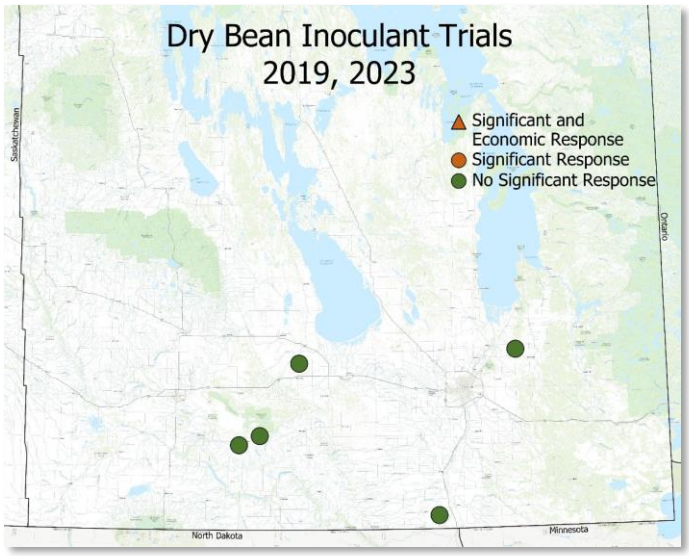
- 4 trials in 2023 tested an inoculant product in dry edible beans.
  - *Agtiv Fuel* is a liquid rhizobium inoculant product for peas and lentils containing *Rhizobium leguminosarum* biovar *viciae*.
  - *Agtiv Thrive* is a liquid product for peas and lentils combining a rhizobium inoculant (*Rhizobium leguminosarum* biovar *viciae*) and a mycorrhizal inoculant (*Rhizophagus irregularis*).
- While these are pea and lentil inoculant products, dry beans are notably promiscuous when interacting with rhizobia and will form nodules with a number of species.

Supporting Data:

- Nodulation was assessed at flowering (R2). The total number of nodules per plant, the colour of above-ground growth and the position and colour of root nodules were noted.
- There were no differences in nodulation numbers among untreated dry beans and inoculant products tested.
- Total number of nodules per plant ranged from none present at trials where N was applied to 29/plant on average.

Yield and Economic Results:

- There were no yield differences among untreated dry beans and those grown with the inoculant products tested.
- Assuming an estimated cost of $18/ac for *Agtiv Thrive* and $5/ac for *Agtiv Fuel*, there was an equivalent loss in profit for each of the products tested when compared to untreated dry beans.



Trial ID	Market Class	Variety	Nearest Town
DB1IN01	Navy	T9905	Glenboro
DB1IN02	Black	Eclipse	Beausejour
DB1IN03	Kidney	Red Hawk	Cypress River
DB1IN04	Navy	T9905	Katrime

Trial ID	-- Avg # of Nodules / Plant --			------ Statistics ------		------ Yield (lbs/ac) ------			---------- Statistics ----------		
	Untreated	Thrive	Fuel	p-value	Significant?	Untreated	Thrive	Fuel	p-value	CV(%)	Significant?
DB1IN01	0.1	0.0	-	*0.3910*	No	3543	3236	-	*0.2818*	*10.4*	No
DB1IN02	0.1	2.6	1.4	*0.1244*	No	1159	1154	1144	*0.5596*	*3.3*	No
DB1IN03	26.1	28.5	-	*0.7165*	No	2239	2362	-	*0.4130*	*8.4*	No
DB1IN04	17.9	-	13.2	*0.3756*	No	2442	-	2425	*0.6064*	*1.8*	No

*DB1IN01 was fertilized with additional N and yield results are hand-harvested estimates.

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In today's era of high input costs, low margins and the ever-increasing need to improve sustainability of the farm operation, validating agronomic management decisions made on-farm are ever-more important. Agronomic recommendations are usually generated by small-plot research, which can efficiently and effectively compare numerous treatments in the same location, at the same time. But what happens when those treatments are used at a field scale? Do they behave the same? Are they just as effective? Are they economical? On-farm trials can help answer these questions.

On-farm research is done by the farmer, for the farmer. Well-conducted on-farm trials investigate questions and outcomes on a case-by-case basis while evaluating the overall effects of management decisions through combining data across trial locations and years.

Facilitating trials to generate meaningful results is a balance between our efforts and farmer efforts. For farmers, there is time involved in conducting the trials on-farm, particularly at seeding and harvest, two of the busiest times of the growing season. But this investment of time generates valuable information on the agronomics and economics of different management practices and products. Results from on-farm trials can be used to shift management practices or validate current practices on individual farms, but they can also be pooled together across space and time to gain an overall, big-picture understanding of the impact of a treatment or decision.

This would not be possible without you, our farmer collaborators. Thank you for your dedication to these trials!

Thank-you to our On-Farm Network collaborators:

- Farmer-members
- Tone Ag Consulting
- New Era Ag Research
- Green Aero Tech
- Assiniboine Community College
- BASF
- UPL

Explore MPSG's On-Farm Network Trial Database

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Interested in Participating in 2024?

Trial Topics:

- Seeding rates
- Row spacings
- Inoculant strategies
- Seed treatments
- Fungicides
- N rates in dry beans
- Biological products
- Tillage and residue management

Have a different trial idea? Let us know!

Contact Chris Forsythe, On-Farm Network Agronomist
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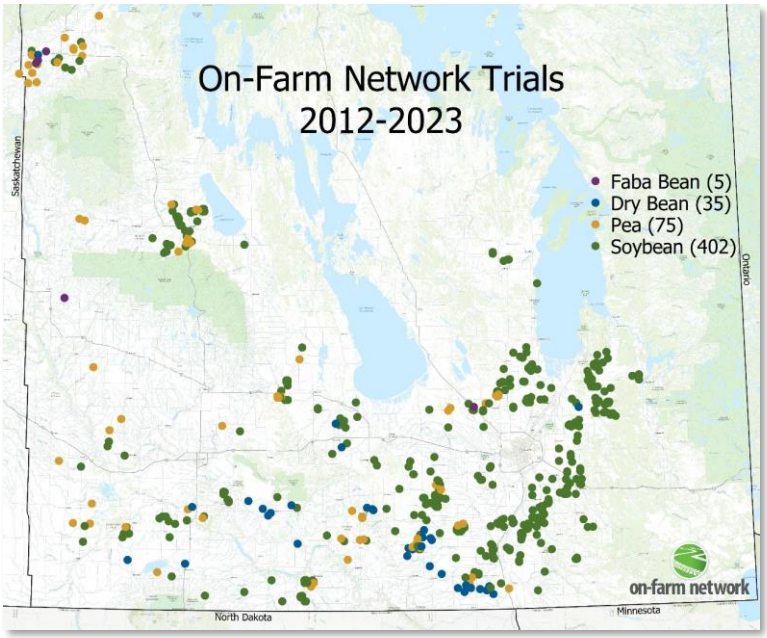

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