2023

ON-FARM RESEARCH RESULTS

Research
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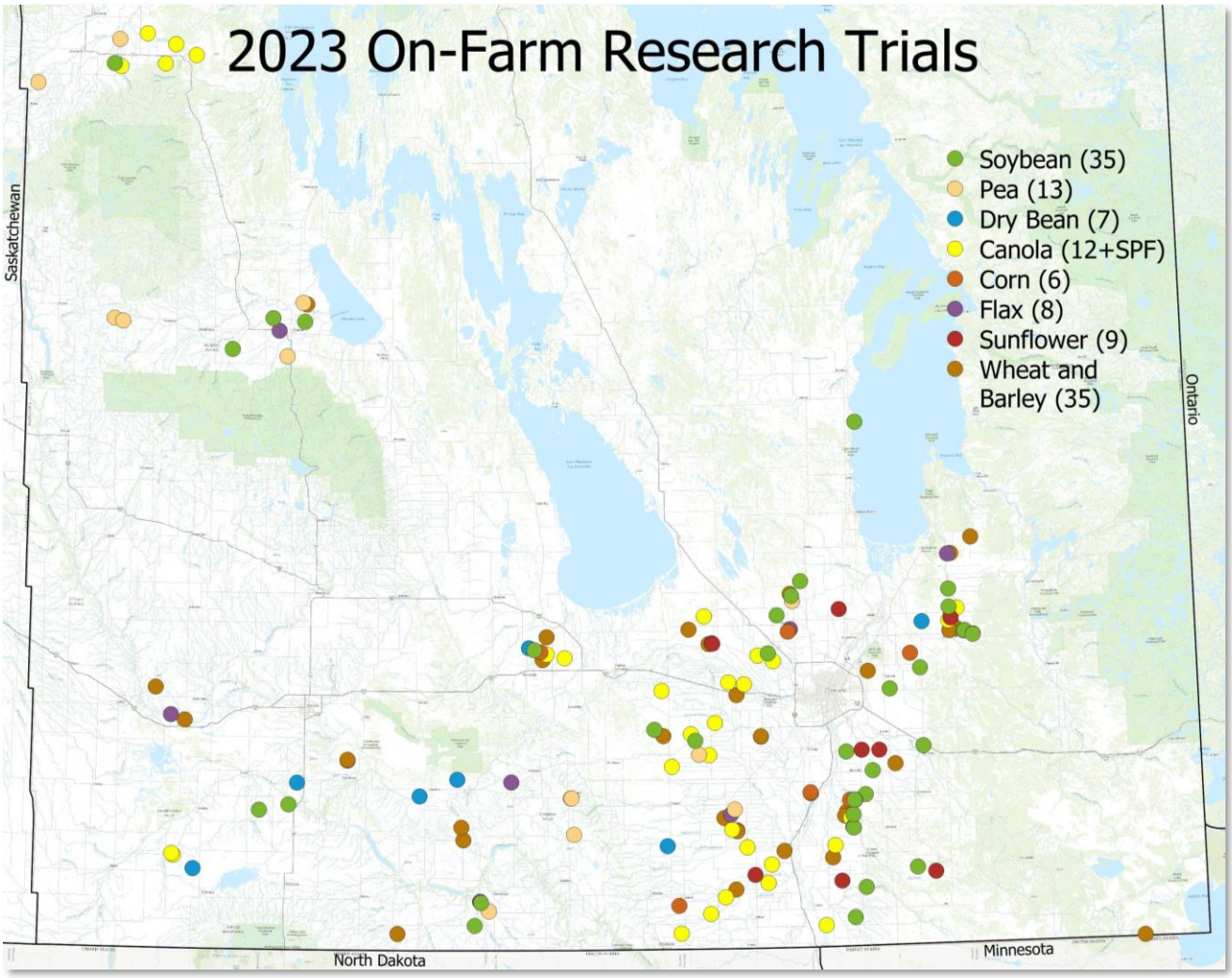
Research on the Farm

December 2023



2023 On-Farm Research Trial Types

Soybeans
- Seeding Rates
- Row Spacings
- Double vs. Single Inoculant
- Single vs. No Inoculant
- Biological Products
- Fungicides

Peas
- Seeding Rates
- Seed Treatments
- Fungicides

Dry Beans
- Inoculants
- Nitrogen Rates
- Fungicides

Barley
- Plant Growth Regulators
- Seed Treatments
- Seeding Rates

Corn
- Nitrogen-Fixing Biologicals

Flax
- Seeding Rates

Sunflowers
- Planting Rates

Wheat
- Enhanced Efficiency Fertilizer
- Fungicides
- Seed Treatments
- Seeding Rates

Canola
- Seeding Rates
- Nitrogen Rates
- Seed-Placed Fertilizer

Thank you for your participation in on-farm research!

This growing season, with your participation and support, more than 130 on-farm trials were conducted across Manitoba through MPSG and MCA and MCGA. We would like to thank each of you for your interest in conducting on-farm research and we hope to help facilitate future research trials on each of your farms.

In this book you will find important information for interpretation of results followed by a growing season weather overview. Within each chapter, organized by crop type, you will find long-term results summaries and summaries of 2023 results for each trial type.

Along with this booklet, additional information is available online. Single-site reports from 2012 to 2023 can be found by following the QR codes below for each organization or by visiting:

- MPSG's On-Farm Network database at manitobapulse.ca/on-farm-research-reports
- MCA's Research on the Farm program at mbcropalliance.ca/research/research-on-the-farm-program
- MCGA's On-Farm Research program at canolagrowers.com/canola-on-farm-research-program

Long-term summary videos of each MPSG trial type are available online and may be viewed at manitobapulse.ca/on-farm-network-results-series or @MBPulseGrowers.

Thank you for your participation and continued support. This farmer-first research would not be possible without you!

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Important Information to Interpreting On-Farm Research Results

Variation in yield is expected within an on-farm trial due to the natural variability that occurs across a field. Statistical analysis allows us to tell if a true yield difference occurred due to a treatment effect (like seeding rate or fungicide application), or if the variation in yield we see at a trial is due to field variability. If results are statistically significant, then we can say with certainty that the treatment caused the yield difference. If the results are not significant, the differences in yield between treatments is due to the variability in the field and not a result of the treatment we were testing.

To achieve statistically-rigorous trials, on-farm field trials are set up using a randomized complete block design (RCBD). Each trial has four to six replicates in the field. Analysis of variance (ANOVA), treating site as a fixed effect and replicate (block) as a random effect, or t-tests, have been conducted to determine yield results.

Single-site reports available are based on single-site analysis, i.e., site-years are not combined. Summaries of trial types within this booklet will report a combined analysis across site-years or a frequency of yield responses if combined analyses have not been conducted yet.

Definitions

Site-year: A site-year, identified by a unique trial ID, is one research trial location in one year. For example, a seeding rate trial conducted in a field near Carman would be one site-year.

Confidence level: A 95% confidence level is used within our trials. This means we can say we are 95% certain of the outcome.

P-value: While a confidence level tells us how certain we are of the results we get from statistical analysis; the p-value indicates if the results are statistically significant. The p-value is a probability that is calculated through the statistical analysis process. A p-value less than 0.05 indicates a statistically significant result, but a p-value greater than 0.05 indicates the results are not significant

Coefficient of Variation (CV): The statistical measure of random variation in a trial. The lower the value, the less variable the data.

MPSG, MCA and MCGA do not endorse the use of products tested in on-farm research. Although trials are conducted at multiple sites under varying conditions, your individual results may vary.

Contacts and Questions

For any questions about existing trial data, data analysis, or for assistance with future trial establishment of an existing or new trial type, please contact your commodity organizations.

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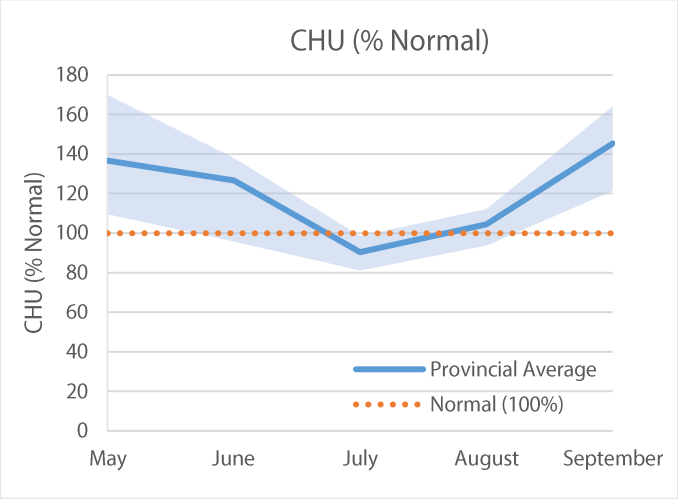
2023 Growing Season Weather

Temperature: May and June were warmer than normal, averaging 126-137% of normal CHUs and 129-142% GDD across the province. July was cooler, followed by a near-normal August and a warm September (145% CHUs). On average, 3000 CHU were accumulated from May to September. 2023 had a long frost-free period, with 134 consecutive days above -2°C (considered a hard, killing frost).

Precipitation: Rainfall was variable and spotty this season. Overall, rainfall was below-normal for the province (50-76% depending on month), indicated by the dashed blue line on the regional graphs below. One major weather system moved across southern Manitoba on June 6-8, otherwise weather systems were fairly localized and sporadic.

On average, from May to September, each region received:

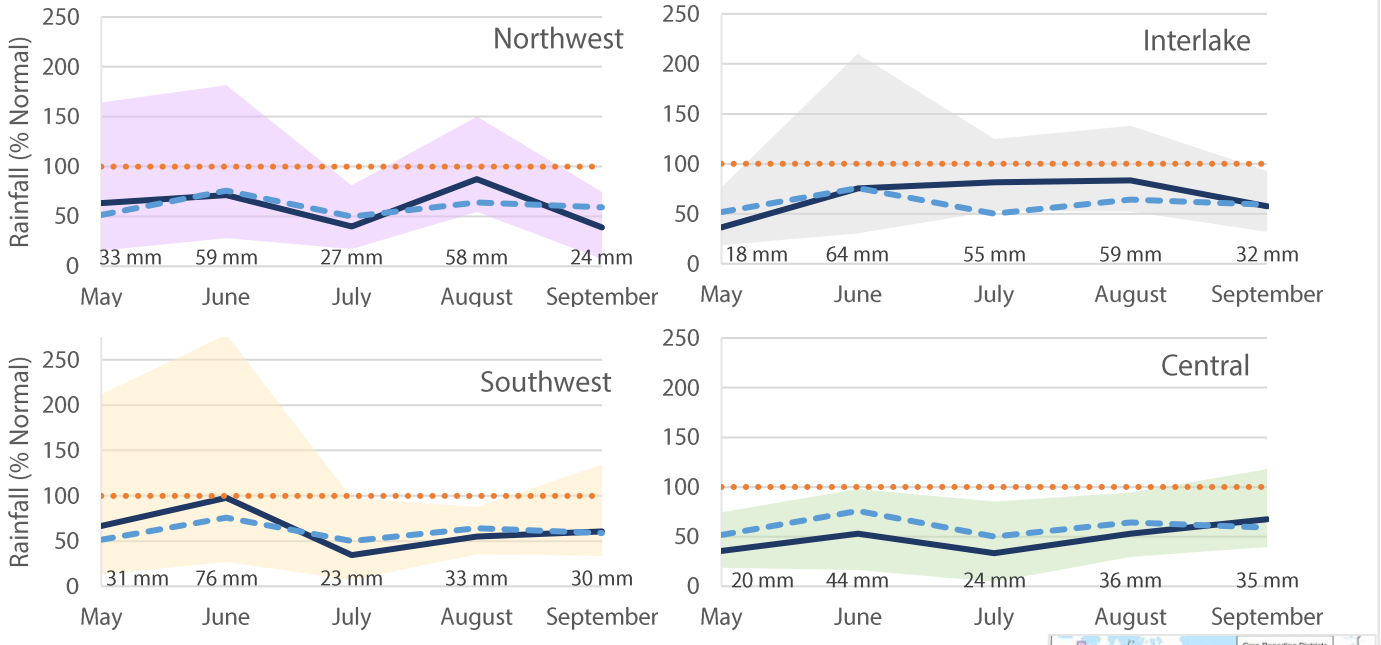
- Northwest: 39-87% of normal rainfall, accumulating 201 mm
- Southwest: 35-98% of normal rainfall, accumulating 193 mm
- Interlake: 36-83% of normal rainfall, accumulating 228 mm
- Central: 33-68% of normal rainfall, accumulating 159 mm
- Eastern: 47-87% of normal rainfall, accumulating 240 mm



Corn Heat Units (CHU) are a measure that accounts for temperatures that are too cool (<10°C during the day and <4.4°C overnight) and too hot (>30°C) for crop growth.

Weather Extremes:

- Hail accompanied thunderstorms, causing crop damage in several areas and varying in severity. More than 470,000 acres of soybeans, canola and spring wheat were damaged. The northwest and central regions had the greatest number of acres reported damaged for these three crops, followed by the southwest.
- There were seven major wind events (>100 km/hr) recorded throughout the season.
- There was only one extreme rain event where Zhoda (SE region) received 3" of rain on July 26.



Data Source: Manitoba Agriculture

Manitoba Pulse & Soybean Growers On-Farm Network

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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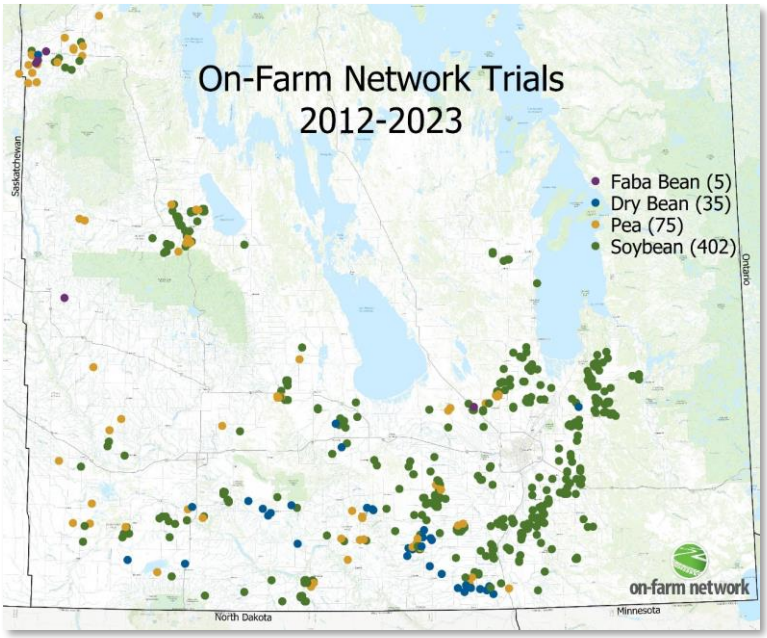

MANITOBA Pulse Soybean GROWERS

Soybean Seeding Rate Trials

Evaluating different soybean seeding rates on-farm

2023 Results

on-farm network
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Trial Information:

- 13 soybean seeding rate trials in 2023
- Seeding rates tested ranged from 100,000 to 297,000 seeds/ac and differed by 18-60,000 seeds/ac.

Supporting Data:

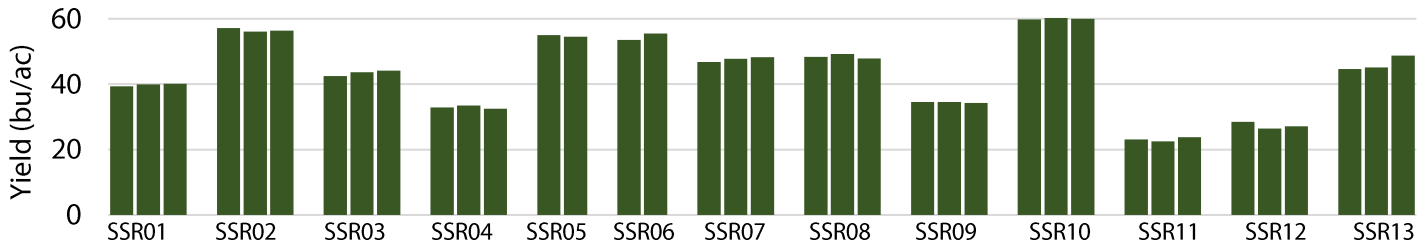
- Plant counts were recorded during V- and R-stages.
- Average early-season establishment was 81% (range: 53-104%) and average late-season survivability was 84% (range: 51-122%).

Yield and Economic Results:

- There were no yield differences among the various soybean seeding rates tested on-farm in 2023.
- Most frequently, seeding rates tested differed by 30,000 and 60,000 seeds/ac, resulting in a loss in profit of $14.55/ac and $29.10, respectively, when compared to the lowest seeding rate tested.

Trial ID	Equipment	Seeding Date	Row Spacing
SSR01	42 ft Disc Drill	May 11	15
SSR02	40 ft Planter	May 16	20
SSR03	60 ft Planter	May 15	15
SSR04	40 ft Planter	May 16	22
SSR05/06	35 ft Press Drill	May 20	7.5
SSR07	42 ft Disc Drill	May 20	7.5
SSR08	44 ft Planter	May 20	22
SSR09	40 ft Planter	May 21	20
SSR10	44 ft Planter	May 22	22
SSR11	60 ft Air Drill	May 22	12
SSR12	60 ft Hoe Drill	June 4	10
SSR13	70 ft SeedHawk	May 16	10

Trial ID	Germ. (%)	Seeding Rates Tested	Plant Stands at V Stages	Plant Stands at R Stages	Yield Difference?	*p-value*
SSR01	96	120 vs. 150 vs. 180	94 vs. 112 vs. 122	108 vs. 129 vs. 145	No	*0.522*
SSR02	98	124 vs. 156 vs. 184	123 vs. 151 vs. 178	121 vs. 148 vs. 175	No	*0.368*
SSR03	96	100 vs. 130 vs. 160	104 vs. 110 vs. 117	122 vs.131 vs. 151	No	*0.315*
SSR04	96	120 vs. 148 vs. 175	98 vs. 129 vs. 145	101 vs. 125 vs. 140	No	*0.622*
SSR05	87	165 vs. 220	130 vs. 181	125 vs. 171	No	*0.143*
SSR06	98	165 vs. 220	108 vs. 158	104 vs. 160	No	*0.058*
SSR07	87	133 vs. 163 vs. 193	112 vs. 133 vs. 139	112 vs. 135 vs. 135	No	*0.203*
SSR08	96	120 vs. 150 vs. 180	86 vs. 106 vs. 123	104 vs. 131 vs. 149	No	*0.369*
SSR09	89	127 vs. 145 vs. 170	95 vs. 114 vs. 147	93 vs. 114 vs. 145	No	*0.815*
SSR10	96	120 vs. 150 vs. 180	110 vs. 138 vs. 156	114 vs. 142 vs. 157	No	*0.668*
SSR11	93	133 vs. 163 vs. 193	145 vs.127 vs. 173	113 vs. 125 vs. 164	No	*0.392*
SSR12	94	223 vs. 260 vs. 297	139 vs. 156 vs. 159	124 vs. 148 vs. 153	No	*0.517*
SSR13	80	130 vs. 160 vs. 190	134 vs. 138 vs. 171	132 vs. 137 vs. 170	No	*0.098*



MANITOBA Pulse Soybean GROWERS

Soybean Seeding Rate Trials

Evaluating different soybean seeding rates on-farm

Long-term Results (2012 – 2023)

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Trial Information:

- 120 trials from 2012 – 2023
- Seeding rates tested are the farmer's traditional practice vs. 30,000 seeds/ac higher and lower.
- All other crop management activities are the same (row spacing, weed control, fertility, etc.).
- Most common comparisons have been 130 vs. 160 vs. 190,000 seeds/ac and 150 vs. 180 vs. 210,000 seeds/ac.
- Equipment: 60% of trials have used an air seeder, 40% have used a planter.
- Row spacings: 51% on narrow rows (7-12"), 32% on intermediate rows (15-20") and 17% on wide rows (22-30").

Supporting Data:

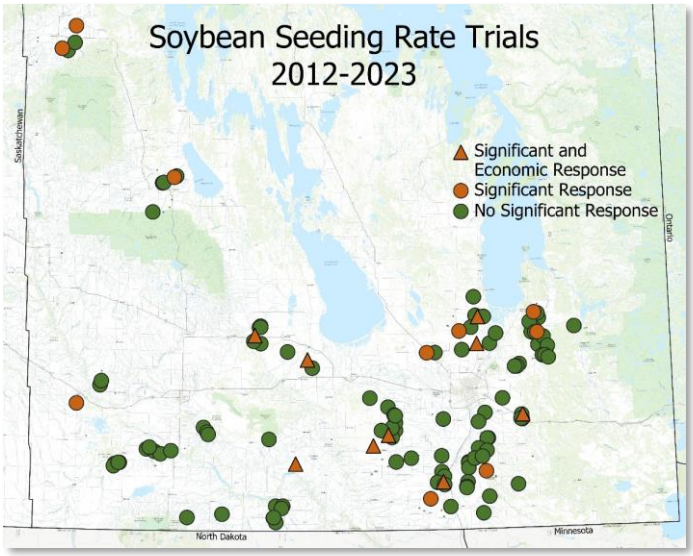
- Plant counts are recorded during V-stages and R-stages.
- Average early-season establishment has been 81% (range: 30-120%) and average late-season survivability has been 76% (range: 26-114%).
- Higher seeding rates were typically associated with lower percent establishment and more mortality throughout the growing season.
- Average survivability with planters has been 82% and 80% with seeders.

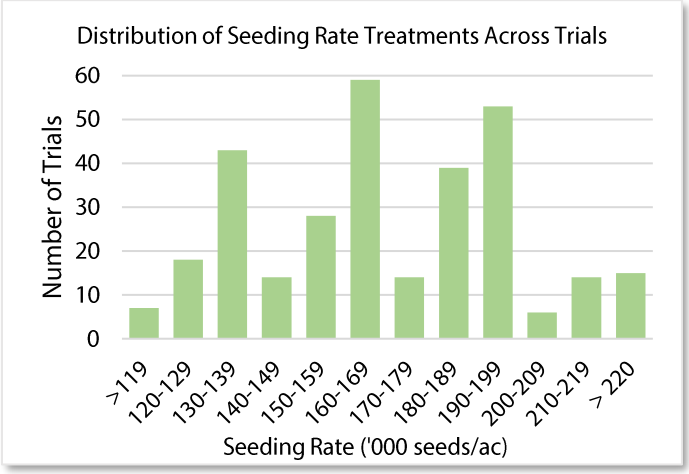
Yield Results:

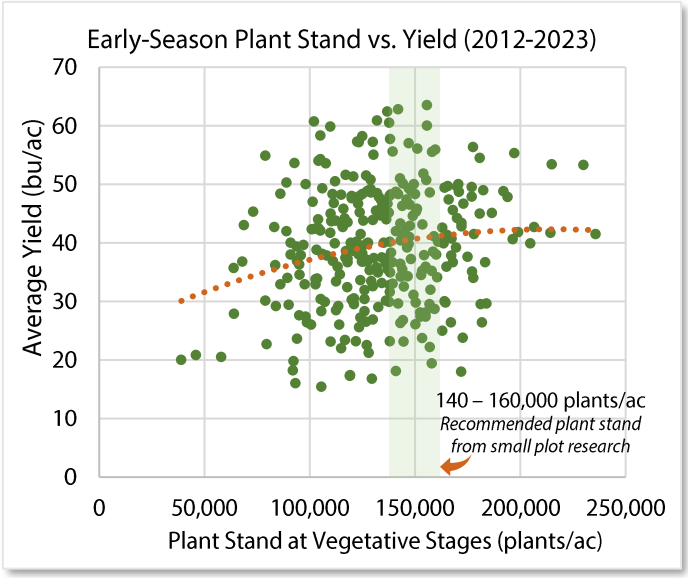
- 84% of the time, changing soybean seeding rate has not changed soybean yield.
- There have been 19 trials where a significant yield response occurred (16% of the time). Of those responses, 14 were economical, where the yield increase was large enough to pay for the increased seed cost (12% of the time).
- Environment has played the biggest role in determining soybean yield in these trials.
- The outcome of seeding rates and the resulting plant stands established in the field have been farm- and field-specific.

Recommendations from this Research:

- Evaluate living plant stands in every field, every year and relate those plant counts back to your seeding rate. Are there areas where you can improve survivability on your farm? (Survivability (%) = plant count / seeding rate)
- Seeding rates of 150 to 190,000 seeds/ac have maintained soybean yield in these trials.







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View on-farm soybean seeding rate individual trial site reports here

Soybean Row Spacing Trials

Evaluating different soybean row widths on-farm

2023 Results

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Trial Information:

- 2 trials in 2023:
  - SRS01 near Crystal City compared 7.5" and 15" rows seeded at 166,000 seeds/ac using a 30ft disc drill.
  - SRS02 near MacGregor compared 15" and 30" rows seeded at 140,000 seeds/ac using a 60 ft planter.

Supporting Data:

- Plant counts were recorded during V- and the same areas revisited at R-stages. Notably, in 30" rows, plant stands were reduced by 9% over the course of the growing season, likely due to intra-specific competition with more plants crowded together in the wide rows.
- Canopy closure was evaluated at R1, R3 and R5 growth stages using the *Canopeo* app to assess % ground cover. There were no differences in canopy closure between 7.5" and 15" spacings, but 15" rows had 25% more row closure at R1, and 17% more closure at R3 than 30" rows.
- In 2023, disease pressure was additionally evaluated. There were no differences at SRS01, but at SRS02, the percent of plants infected with northern stem canker was 25% greater in 30" rows than 15" (30% vs. 5% incidence, respectively).
- A nitrogen deficiency was observed at SRS02, where the 15" rows were briefly more deficient in N than the 30" rows, despite similar amounts of nodulation between treatments. Nodulation was sufficient and crop coloured evened out as the season progressed.

Yield Results:

- There was no difference in yield between 7.5" and 15" row spacings at SRS01. At SRS02, there was a 3.2 bu/ac yield advantage for soybeans planted on 15" rows vs. 30" rows.
- Economics of these trials are difficult to quantify since it is very farm- and equipment-specific in how differences in row width are achieved.

2023SRS01

	V-Stages		R- Stages		Canopy Closure (%)				
Row Spacing	Early-Season Plant Stand	% of seeding rate established	Late-Season Plant Stand	% of seeding rate survived	R1	R3	R5	Weed Density	Yield (bu/ac)
7.5"	156,000	94%	168,000	101%	75	71	87	6.9	23.5
15"	135,000	81%	135,000	81%	77	74	85	5.8	22.8
p-value	*0.240*		*0.075*		*0.251*	*0.244*	*0.106*	*0.657*	*0.492*

2023SRS02

	V-Stages		R-Stages		Canopy Closure (%)			
Row Spacing	Early-Season Plant Stand	% of seeding rate established	Late-Season Plant Stand	% of seeding rate survived	R1	R3	R5	Yield (bu/ac)
15"	137,000	98%	136,000 A	97%	95 a	99 a	93	**57.8 A**
30"	136,000	97%	123,000 B	88%	70 b	82 b	91	**54.6 B**
p-value	*0.728*		*0.015*		*0.0002*	*0.034*	*0.278*	***0.012***

Values within columns followed by different letters are significantly different at $p < 0.05$.

Soybean Row Spacing Trials

Evaluating different soybean row widths on-farm

Long-term Results (2019 – 2023)

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Trial Information:

- 21 trials from 2019 – 2023.
- Seeding rates are the same for both row widths.
- 10 trials have tested narrow (7.5"-10") vs. intermediate (15"-20") rows and 11 trials have tested intermediate (15") vs. wide (30") rows.
- Different row widths are achieved by doubling up on a strip, offset in between the previously seeded rows.

Supporting Data:

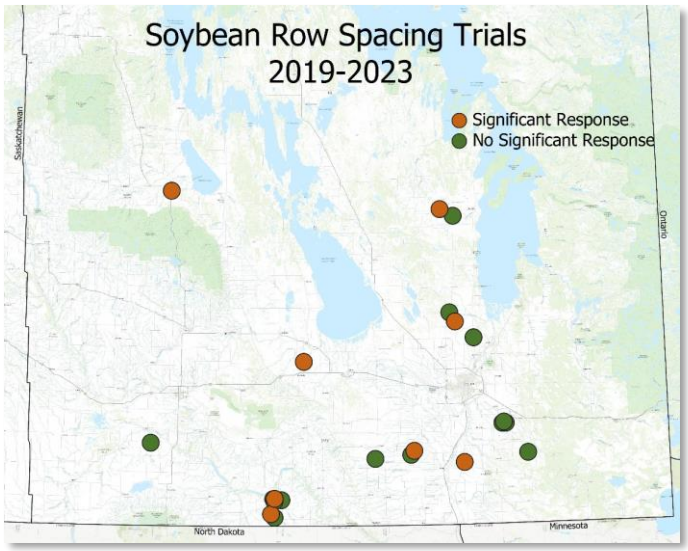
- Plant counts are recorded during V-stages and R-stages
- Average early-season survivability has been 83% for 7.5" rows, 81% for 15" rows and 77% for 30" rows.
- Wide row widths were typically associated with lower percent survivability and more mortality throughout the growing season (4% on average) due to increased competition within the row.
- Canopy closure is assessed at R1, R3 and R5 growth stages using the Canopeo app to assess % ground cover.
- Narrower row widths cover more ground and close earlier in the season than wide rows, improving crop competitive ability against weeds.

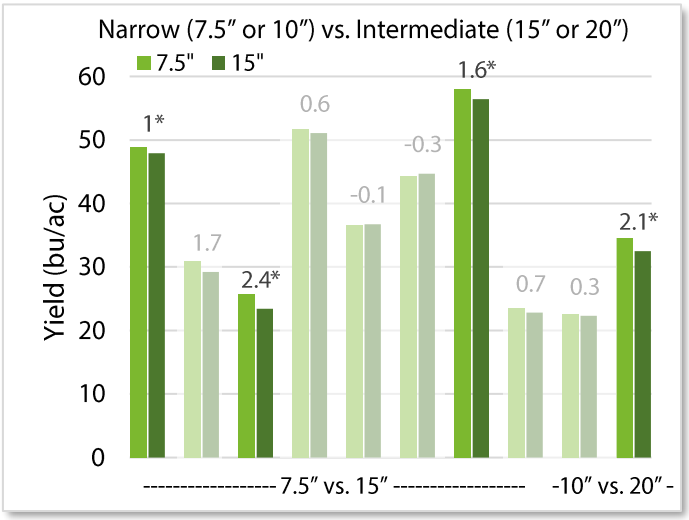
Yield Results:

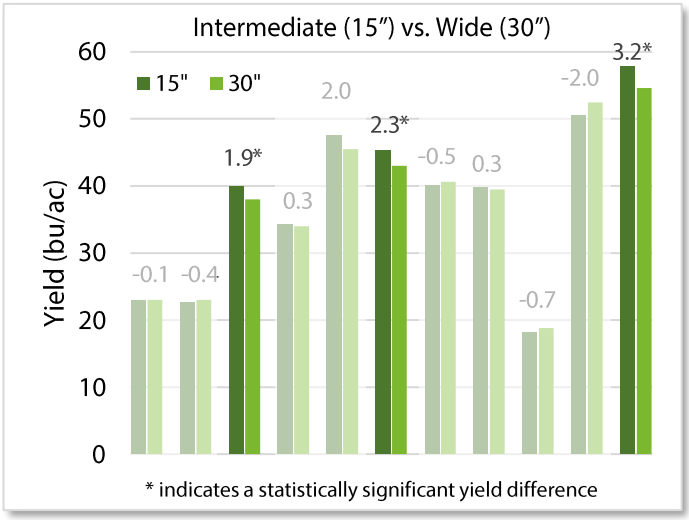
- Narrow rows (7.5-10") improved yield over intermediate rows (15-20") 40% of the time, increasing yield by 1.8 bu/ac on average.
- Intermediate rows (15") improved yield over wide rows (30") 27% of the time, increasing yield by 2.5 bu/ac on average.
- Overall, narrowing row widths increased soybean yield 33% of the time, on average improving yield by 2.1 bu/ac.
- The economics of changing row widths are difficult to quantify since how differences in row width are achieved is very farm and equipment specific.

Recommendations from this Research:

- Soybeans may be grown successfully at any row spacing, however, there is greater yield potential with narrower row widths.
- Though yield responses may not occur every year on every farm, the competitive advantage of a crop canopy that closes earlier in the season is important to mitigating the development of herbicide-resistant weeds.







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View on-farm soybean row spacing individual trial site reports here

Soybean Double Inoculant Trials

Comparing double vs. single inoculation strategies

2023 Results

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Trial Information:

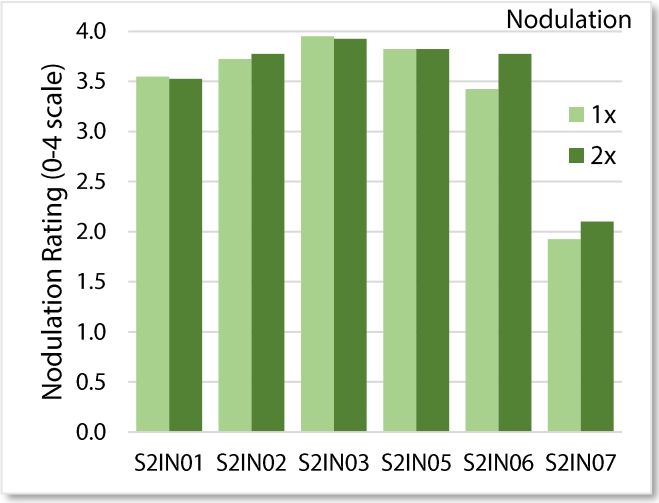
- 6 trials in 2023 comparing double (granular or peat in-furrow + liquid on-seed) vs. single (liquid on-seed alone) inoculant strategies.
- These trials require a minimum field history of two previous soybean crops and the most recent soybean crop within the last four years.

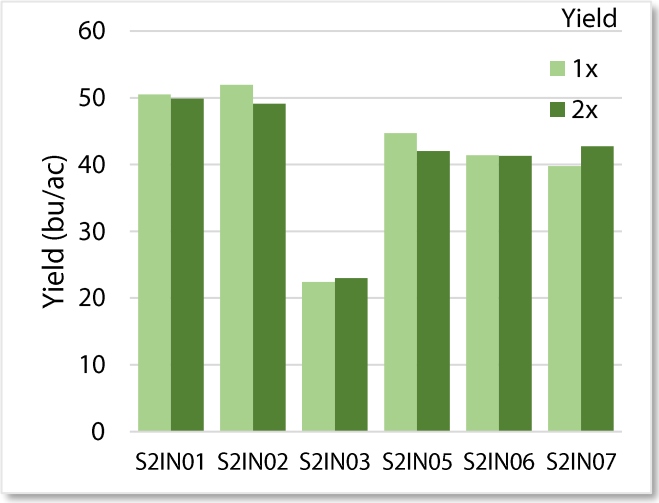
Supporting Data:

- Nodulation is rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
  - 0 (None) = 0 nodules/plant
  - 1 (Poor) = 1-4 nodules/plant
  - 2 (Fair) = 5-9 nodules/plant
  - 3 (Good) = 10-19 nodules/plant
  - 4 (Excellent) = 20 or more nodules/plant
- There were no differences in nodulation between inoculation strategies in 2023.

Yield and Economic Results:

- There were no significant yield differences between double (2x) and single (1x) inoculation strategies on-farm in 2023.
- Assuming a cost of $10/ac for the additional granular inoculant, there was a loss in profit of $10/ac with a double inoculation strategy.





	History		Average Nodulation Rating			Statistics			
TrialID	# previous soybean crops	years since last soybean crop	1x	2x	Nodulation Difference?	*p-value*	Yield Difference?	*p-value*	*CV (%)*
S2IN01	5+	3	3.6	3.5	No	*0.853*	No	*0.532*	*2.6*
S2IN02	2	3	3.7	3.8	No	*0.604*	No	*0.135*	*6.1*
S2IN03	5+	2	4.0	3.9	No	*0.718*	No	*0.407*	*3.5*
S2IN05	2+	<4	3.8	3.8	No	*1.000*	No	*0.421*	*1.9*
S2IN06	2	3	3.4	3.8	No	*0.155*	No	*0.831*	*2.2*
S2IN07	2+	<4	1.9	2.1	No	*0.213*	No	*0.208*	*9.8*

MANITOBA Pulse Soybean GROWERS

Soybean Double Inoculant Trials

Comparing double vs. single inoculation strategies

Long-term Results (2013 – 2023)

on-farm network
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Trial Information:

- 56 trials from 2013 – 2023.
- Treatments compared double (granular or peat in-furrow + liquid on-seed) vs. single (liquid on-seed alone) inoculant strategies.
- These trials require a minimum field history of two previous soybean crops and the most recent soybean crop within the last four years.

Supporting Data:

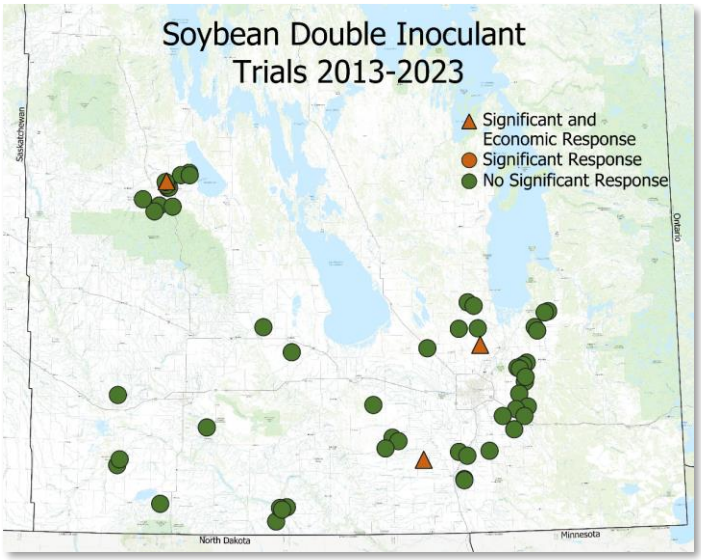
- Nodulation is rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
  - 0 (None) = 0 nodules/plant
  - 1 (Poor) = 1-4 nodules/plant
  - 2 (Fair) = 5-9 nodules/plant
  - 3 (Good) = 10-19 nodules/plant
  - 4 (Excellent) = 20 or more nodules/plant
- Nodulation ratings at flowering were similar between single and double inoculant strips at 96% of trials.

Yield Results:

- 95% of the time, an additional granular or peat in-furrow inoculant did not improve soybean yield over liquid on-seed inoculant alone, resulting in a loss of roughly $10/ac.
- There have been 3 trials where a significant yield response occurred (5% of the time). Of those responses, all 3 were economical, where the yield increase was large enough to pay for the increased seed cost (1.5-3.0 bu/ac increase).

Recommendations from this Research:

- Choose a soybean inoculation strategy based on field history. Consider a single inoculation strategy if the:
  - ✓ field has had at least two previous soybean crops,
  - ✓ previous soybean crops have been well nodulated,
  - ✓ most recent soybean crop was within the past four years, and the
  - ✓ field has had no significant flooding or drought.
- Granular in-furrow inoculants will have more resiliency and longevity in the soil in years with challenging spring conditions (excessive moisture or drought).



Soybean History (Number of Previous Soybean Crops)	*Number of Trials*
2 crops	34 (63%)
3 crops	13 (24%)
4 crops	2 (4%)
5 or more crops	4 (7%)

Years Since Inoculant Last Applied	*Number of Trials*
1 year	12 (22%)
2 years	16 (30%)
3 years	18 (33%)
4 years	7 (13%)

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View on-farm soybean double inoculant individual trial site reports here

Soybean Single Inoculant Trials

Comparing a single inoculation strategy vs. none

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

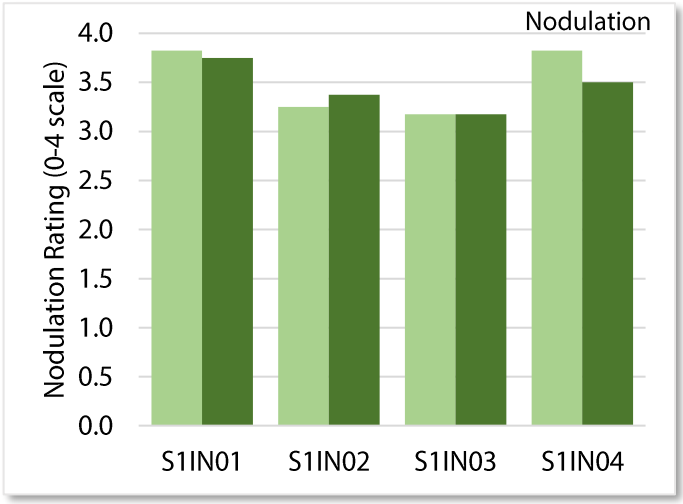
- 4 trials in 2023 compared a single inoculant strategy (one inoculant formulation or placement) vs. no inoculant applied at all.
- These fields had a minimum field history of three previous soybean crops and the most recent soybean crop within the last four years.

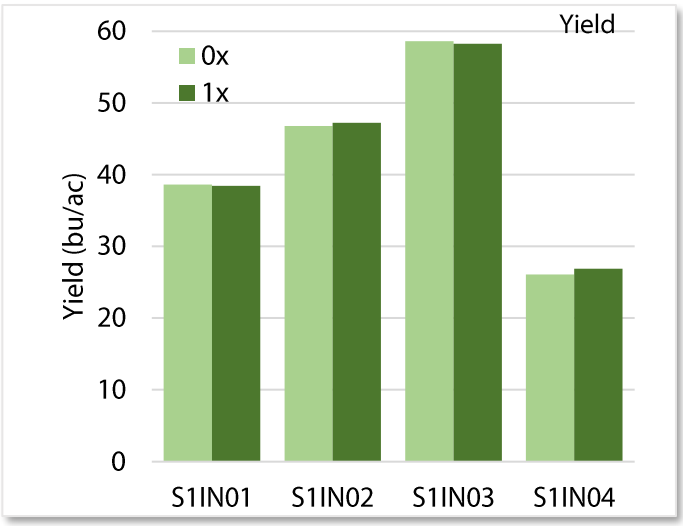
Supporting Data:

- Nodulation was rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
  - 0 (None) = 0 nodules/plant
  - 1 (Poor) = 1-4 nodules/plant
  - 2 (Fair) = 5-9 nodules/plant
  - 3 (Good) = 10-19 nodules/plant
  - 4 (Excellent) = 20 or more nodules/plant
- Nodulation ratings at flowering were the same between single and no inoculant strips at all 4 trials in 2023.

Yield and Economic Results:

- There were no yield differences between soybeans without inoculant and a single inoculant strategy.
- As a result, there is an estimated loss in profit equivalent to the cost of the on-seed inoculant (-$3.00/ac) or granular in-furrow inoculant (-$10.00/ac).





	History		Avg Nod. Rating			Statistics			
TrialID	# previous soybean crops	years since last soybean crop	0x	1x	Nodulation Difference?	*p-value*	Yield Difference?	*p-value*	*CV (%)*
S1IN01	>3	1	3.8	3.8	No	*0.644*	No	*0.8349*	*2.3*
S1IN02	5+	1	3.3	3.4	No	*0.743*	No	*0.6275*	*2.4*
S1IN03	5+	3	3.2	3.2	No	*1.000*	No	*0.4845*	*1.3*
S1IN04	>3	<4	3.8	3.5	No	*0.071*	No	*0.1557*	*3.5*

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Soybean Single Inoculant Trials

Comparing a single inoculation strategy vs. none

Long-term Results (2016 – 2023)

on-farm network
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Trial Information:

- 42 trials from 2016 – 2023.
- Treatments compared a single (typically liquid or peat on-seed) inoculant strategy vs. no inoculant applied at all.
  - 90% of trials testing liquid on-seed and 10% using peat on-seed.
- These trials require a minimum field history of three previous soybean crops and the most recent soybean crop within the last four years.

Supporting Data:

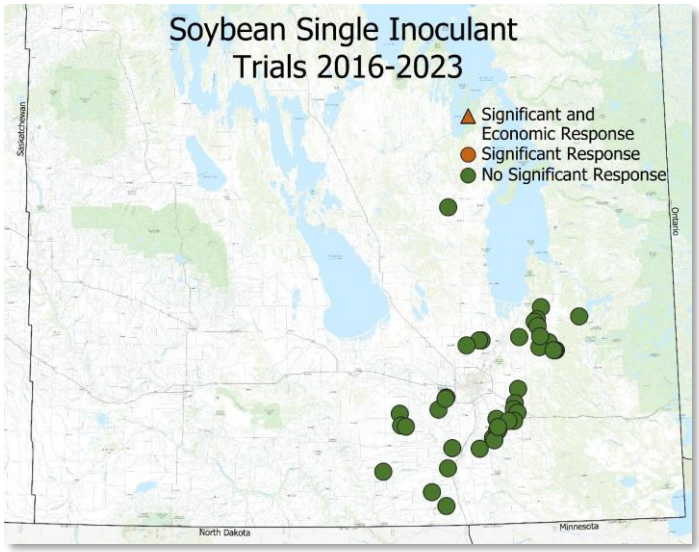
- Nodulation is rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
  - 0 (None) = 0 nodules/plant
  - 1 (Poor) = 1-4 nodules/plant
  - 2 (Fair) = 5-9 nodules/plant
  - 3 (Good) = 10-19 nodules/plant
  - 4 (Excellent) = 20 or more nodules/plant
- Nodulation ratings at flowering were similar between single and no inoculant strips at 95% of trials.

Yield Results:

- A single inoculation strategy has never improved soybean yield on fields with more than three previous soybean crops after 8 years of testing single vs. no inoculant at 42 soybeans fields in Central Manitoba.
- Assuming a cost of $3/ac for liquid inoculant, and a soybean sell price of $12/bu, a consistent yield increase of 0.25 bu/ac is needed to pay for the inoculant. Overall, the average yield difference has been 0.02 bu/ac between single vs. no inoculant treatments.

Recommendations from this Research:

- Naturalized populations of *Bradyrhizobium japonicum* are effectively colonizing root nodules and fixing nitrogen in fields with sufficient soybean history.
- Although yield responses have not occurred to date on soybean fields with more than three previous soybean crops, at a cost of roughly $3.00/ac, liquid on-seed inoculant may be considered 'cheap insurance' to avoid a much more costly nodulation failure.



Soybean History (Number of Previous Soybean Crops)	*Number of Trials*
3 crops	11 (26%)
4 crops	15 (36%)
5 crops	7 (17%)
6 or more crops	9 (21%)

Years Since Inoculant Last Applied	*Number of Trials*
1 year	11 (27%)
2 years	10 (24%)
3 years	15 (37%)
4 years	5 (12%)

View on-farm soybean single inoculant individual trial site reports here

MANITOBA Pulse Soybean GROWERS

Soybean Biological Trials

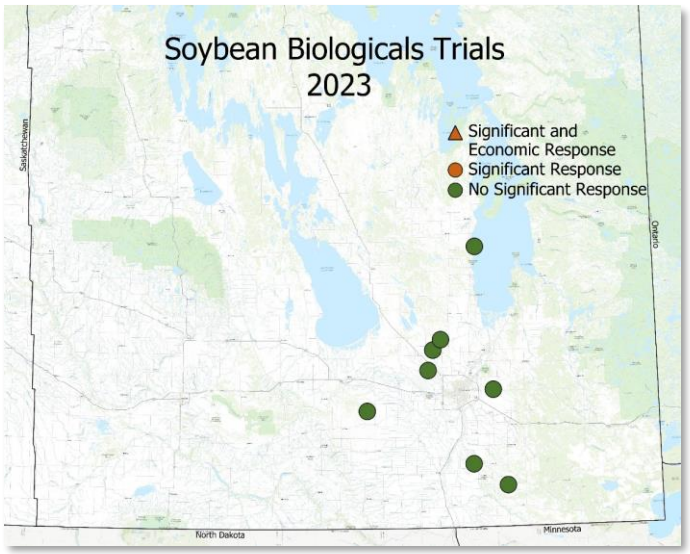
Evaluating different biological products on-farm

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- 8 trials in 2023 tested 3 different products (*Coarse Humic Acid*, *Fertiactyl*® and *Envita*®).
    - *Coarse Humic Acid* is a soil amendment that claims to improve soil structure, increase water retention, nutrient availability and stimulate microbiology.
    - *Fertiactyl*® is a soil amendment containing humic and fulvic acids and claims to improve resistance to abiotic stress, enhance root growth and development and improve nutrient uptake.
    - *Envita* is a liquid nitrogen-fixing biological containing *Gluconacetobacter diazotrophicus* that aims to supply plants with an additional source of nitrogen.
- Humic acid was applied on-seed at two rates at SB01.
- *Fertiactyl* was broadcasted at a rate of 1.5 L/ac when soybeans were at VE or V2 stages at SB02,03,04,06,07.
- *Envita* was broadcasted at a rate of 40 ac/jug in the last week of June when soybeans were at V2 at SB05 and SB08.



Supporting Data:

- The goal of these trials is first and foremost to assess the impact of various biological products on yield. As a results, the only supporting data collected are to determine living plant stands.
- There were no significant differences between plant stands of treated and untreated soybeans.

Yield and Economic Results:

- There were no soybean yield responses to the biological products tested in 2023.
- As a result, there was a loss in profit equivalent to the cost of these products (ranging roughly $15/ac for *Envita* and $28/ac for *Fertiactyl*) plus application costs.

			------- Plant Stand-------		------ Yield (bu/ac) ------		---------- Statistics ----------		
Trial ID	App. Date	Product	Untreated	Treated	Untreated	Treated	p-value	CV (%)	Significant?
2023SB01	May 14 (at seeding)	Humic Acid (1x and 2x rates)	123,000	1x: 119,000 2x: 111,000	18.4	1x: 18.6 2x: 18.5	*0.984*	*6.9*	No
2023SB02	May 30 (VE)	Fertiactyl®	237,000	255,000	47.1	46.7	*0.468*	*1.7*	No
2023SB03	June 1 (VE)	Fertiactyl®	121,000	123,000	62.4	65.0	*0.402*	*6.0*	No
2023SB04	June 26 (V2)	Fertiactyl®	130,000	129,000	50.5	50.7	0.514	1.4	No
2023SB05	June 26 (V2)	Envita®	125,000	126,000	55.6	55.3	*0.796*	*2.7*	No
2023SB06	June 26 (V2)	Fertiactyl®	146,000	140,000	59.5	59.1	*0.760*	*2.8*	No
2023SB07	June 29 (V2)	Fertiactyl®	153,000	141,000	37.0	37.2	0.870	5.1	No
2023SB08	June 30 (V2)	Envita®	143,000	146,000	47.6	47.6	0.928	2.4	No

Soybean Biological Trials

Evaluating different biological products on-farm

Long-term Results (2019 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- 25 trials have compared an application of a biological product vs. untreated soybeans on-farm from 2019 – 2023.
- Biological products are chosen by the farmer and applied according to label recommendations.
- 11 products have been tested to-date (see table).

Supporting Data:

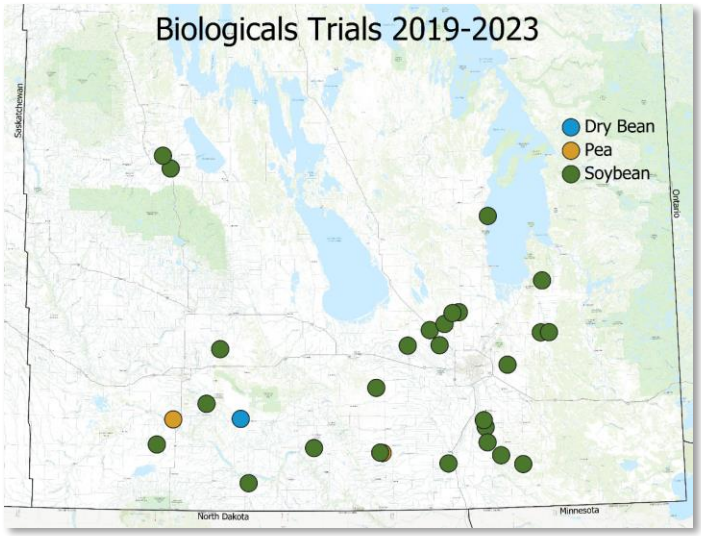
- The goal of these trials is first and foremost to assess the impact of various biological products on yield. As a results, the only supporting data collected are to determine living plant stands.

Yield Results:

- Yield has not been increased with the biological products we have test on-farm to-date.
- There has been one, negative yield response where the application of *Crop Aid Foliar* reduced soybean yield by 1.8 bu/ac.
- These biological products cost anywhere from $5 to $28/ac. With no yield improvements, there has been a loss in profit equivalent to the product cost.

Recommendations from this Research:

- There are a lot of biological products entering the market, all with different claims to promote plant or soil health.
- The best course of action to determine how these products perform in your production system is to conduct an on-farm test.
- Testing these products on-farm helps inform if we can reliably expect to see an effect on yield in the field.



Biological Product	*Number of Trials*	*Yield Response?*
Envita®	9	No
Fertiactyl®	5	No
OHM	3	No
Humic Acid	1	No
Primacy Alpha®	1	No
EZ Gro Prime	1	No
Active Flower™	1	No
HeadsUp® ST	1	No
ACF-SR In-furrow	1	No
Crop Aid Soil	1	No
Crop Aid Foliar	1	Yes, negative

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View on-farm biological individual trial site reports here

Soybean Fungicide Trials

Evaluating fungicide applications on-farm

2023 Results

on-farm network
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Trial Information:

- 2 trials in 2023 comparing a single application of *Veltyma* fungicide to untreated soybeans.
- *Veltyma* was applied at R1 at a rate of 202 mL/ac.
- Diseases on the label for *Veltyma* include Cercospora leaf blight, Septoria brown spot, frogeye leaf spot and pod and stem blight.

Supporting Data:

- Rainfall at SF01 was below normal all season (July: 85%, Aug: 63%), reducing disease pressure. At SF02, rainfall was more variable, swinging from quite dry in July to normal in August (July: 18%, Aug: 101%).
- Diseases were rated 14 days after application. Disease pressure was generally similar between soybeans that received a fungicide application and those that did not (see tables below). At SF02, 5% fewer plants were infected with northern stem canker with a single fungicide application.

Yield and Economic Results:

- There were no yield responses to a single application of foliar fungicide applied at flowering in soybeans in 2023. As a result, there was a loss in profit equivalent to the product cost ($20/ac).
- It is infrequent in Manitoba for Septoria brown spot, frogeye leaf spot, pod and stem blight or Cercospora leaf blight to occur at severity levels great enough to influence soybean yield.

						------ Crop History -------		
Trial ID	R.M.	App. Date (Crop Stage)	App Method	Row Spacing	Seeding Rate (seeds/ac)	2023	2022	2021
SF01	De Salaberry	July 3 (R1)	Aerial	22"	170,000	Wheat	Sunflower	Wheat
SF02	Dauphin	July 6 (R1)	Ground	10"	-	Canola	Wheat	-

2023SF01	----- Septoria Brown Spot ------		----------Incidence (% of plants infected) ----------			
	Incidence (%)	Severity (0-5)	Frog Eye Leaf Spot	Northern Stem Canker	White Mould	Yield (bu/ac)
Untreated	80	1.0	35	0	0	49.0
Single App	90	1.1	33	0	0	49.4
					p-value	*0.5375*
					CV (%)	*7.6*
					Significant?	*No*

2023SF02	----- Septoria Brown Spot ------		----------Incidence (% of plants infected) ----------			
	Incidence (%)	Severity (0-5)	Frog Eye Leaf Spot	Northern Stem Canker	White Mould	Yield (bu/ac)
Untreated	97	1.9	0	13	0	31.3
Single App	98	1.9	0	8	0	31.4
					p-value	*0.8121*
					CV (%)	*3.2*
					Significant?	*No*

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Soybean Fungicide Trials

Evaluating fungicide applications on-farm

Long-term Results (2014 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

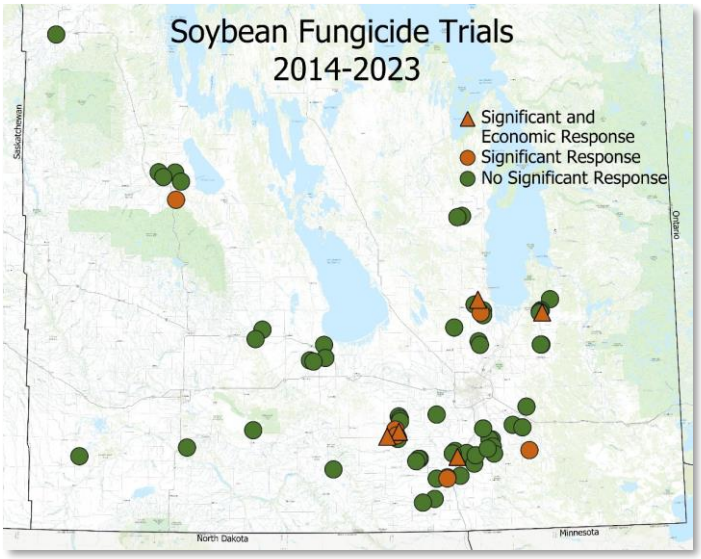
- 66 trials from 2014 – 2020 and 2 trials in 2023 compared a single application of foliar fungicide vs. none in soybeans.
- Fungicide product was chosen by the farmer and fungicides were applied according to the label.
  - Products were most frequently applied at R2 (full flower).
  - Products included *Acapela* (25% of trials), *Cotegra* (19%), *Delaro* (22%), *Dyax* (6%), *Priaxor* (25%) and *Veltyma* (3%).

Supporting Data:

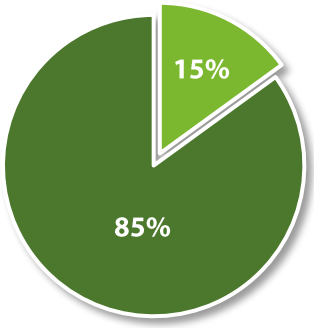
- July rainfall was equal to or greater than normal at 23 trials (34% of trials).
- Incidence (% of plants infected) and severity (0-5 scale) of fungal diseases are rated 10-14 days after fungicide application.
- Diseases evaluated include white mould, Septoria brown spot, frogeye leaf spot, downy mildew, northern stem canker, anthracnose and the presence of bacterial blight and Phytophthora root rot are additionally noted.
  - Of the diseases managed by fungicides, white mould has the greatest potential to limit yield in Manitoba.
- White mould was present at 14 trials (21%), occurring in 2015-17. White mould incidence was reduced with a fungicide app at 6 of those trials (9% of trials overall).

Yield Results:

- A single foliar fungicide application has improved soybean yield 15% of the time, improving yield by 1.3 bu/ac, on average, when significant.
- Larger yield responses (>2 bu/ac) were due to a reduction in the percent of plants infected with white mould. However, at 8 out of 11 trials where a yield response occurred, white mould was not present.



A single application of foliar fungicide improved soybean yield and provided a return on investment only 15% of the time in these on-farm trials over the years.



Recommendations from this Research:

- White mould has the potential to limit soybean yields when conditions are optimal for disease development (warm, humid conditions around flowering) and fungicides can provide a return on investment in those scenarios.
- Assess risk of white mould development at flowering to inform fungicide decisions, consider:
  - weather conditions (15-25°C and 1-2 inches of rain within 1-2 weeks of flowering),
  - canopy thickness (greater plant stands on narrow rows), and
  - crop rotation with other susceptible hosts (canola, beans, sunflowers) and if the previous broadleaf crop had a severe white mould infection.

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View on-farm soybean fungicide individual trial site reports here

Pea Seeding Rate Trials

Evaluating different pea seeding rates on-farm

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- Two trials in 2023 investigated pea seeding rates on-farm near Notre Dame (PSR01) and Dauphin (PSR02).

Trial ID	R.M.	Germ.	Variety	TKW (/1000 seeds)	Row Width
PSR01	Lorne	76%	Chrome	240 g	12″
PSR02	Dauphin	-	Lewochko	230 g	10″

Supporting Data:

- Plant counts were recorded during V-stages and revisited during R-stages to capture how many plants established from the seeding rate and how many survived to harvest.
- At PSR01, 4.2-5.1 plants/ft^2 were established from seeding rates ranging 168-222 lbs/ac (53-57% establishment) and 4.1-4.7 plants/ft^2 survived to harvest (49-56%).
- At PSR02, 5.4-7.1 plants/ft^2 were established from seeding rates ranging 160-240 lbs/ac (66-74% establishment) and 4.8-6.5 survived to harvest (59-67%).

Yield and Economic Results:

- There were no significant yield differences among pea seeding rates tested in 2023.
- Since there were no yield increases to cover the increased seed cost, there was a loss of profit with increased seeding rates at both trials.
- Assuming a seed cost of $29.33/bu *(2023 Cost of Crop Production, Manitoba Agriculture)*:
  - At PSR01, a loss of $11.73/ac and $26.40/ac occurred for the 192 lbs/ac and 222 lbs/ac seeding rates, respectively, when compared to the lowest rate of 168 lbs/ac.
  - At PSR02, there was a loss in profit of $19.55/ac with each seeding rate increase of 40 lbs/ac.

2023PSR01

Seeding Rates Tested		------ Early Season (V) -----		----- Late Season (R) -----			
(lbs/ac)	(bu/ac)	plant stand (plants/ft^2)	% of seeding rate established	plant stand (plants/ft^2)	% of seeding rate survived	% change in plant stand	Yield (bu/ac)
168	2.8	4.2	57%	4.1	56%	-1%	79.3 A
192	3.2	4.9	59%	4.7	56%	-2%	79.1 A
222	3.7	5.1	53%	4.7	49%	-4%	77.5 A
% established or survived = plant count/seeding rate						*p-value*	*0.550*
						CV	*3%*
						Yield Difference?	*No*

2023PSR02

Seeding Rates Tested		----- Early Season (V) -----		----- Late Season (R) -----			
(lbs/ac)	(bu/ac)	plant stand (plants/ft^2)	% of seeding rate established	plant stand (plants/ft^2)	% of seeding rate survived	% change in plant stand	Yield (bu/ac)
160	2.7	5.4	74%	4.8	67%	-7%	62.3 A
200	3.3	6.4	67%	5.5	61%	-7%	59.4 A
240	4.0	7.1	66%	6.5	59%	-6%	56.9 A
% established or survived = plant count/seeding rate						*p-value*	*0.174*
						CV	*6%*
						Yield Difference?	*No*

Pea Seeding Rate Trials

Evaluating different pea seeding rates on-farm

Long-term Results (2021 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- Recommended pea plant stands are 7-8 living plants/ft^2.
- A wide range in living plant stands had previously been noted in other on-farm pea trials (2.7-7.3 plants/ft^2) with seemingly little relationship to yield.
- 9 pea seeding rate trials from 2021 – 2023.
- Seeding rates tested are determined by each farmer with a minimum difference of 20 seeds/m^2 (80,000 seeds/ac).
- All other crop management activities are the same (row spacing, weed control, fertility, etc.).

Supporting Data:

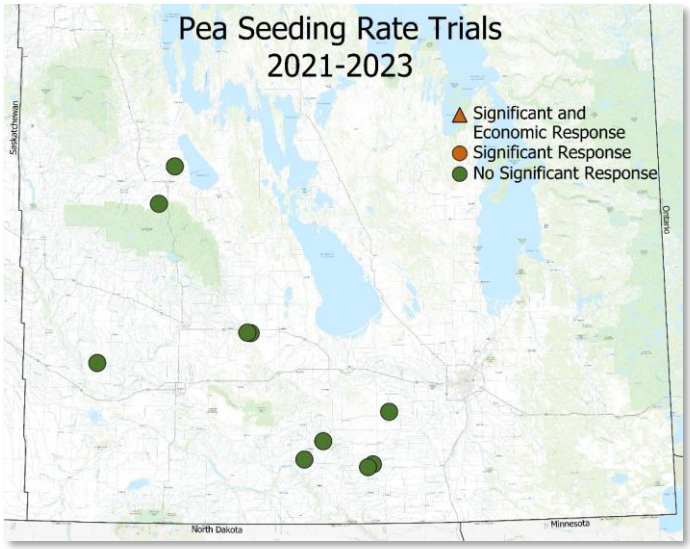
- Plant counts are recorded during V-stages and R-stages.
- Early-season establishment has been 67% on average.
- On average, 4% of pea plants have died during the growing season between early-season and late-season plant counts.
- When comparing among seeding rates, lower seeding rates typically have better percent establishment (on avg 6%↑) and a greater proportion of plants surviving to R stages than medium or high seeding rates tested.

Yield and Economic Results:

- To-date, there have been no significant yield responses to different pea seeding rates tested on-farm.
- When combining results across years, only environment has had a significant effect on yield ($p<0.0001$), accounting for 76% of the variation in pea yield. Seeding rate has only accounted for 4% of the variation in pea yield in these trials to-date.
- A difference of 20 seeds/m^2 is roughly 40 lbs/ac, depending on variety TKW, and this would result in a profit loss of $19.55 with each seeding rate increase of 40 lbs/ac.

Recommendations from this Research:

- Pea seed survivability has been lower than expected on-farm, with only 67% of the seed put in the ground establishing a living plant on average.
- While no yield responses have occurred, dropping seeding rates too low can have negative impacts on standability and crop competition with weeds.
- Evaluate living plant stands in your pea fields and relate those plant counts back to your seeding rate. Are there areas where you can improve survivability on your farm?



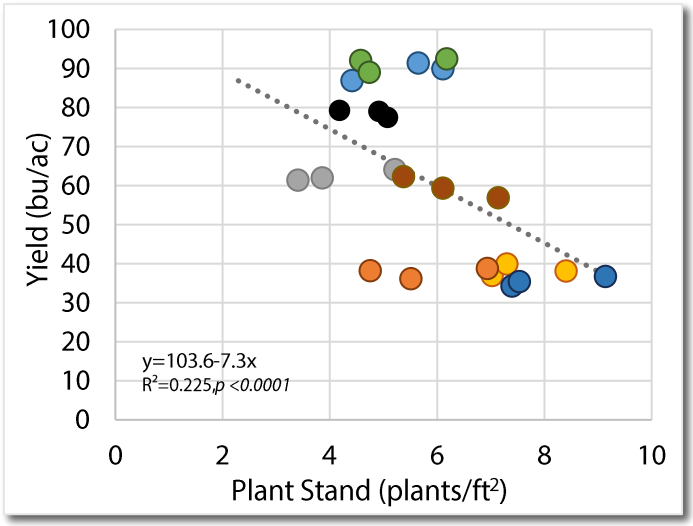


Figure 1. Average pea yields for each seeding rate treatment tested at 8 on-farm trials from 2021-2023, reported by the established living plant stand at V stages (plants/ft^2). Datapoints are colour-coded by trial.

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View on-farm pea seeding rate individual trial site reports here

Pea Seed Treatment Trials

on-farm network
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New Trial Type in 2023!

Why are these trials important?

Fungicide Seed Treatments and Root Rots in Peas

Aphanomyces root rot is the most devastating disease of peas and can lie dormant in the soil for more than 10 years between host crops. Once Aphanomyces is present in a field, there is very little farmers can do besides extend the rotation break between pea crops to draw disease levels down. Even after an 8–10-year break between pea crops, Aphanomyces will likely still be present at low levels in the field. If soil conditions are saturated, there is the potential for this disease to flourish.

Aphanomyces root rot often co-infects with Fusarium root rots, resulting in much more severe infections. Fusarium root rots are detected in every pea field, every year at some level. The risk for these two root rots is greatest in warm, saturated soils.

Fungicide seed treatments provide early-season protection against Fusarium root rots and fairly new to the market are two registered seed treatment options for Aphanomyces suppression *(Rancona Trio* and products containing *Intego Solo*). While season-long control is not expected, these products may help peas establish in the early-season, allowing them to better tolerate infections later in the season. Will these products provide enough protection to pay for themselves? That is the desire behind testing them on-farm, at the field scale.

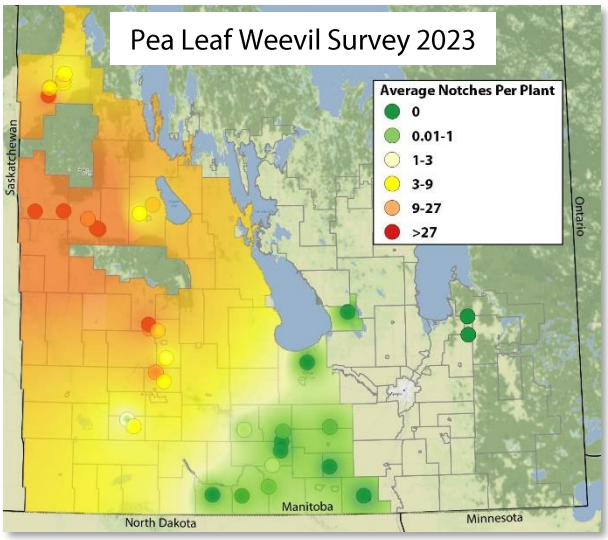
Insecticide Seed Treatments and Pea Leaf Weevils (PLW)

Pea leaf weevils (PLW) are a fairly new pest to Manitoba and their population numbers have been increasing in the northwest region.

In the spring, adult PLWs feed on pea leaves. This results in a characteristic leaf notching pattern that can be used to estimate PLW populations (see map). The adult PLW feeding does not cause yield loss, but once they have started feeding on peas, they begin laying eggs in the field. Those eggs hatch, larvae burrow below ground and feed on root nodules, robbing the plant of nitrogen fixation. This larval feeding causes yield loss.

While foliar insecticides are available for PLW, they are considered ineffective since PLW eggs have already been laid once adult numbers have reached threshold levels in the field. Insecticide seed treatments are one of few effective tools available to combat PLW. However, it is not known what PLW population level we are likely to see a return on investment to insecticide seed treatments. Additionally, these seed treatments mainly paralyze adult PLWs. While defoliation, egg laying and larval feeding are reduced with a seed treatment, PLW damage is not eliminated entirely.

Complementary to these on-farm trials, small-plot trials were initiated in 2023 at Roblin and Swan River comparing registered seed treatment options for pea leaf weevil control (*Cruiser FS* (thiamethoxam), *Stress Shield 600* (imidacloprid), *Lumivia CPL* (chlorantraniliprole) vs. untreated peas). These trials are planned to continue to 2025.



MANITOBA Pulse Soybean GROWERS

Pea Seed Treatment Trials

Comparing treated vs. untreated seed on-farm

on-farm network
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2023 Results

Trial ID	R.M.	Variety	Seeding Rate	Row Width	Seeding Date
PST01	Roblin	Carver	180 lbs/ac	10″	May 4
PST02	Louise	Lewochko	228 lbs/ac	7.5″	May 13

Trial Information:

- Two trials in 2023 investigated pea seed treatments on-farm near Roblin (PST01) and Crystal City (PST02).

Supporting Data:

- High-risk areas of trial fields were soil sampled in the spring and submitted to Discovery Seed Labs to test for Aphanomyces root rot. Aphanomyces was not detected at PST01 and a high level of Aphanomyces was detected at PST02.
- At V6, 10 plants per plot were rated for root rot at both trials. At PST01, 10-20% fewer plants were infected with root rot when comparing treated to untreated peas. At PST02, 13% fewer plants were infected with root rot. At both sites, severity of root rot remained very low (<1 on a 0-9 scale) due to dry spring conditions.
- Pea leaf weevil predation was assessed at PST01 since an insecticide seed treatment was tested. There were no differences in total number of notches per plant at V6 and, while the insecticide treatment did have more nodules at R3, it was not significantly different from the untreated peas.
- Two complementary small-plot trials are on-going at Roblin and Swan River to test different available insecticide seed treatments for pea leaf weevil management. There were no yield differences at those trials in 2023.

Yield and Economic Results:

- There were no significant yield differences among pea seed treatments or untreated peas in 2023.
- Since there were no yield increases to cover the extra seed treatment cost, there was a loss in profit of $14-17/ac for *Rancona Trio* alone, $27/ac for *Rancona Trio* + imidacloprid insecticide and $11/ac for *Trilex Evergol.*

2023PST01

Seed Treatment	Germ.	Plant Stand (plants/ft^2)	Root Rot: Incidence (% of plants infected)	Root Rot: Severity (0-9 scale)	Pea Leaf Weevil: Total # Notches per plant at V6	Pea Leaf Weevil: Total # Nodules per plant at R3	Yield (bu/ac)
Rancona Trio	92%	4.5	48%	0.5	50	3.6	79.9 A
Rancona Trio + insecticide	90%	4.6	58%	0.6	50	6.0	81.6 A
Trilex Evergol	94%	3.8	58%	0.6	58	4.2	79.7 A
Untreated	95%	4.1	68%	0.8	61	4.3	77.3 A
				p-value	*0.423*	*0.798*	*0.464*
				CV	*24%*	*77%*	*5%*
				Difference?	*No*	*No*	*No*

Pea root rot severity ratings. L to R: 0 = healthy roots, 1 = infection at the point of seed attachment and 2 = lesion covering 5-10% of roots.

2023PST02

Seed Treatment	Germ.	Plant Stand (plants/ft^2)	Root Rot: Incidence (% of plants infected)	Root Rot: Severity (0-9 scale)	Yield (bu/ac)
Rancona Trio	82%	5.4	10%	0.1	34.3 A
Untreated	83%	5.0	23%	0.3	35.6 A
				p-value	*0.266*
				CV	*5%*
				Difference?	*No*

MANITOBA Pulse Soybean GROWERS

Pea Fungicide Trials

Evaluating fungicide applications on-farm

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

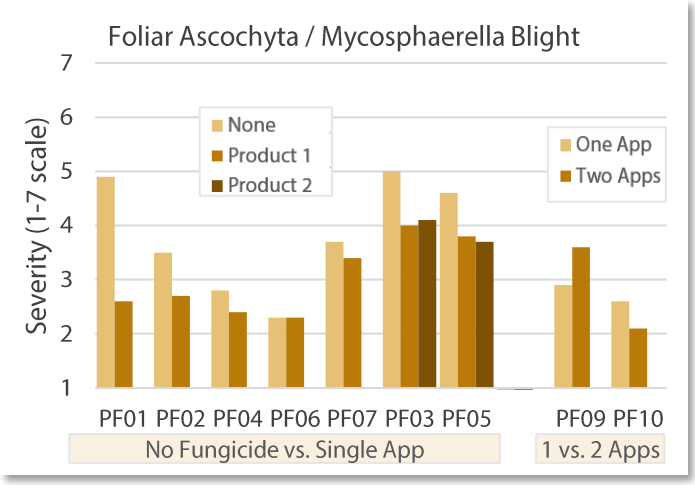
- 7 trials compared a single application of fungicide applied at flowering vs. none in 2023.
  - 2 trials compared more than one product vs. none (PF03 and PF05).
- 2 trials compared two applications of fungicide vs. one app (PF09 and PF10).

Supporting Data:

- Foliar and stem infections of Ascochyta / Mycosphaerella (A/M) blight and other fungal diseases were rated 10-14 days after application.
  - The percent of plants with foliar A/M lesions was similar between sprayed and untreated peas. The severity of those infections, however, was reduced with a fungicide application at 7 out of 9 trials in 2023.
  - The percent of plants with stem infections of A/M was reduced with a fungicide app at 7 out of 9 trials in 2023, though the severity of stem infections remained low.
- 10 pea plants with visible A/M blight lesions were sampled from untreated areas of select fields and tested to determine the proportion of the disease population that was resistant to group 11 fungicides. The greatest amount of resistance was found in central Manitoba (4.5-4.8%).
- After harvest, seed samples were submitted for further disease testing to assess if fungicide had an impact on the amount of seed infected with Ascochyta. A fungicide application reduced the amount of seed infections at 5 out of 7 trials in 2023.

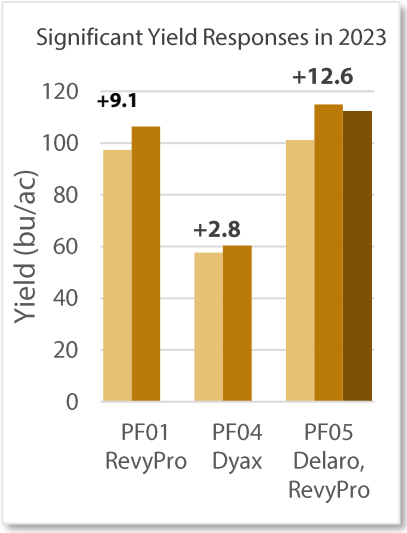
Yield and Economic Results:

- There was a significant yield increase with a single application of fungicide vs. none at 3 out of 7 single vs. none trials (43% of 2023 trials). Yield was increased by 2.8-12.6 bu/ac.
  - At PF05, both products tested (Delaro and RevyPro) increased yield vs. no app, but products did not perform differently from one another.
- There were no yield differences at the two double vs. single trials in 2023.
- Assuming a product cost ranging $10-23.00/ac and a pea sell price of $10/bu, a break-even yield increase would be 1.0-2.3 bu/ac.



Trial ID	Nearest Town	Gr 11 Resistance[1]	--- Seed-Borne Ascochyta[2] --- No App	Product 1	Product 2
PF01	Dauphin	0.2 %	3.9 %	0.8 %	-
PF02	Roblin	0.5 %	0.5 %	0	-
PF03	Sperling	4.5 %	0	0	0
PF04	Elm Creek	1.8 %	0	0.1 %	-
PF05	Notre Dame	0.1 %	2.3 %	0.1 %	1.0 %
PF06	Notre Dame	-	0.5 %	0	-
PF07	Stonewall	4.8 %	1.5 %	1.0 %	-
PF10	Swan River	0.02 %	-	-	-

[1]Percent of Ascochyta/Mycosphaerella blight resistant to group 11 fungicides
[2]Post-harvest assessment of the effect of an in-season fungicide app on percent of seed infected with Ascochyta



MANITOBA Pulse Soybean GROWERS

Pea Fungicide Trials

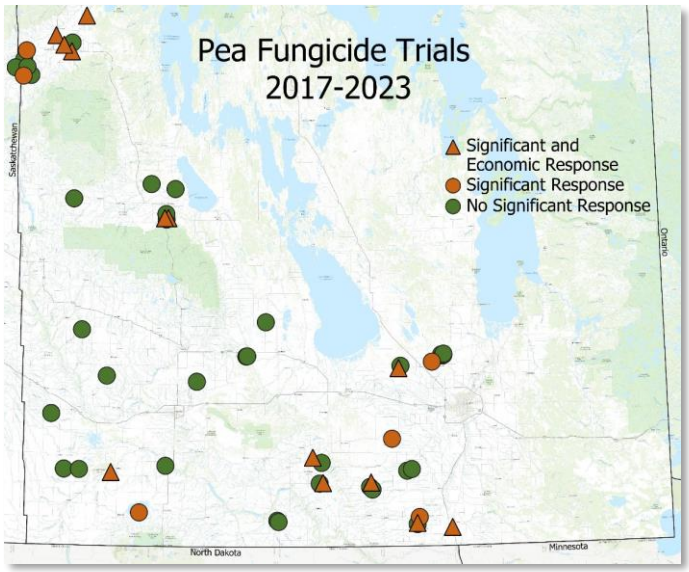
Evaluating fungicide applications on-farm

Long-term Results (2017 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- 53 on-farm trials have explored fungicide applications in peas from 2017 – 2023.
  - 32 trials have compared a single application vs. none (1 vs. 0).
  - 18 trials have compared two applications vs. a single application (2 vs. 1).
- Products are chosen by participating farmers and applied according to label recommendations.
  - 1st apps are typically applied at R1-R2 (early to full flower) and 2nd apps 10-14 days later at R3 (flat pod).



Supporting Data:

- Diseases have been evaluated since 2019. Ascochyta / Mycosphaerella (A/M) blight is the main disease target of fungicide application and both foliar and stem infections are rated.
- Single vs. None (1 app vs. 0):
  - The percent of plants with foliar A/M infections has been similar between treated and untreated peas. The severity of those foliar infections has been reduced with a fungicide app at 43% of trials. Stem infections have been reduced in both incidence and severity at 25% of trials.
- Double vs. Single (2 vs. 1 app):
  - The percent of plants with foliar infections has been similar between one app and two. The severity of foliar infections was reduced at 27% of trials. Stem infections occurred less with a second app at 27% of trials and severity of stem infections was reduced at 18% of trials.

Yield Results:

- Single vs. None (1 app vs. 0):
  - A single application of fungicide improved pea yield 31% of the time vs. no app, increasing yield by 5.6 bu/ac on average (range: 2.0-12.6 bu/ac).
  - During dry years (2019-21), it was more common for a farmer to question if a fungicide application was necessary at all due to low disease risk. In these years, fungicide application paid less frequently.
- Double vs. Single (2 vs. 1 app):
  - Two applications improved pea yield 39% of the time vs. one app, increasing yield by 5.1 bu/ac on average (range: 2.7-7.1 bu/ac).
  - In wetter growing conditions that were conducive to disease development, it was more common to question if a second fungicide application was necessary to manage disease. When a second application has protected yield, it has consistently provided a return on investment in on-farm trials (all yield responses were economical).

Recommendations from this Research:

- Make informed fungicide application decisions by scouting peas ahead of application from V10 to R2, around late June to mid July. Look in the bottom of the crop canopy for freckling symptoms on lower leaves .
- Use *MPSG's Fungicide Decision Worksheet* to assess risk factors like crop canopy thickness, humidity, weather conditions and the amount of plants showing symptoms.
- Revisit pea fields following application to assess if a second application may be warranted.

MANITOBA Pulse Soybean GROWERS

View on-farm pea fungicide individual trial site reports here

Dry Bean Inoculant Trials

on-farm network
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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.

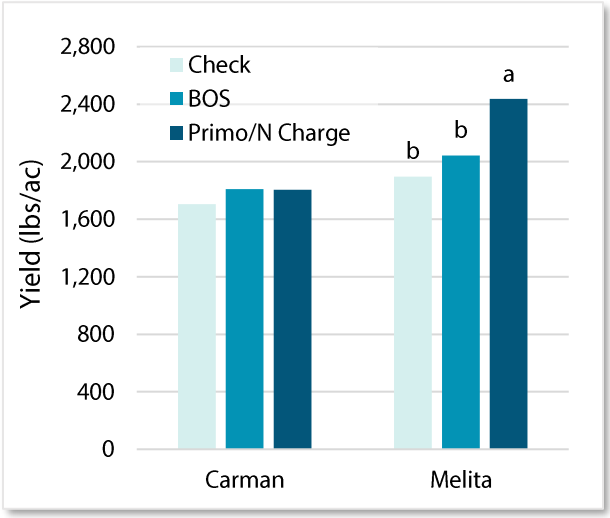


Figure 1. Average pinto, navy and black bean yield response to inoculant products at Carman (2019-21) and Melita (2020-21). Different letters above bars indicate statistically different yields at $p < 0.05$.

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.

Dry Bean Inoculant Trials

Evaluating inoculant products on-farm

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

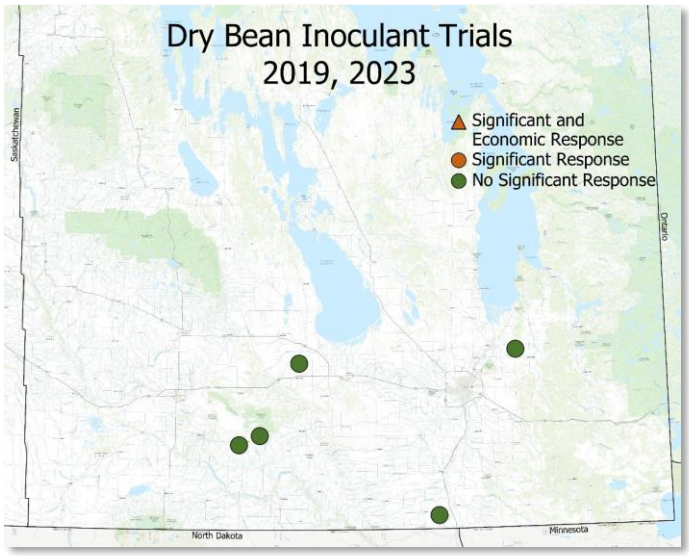
- 4 trials in 2023 tested an inoculant product in dry edible beans.
  - *Agtiv Fuel* is a liquid rhizobium inoculant product for peas and lentils containing *Rhizobium leguminosarum* biovar *viciae*.
  - *Agtiv Thrive* is a liquid product for peas and lentils combining a rhizobium inoculant (*Rhizobium 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.

MANITOBA Pulse Soybean GROWERS

Dry Bean Nitrogen Trials

Evaluating rates of nitrogen fertilizer on-farm

2023 Results

on-farm network
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Trial Information:

- One trial in 2023 tested four rates of nitrogen (N) fertilizer (0, 25, 55 and 85 lbs N/ac) in black beans near Deloraine.
- Residual nitrate-N in the fall for the field was 36 lbs N/ac A second soil test was taken in the spring before seeding of the trial area and residual nitrate-N was 88 lbs N/ac (0-24").

Supporting Data:

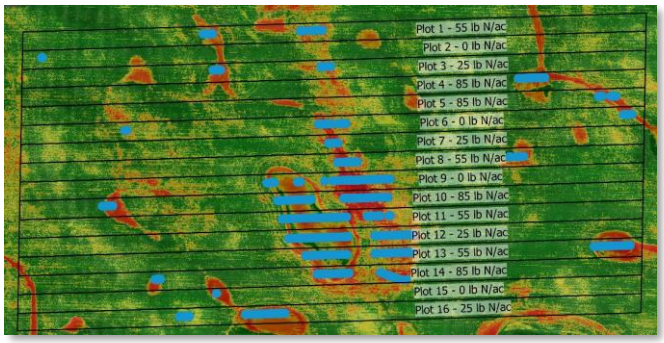
- Nodulation was assessed at flowering (R2). There were no differences in nodulation numbers among nitrogen rates tested, with low numbers of nodules observed ranging from 0.8 to 3.0 nodules/plant, on average.
- There were no differences in lowest pod height among N rates tested, lowest pod heights were 3.2 inches from soil to the point of pod attachment, on average.

Yield and Economic Results:

- There were no significant yield differences among nitrogen fertilizer rates tested, however the trend was that with increasing N fertilizer rates, yield increased.
- Assuming a nitrogen cost of $1745/tonne, nitrogen rate treatments cost $0.97/lb N, resulting in a profit loss of $24 for 25 lbs N/ac, $53 for 55 lbs N/ac and $82 for 85 lbs N/ac.

DBN01

Nitrogen Rate (lbs N/ac)	Total # nodules/plant	Lowest pod height (in)	Yield (lbs/ac)
0	1.8	3.0	1382
25	3.0	3.2	1481
55	3.0	3.4	1589
85	0.8	3.3	1611
p-value	*0.278*	*0.230*	*0.082*
Significant?	*No*	*No*	*No*



To compensate for disproportionate field variability in the trial, a yield correction was performed by removing areas of the field that yielded <250 lbs/ac, indicated in blue.

Nitrogen Balance:

- Nitrogen removal, uptake and total N supply to the crop were estimated. Post-harvest, N remaining in the soil was determined by taking composite soil samples (0-24") from each treatment strip.
- For the 0N strips, a 1382 lbs/ac yield would require an estimated 54-65 lbs N/ac for plant uptake. Residual soil N and N from MAP fertilizer would have provided 93 lbs N/ac. Post-harvest soil tests indicate a surplus of N, with 72 lbs N/ac remaining in the soil after harvest.
- Additional N fertility was likely supplied by mineralization since nodule numbers were low, indicating little contribution from biological N fixation and plant roots were concentrated at the 0-24" depth, so sources of N deeper than two feet were unlikely to have contributed to N nutrition as well.

Nitrogen Rate (lbs N/ac)	Yield (lbs/ac)	Estimated N Removal[1] (lbs N/ac)	Estimated N Uptake[2] (lbs N/ac)	Estimated N Supply[3] (lbs N/ac) (0-24")	Post-harvest N (lbs N/ac) (0-24")
0	1382 a	49	59	93	72
25	1481 a	53	64	118	146
55	1589 a	56	68	148	80
85	1611 a	57	69	178	153

[1] Estimated N Removal is 3.5 lbs/cwt of seed (Prairie Nutrient Removal Calculator 2022)
[2] Estimated N Uptake range is 3.9 - 4.7 lbs/cwt of seed (Heard 2008). Values in the table are estimated using 4.3 lbs/cwt of seed.
[3] Estimated N Supply is the combination of N supplied from residual soil nitrate-N, MAP fertilizer and N fertilizer treatments

MANITOBA Pulse Soybean GROWERS

Dry Bean Nitrogen Trials

Evaluating rates of nitrogen fertilizer on-farm

Long-Term Results (2019 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- 6 on-farm trials have tested a range of nitrogen rates (0-140 lbs N/ac) in navy, pinto and black beans from 2019-2023.
  - Rates tested are chosen by the farmer and 3 or 4 rates are compared.
  - Residual soil-N ahead of growing dry beans ranged from 20-88 lbs N/ac.

Supporting Data:

- These on-farm trials have not been inoculated, yet often have good to excellent nodulation ratings (>15 nodules/plant on average).
- As N fertilizer rates applied increased, dry bean nodulation decreased since plants become 'lazy' and rely on soil N alone.
- In most trials, nodulation was greatest when N rates applied were below 70 lbs N/ac.

Yield Results:

- Yield response to nitrogen rate has been inconsistent on-farm.
- At four trials, there was no yield response to different N rates and at two trials, opposite yield responses occurred (yield increasing or decreasing with additional N).
- Yield was increased at one on-farm trial in 2021, where drought is expected to have impacted mineralization, leading the crop to rely more heavily on applied fertilizer-N.

Small-Plot Trials Results:

- These on-farm trials have complimented two small-plot trials from 2017-2019 at Carman and Portage and from 2021-2022 at Brandon, Carberry and Melita.[1]
- At Carman and Portage, yield was increased with the highest rate of N fertilizer (140 lbs N/ac), however, when considering the return on investment it was statistically similar for all rates of N tested, meaning the economic optimum was to not apply any N fertilizer at all.
- At Brandon, Carberry and Melita, there was no yield response to different N rates at 9 out of 10 site-years.
- Small-plot trials are planned to continue investigating the combination of N rates and inoculant products.

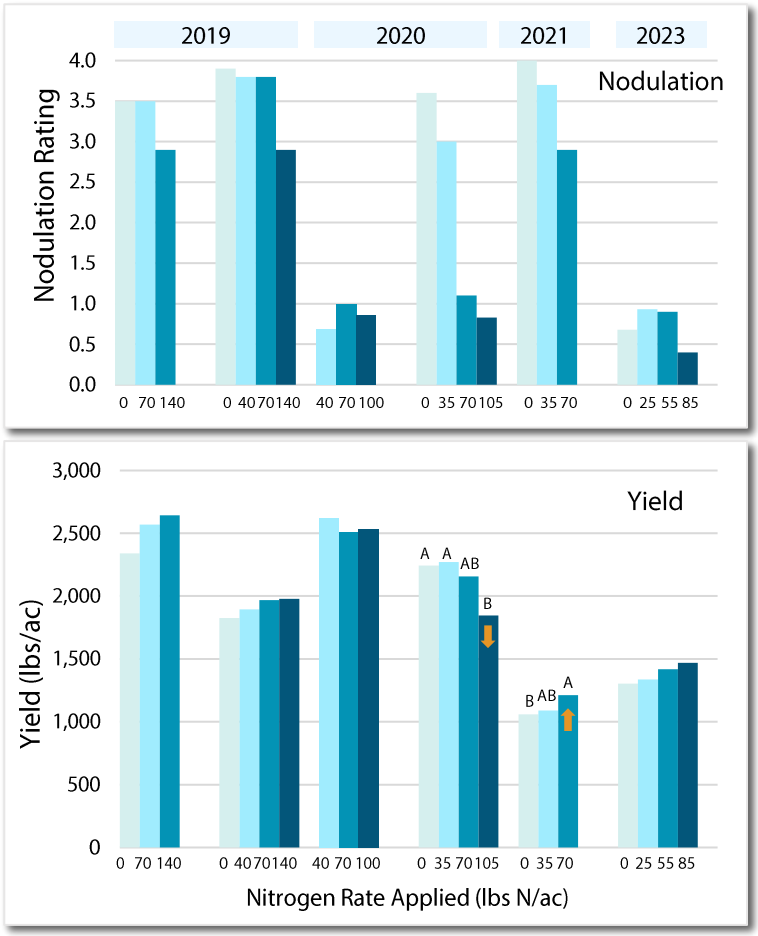


Figure 1. Nodulation (rated on a scale of 0-4) and yield of dry beans at six on-farm trials testing nitrogen fertilizer rates.

Recommendations from this Research:

- Results from the small-plot and on-farm research are being reviewed along with inoculant research to revisit N recommendations for dry beans in Manitoba.
- Consider crop nitrogen needs by calculating nitrogen uptake for your yield goal (4.5 lbs N required per cwt) and account for soil residual N.
- Dig up dry bean roots at flowering to evaluate nodulation in your fields. If nodules are present and actively fixing N (pink colour inside the nodule), there is the potential to reduce N rates applied to dry bean crops in that field by attributing an N credit to biological N fixation.

[1] Small-plot research conducted at Carman and Portage in pinto and navy beans by Kristen MacMillan, MPSG-UM Agronomist-in-Residence, University of Manitoba and research conducted at Brandon, Carberry and Melita in narrow-row black and pinto beans by Dr. Ramona Mohr, AAFC-Brandon

MANITOBA Pulse Soybean GROWERS

View on-farm dry bean nitrogen individual trial site reports here

Dry Bean Fungicide Trials

Evaluating fungicide applications on-farm

2023 Results

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

- 2 trials in 2023 compared a single application of foliar fungicide applied at flowering vs. none in dry beans.

Supporting Data:

- Rainfall in July plays a large role in white mould development. At both trials, rainfall in July was 40% of normal, with 35-49% of normal rainfall in August.
- Diseases were rated 10-14 days after application and fields were revisited 30 days after application for a second disease assessment. White mould was not observed in these trials in 2023.
- Bacterial blight was present at both trials, infecting 24% of plants at DBF01 and 47% of plants at DBF02. As bacterial blight is not controlled by fungicide applications, disease severity was not evaluated.

Yield and Economic Results:

- Yield was increased by 165 lbs/ac with a fungicide application in black beans at DBF01.
- Assuming a product cost of $22/ac for Proline Gold and a black bean sell price of $0.47/lb, there was an increase in profit of $55.50/ac with a single fungicide application at DBF01.
- There was no yield response to fungicide app at DBF02, so a loss in profit of roughly $13-18/ac occurred.

White mould (pictured above) was not observed in on-farm dry bean fungicide trials in 2023.

						---------- Crop History ----------			
Trial ID	Market Class	R.M.	Product	Row Spacing	Seeding Rate	2022 Crop	2021 Crop	2020 Crop	July/Aug Rainfall (% normal)
DBF01	Black	Souris-Glenwood	Proline Gold	12"	152.000	Canola	Wheat	Canola	40 / 35
DBF02	Pinto	Roland	Lance	15"	70,000	Canola	Sunflower	Wheat	39 / 49

	---------- Yield (lbs/ac) ----------			---------- Statistics ----------			---------- Economics ----------	
Trial ID	Untreated	Single App	Difference	*p-value*	CV (%)	Significant?	Product Cost ($/ac)	Change in Profit ($/ac)
DBF01	2154	2318	**+165**	0.0071	4.2	**Yes**	$22.00	**+$55.50**
DBF02	1553	1545	-8	0.8827	5.5	No	$12.95-17.80	-$12.95-17.80

Product costs are estimates and do not include the cost of application. Change in profit has been calculated for DBF01 assuming a black bean sell price of $0.47/lb.

Dry Bean Fungicide Trials

Evaluating fungicide applications on-farm

Long-term Results (2016 – 2023)

on-farm network
PARTICIPATORY • PRECISE • PROACTIVE

Trial Information:

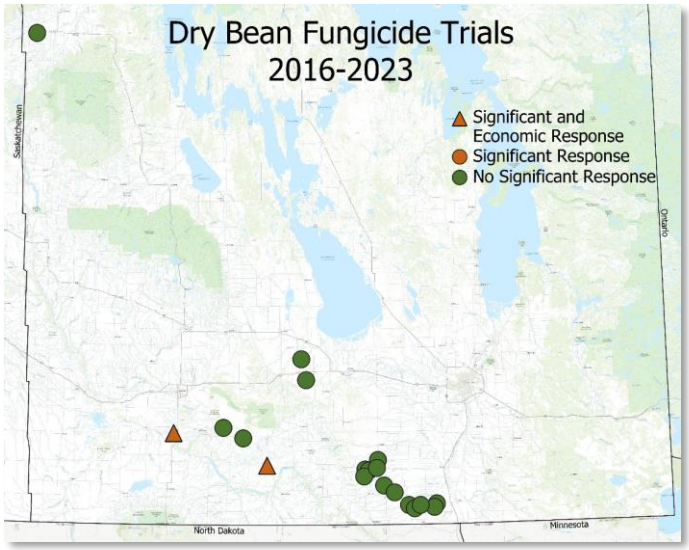
- 18 trials from 2016-2023 have compared a single application of foliar fungicide vs. none in dry beans.
  - 1 trial compared two apps to one.
- Fungicide product was chosen by the farmer and fungicides were applied according to the label .
  - Products were most frequently applied at R2 (early pin bean).
  - Products included *Acapela, Lance, Cotegra, Allegro, Proline Gold* and *Dyax.*
- 16 trials were grown on 30" rows and 2 trials were on <15" rows.

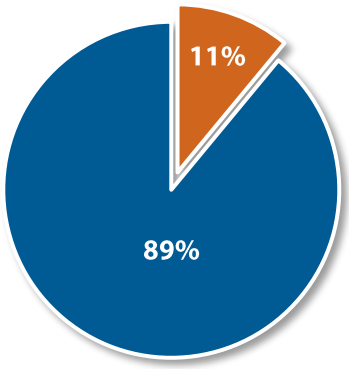
Supporting Data:

- White mould is the main disease target of fungicides applied in dry beans. July rainfall is critical for this disease's development. July rainfall was at or above normal at 4 of 18 single vs. none trials, otherwise trial fields were drier than normal.
- Diseases were rated 10-14 days after application. White mould was present at 50% of trials and the percent of plants infected were lower in those that had a fungicide app at 7 out of 8 trials where the disease was present.

Yield Results:

- A single foliar fungicide application has improved dry bean yield at 2 trials (11% of the time). Yields were improved by 165-175 lbs/ac, where significant.
- Assuming an average product cost of $18/ac and a dry bean sell price of $0.40/lb, a profit increase of roughly $50/ac occurred at those two significant sites.





A single application of foliar fungicide improved dry bean yield and provided a return on investment only 11% of the time in these on-farm trials.

Recommendations from this Research:

- Fungicides for white mould are preventative, meaning they must be applied before symptoms of the disease are observed in the field.
- White mould has the potential to limit dry bean yields when conditions are optimal for disease development (warm, humid conditions around flowering) and fungicides can protect yield and provide a return on investment in those scenarios.
- Assess risk of white mould development at flowering to inform fungicide decisions, consider:
  - ✓ Weather conditions (15-25°C and 1-2 inches of rain within 1-2 weeks of flowering are the greatest risk),
  - ✓ Canopy thickness (greater plant stands on narrow rows or high N rates leading to lush, thick canopies),
  - ✓ Crop rotation with other susceptible hosts (canola, beans, sunflowers) and if the previous broadleaf crop had a severe white mould infection.

View on-farm dry bean fungicide individual trial site reports here

MANITOBA Pulse Soybean GROWERS

NOTES

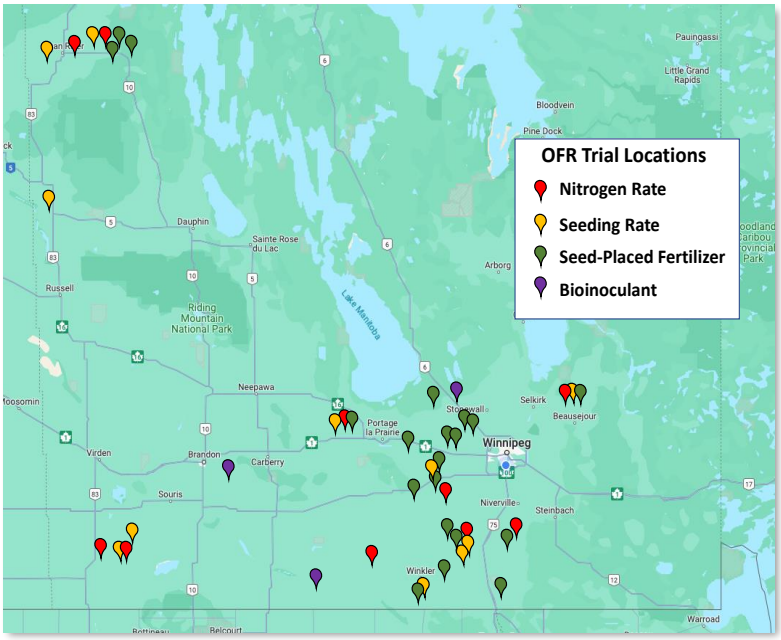
Canola On-Farm Research Program

Manitoba Canola Growers On-Farm Research Program began in 2022 with nitrogen rate, seeding rate and bioinoculant trials. In 2023, an additional seed-placed fertilizer toxicity trial launched and a cover crop for flea beetle management trial is planned to start in the 2024 field season.

Number of Locations by Trial Type

Trial Type	2022	2023	2024 (target)
Nitrogen Rate	5	5	5
Seeding Rate	4	7	5
Bioinoculant	3	-	-
Seed-placed Fertilizer	-	20*	30*
Cover Cropping for Flea Beetle Management	-	-	3

Replicated by location (1 rep per location)



MCGA On-Farm Research Program aims to collaborate with farmers, agronomists and researchers to provide the most relevant and valuable information to our members.

Canola Growers: If you are interested in participating in, or have a trial idea for our on-farm program

Agronomists: MCGA contracts agronomists from across the province to work with farms to establish, manage and harvest research trials. If you are interested in working with MCGA as an Agronomic Partner

Researchers: If you are interested in collaborating with the Canola On-Farm Research Program to complement your research program

2023 Agronomic Partners:

- Antara Agronomy Service Ltd.
- Tone Ag Consulting Ltd.
- New Era Ag Research
- A1 Agronomy Inc.
- Field 2 Field Agronomy Inc.
- Ag Advantage Ltd. (Meadows)

Please contact Amy Delaquis at (204) 384-1196 or Amy@CanolaGrowers.com

Sustainable Canadian Agricultural Partnership

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Manitoba Canola Growers

Canola Nitrogen Rate Trials

2022 – 2023

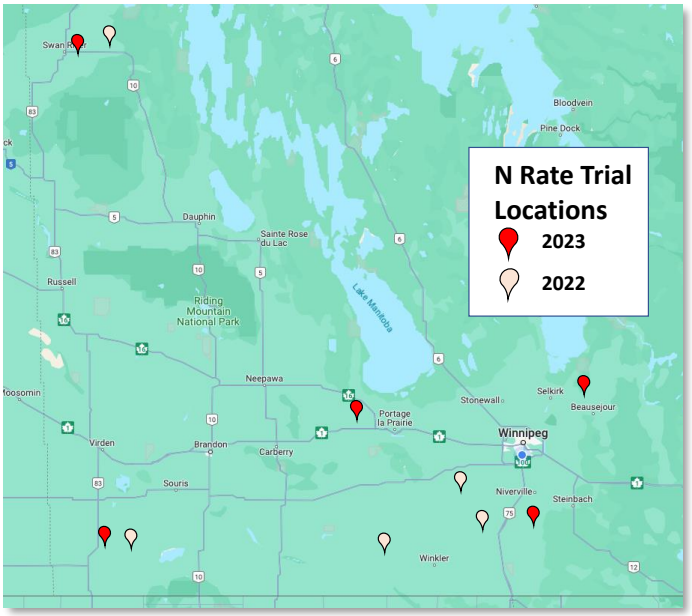
Research Question: Are N rates being used on canola across Manitoba sufficient for optimizing yield, nitrogen efficiency and return on investment?

Treatments

1. Reduced N Rate (75%)
2. Standard N Rate (100%)
   Farm Normal for Field
3. High N Rate (125%)

Trial Setup: Randomized complete block, each treatment was one equipment width x field length, with 4 replicates per locations (12 strips per location)

Data Collection: Plant Counts, Tissue N (bolting), Yield, Protein, Oil Content



Trial ID (year)	RM	Standard N Rate (100%)		Reduced N Rate (75%)	High N Rate (125%)	CV
		N Applied (soil residual N)	Yield	Change in Yield from Standard Rate		
		lbs. N/ac	*bu/ac*	*bu/ac*	*bu/ac*	*%*
NR_01 (2022)	Swan Valley West	113 (76)	47.1	-0.4	+1.6	1.8
NR_02 (2022)	Macdonald	122 (55)	52.0	+2.3	**+3.9***	4.1
NR_03 (2022)	Lorne	138 (60)	35.4	+0.9	+0.1	5.5
NR_04 (2022)	Morris	120 (53)	58.6	**-4.2***	+0.4	4.5
NR_05 (2022)	Two Borders	118 (79)	42.0	-3.3	+0.9	11.9
NR_06 (2023)	Minitonas-Bowsman	113 (18)	55.5	**-5.3***	-0.5	5.2
NR_08 (2023)	North Norfolk	135 (25)	58.0	-2.5	+4.2	9.2
NR_09 (2023)	Brokenhead	137 (30)	61.7	-0.9	+3.0	4.2
NR_10 (2023)	Two Borders	130 (50)	51.4	+2.3	+3.3	7.6
NR_11 (2023)	De Salaberry	158 (127)	22.8	-1.3	-0.1	5.5
COMBINED		**129 (57)**	**48.4**	**-1.3**	**+1.6***	**24**

*Significantly different from standard N rate (p-value < 0.05)

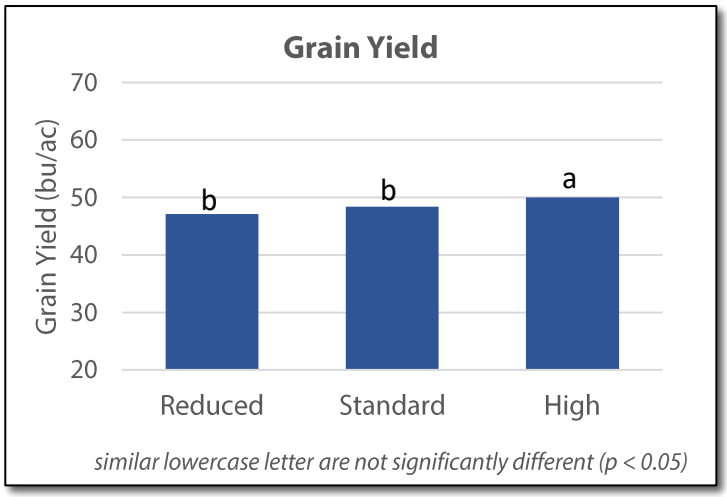
- Average farm standard N rate (fertilizer +soil residual) was **186 lbs. N/ac**, ranging from **131 – 285 lbs. N/ac**.

Canola Nitrogen Rate Trials

2022 – 2023

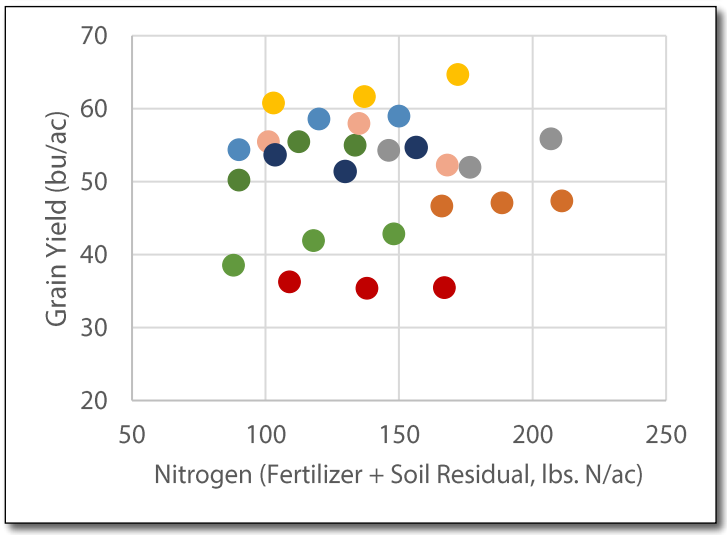
Grain Yield

- Average grain yield across all trial locations when the farm normal rate of N fertilizer was applied was **48 bu/ac,** ranging from **23 – 62 bu/ac.**
- Overall, there was a significant 1.6 bu/ac increase in yield when an additional 25% N fertilizer was applied to the farm standard N rate.
- 2 of 10 locations had a significant yield reduction of -4.2 and -5.3 bu/ac when N was reduced by 25%.
- 1 of 10 locations had a significant yield increase of 3.9 bu/ac when N fertilizer was increased by 25%.



Nitrogen Fertilizer Efficiency

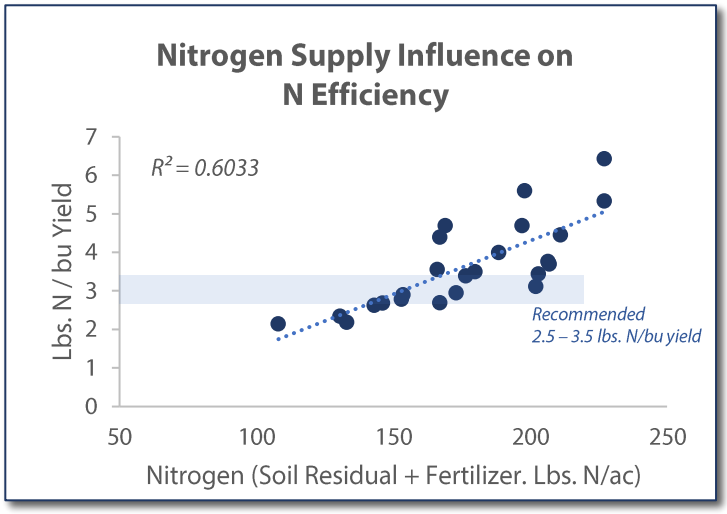
- The current N fertilization recommendation for canola in Manitoba is to provide canola with 2.5 to 3.5 lbs. N (soil + fertilizer) per bushel of yield targeted (Canola Council of Canada and Manitoba Agriculture). Example: for a target yield of 50 bu/ac recommended N would be from 125 to 175 lbs. N/ac (soil + fertilizer).
- N provided to the crop per bushel at farm standard N rate ranged from 2.4 to 5.6.
- As the amount of fertilizer supplied to the crop increases the efficiency of N was reduced → more N provided per bushel of yield.



Economic considerations will vary farm-to-farm depending on buying price of N fertilizer, canola price and standard N rates.

In Summary

- <u>All results presented are preliminary</u> as this trial will run in 2024 and 2025 field seasons.
- Farms that saw a decrease in yield with reduced N rates achieved high grain yield (>55bu/ac) with modest N fertilization (2.4 and 2.9 lbs. N/bu yield).
- The significant combined increase in grain yield of 1.6 bu/ac for could be sufficient to cover the added cost of 32 lbs. N/ac ($0.76 lbs. N and $16 canola).
- Grain protein and oil content results are pending.



For full individual trial reports with all data collected please visit ***Canolagrowers.com***

Canola Seeding Rate Trials

2022 – 2023

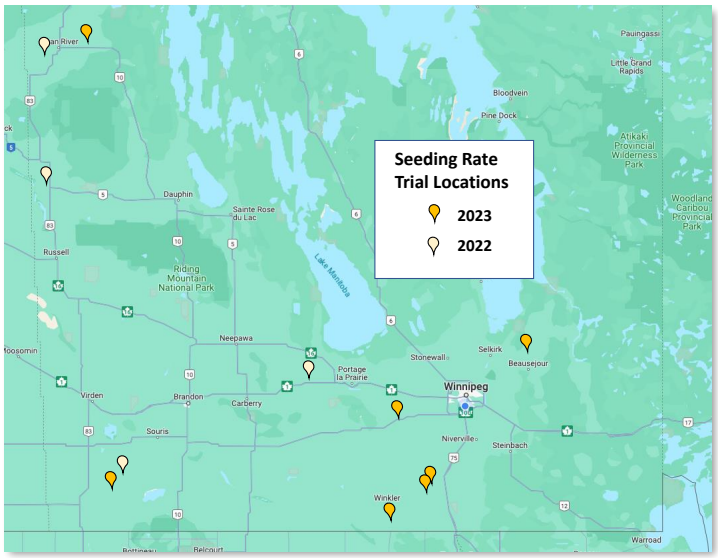
Research Question: Can Manitoba canola farms reduce their seeding rates without sacrificing yield to increase return on investment?

Treatments

1. Reduced Seeding Rate (75%)
2. Standard Seeding Rate (100%)
   Farm Normal
3. High Seeding Rate (125%)

Trial Setup: Randomized complete block, each treatment was one equipment width x field length, with 4 replicates per locations (12 strips per location)

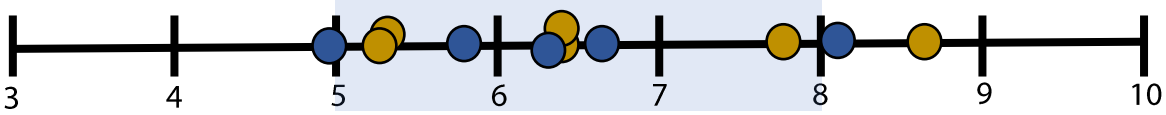
Data Collection: Plant Counts (4 leaf and Maturity), Grain Yield



Trial ID (year)	RM	Plant Counts at 4-Leaf Stage			Change in Emergence from Standard Rate	
		Reduced	Standard	High	Reduced	High
		plants/ft²			%	
SR_01 (2022)	Swan Valley West	5.1a[i]	5.3a	6.3a	+17	-3
SR_03 (2022)	Roblin	6.2b	6.4ab	6.8a	+16*	-9*
SR_04 (2022)	Brokenhead	5.1b	5.8b	**7.4a**	+21*	0
SR_05 (2022)	Two Borders	8.7b	8.7b	**10.8a**	+29	4
SR_06 (2023)	Minitonas-Bowsman	5.5b	6.4b	**8.7a**	+9	-5
SR_07 (2023)	Rhineland	6.1a	6.4a	7.4a	+23	-6
SR_08 (2023)	Grey	5.4b	6.6b	**7.7a**	+10	-7
SR_09 (2023)	Morris	4.5b	5.3b	**6.6a**	+7	0
SR_10 (2023)	Brenda-Waskada	8.3a	7.8a	9.1a	+32*	-5
SR_11 (2023)	Rhineland	**6.1c**	8.1b	**11.1a**	0	+8
SR_12 (2023)	Brokenhead	4.5a	4.9a	5.5a	+23	-9
COMBINED		**5.9c**	6.5b	**8.0a**	+17*	-1

[i]Similar lowercase letters in the same rows are not significantly different ($p<0.05$)
*indicates significantly (p-value < 0.05) different from standard seeding rate

Plant Establishment with Farm Standard Seeding Rate



	Emergence	Seeding Rate
Air Drill	51 – 89%	4 – 5 lbs./ac
Planter	89 – 90%	2.7 – 3.3 lbs./ac

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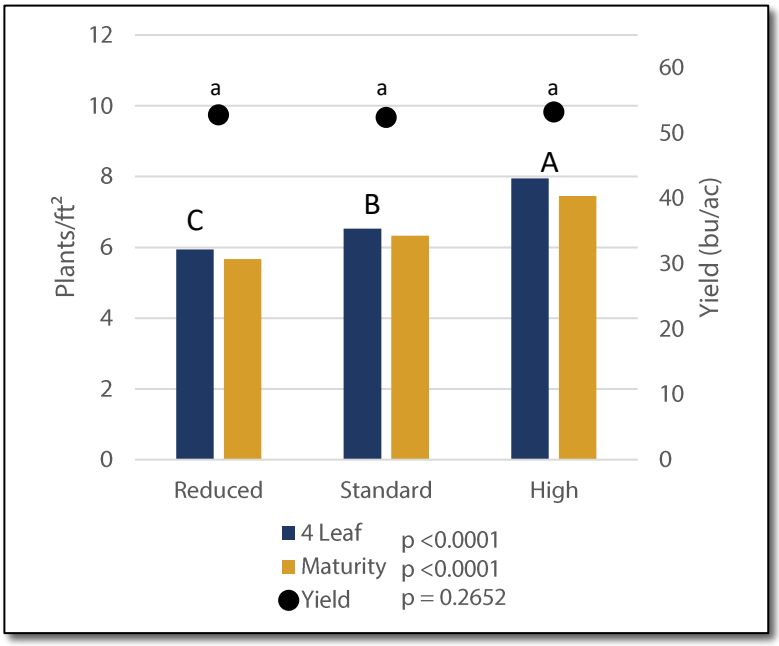
Canola Seeding Rate Trials

2022 – 2023

Plant Establishment

- Overall, high seeding rates increased plant counts, while reduced seeding rates lowered plant counts.
- Reduced seeding rates increased emergence %
- Seeding rate treatment did not influence plant survival from 4 leaf to maturity (93-96%)
- Trials that use planters generally had higher emergence than trials with air drills, allowing for reduced seeding rates, the number of plants established were similar.

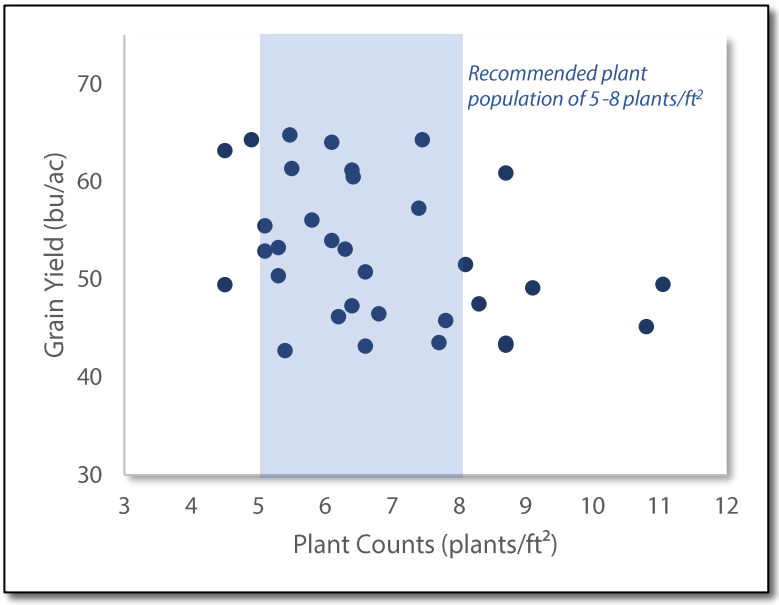


Grain Yield

- **<u>Grain yield was not significantly influenced by seeding rate</u>** in this trial
- There was no significant relationship between plant counts and grain yield.

Economic Considerations

- Canola seed SRP for 2024 is approximately $1000/bag (targeted to seed 10 acres at 60% emergence), will vary with variety and seed treatment.
- Preliminary trial results indicate that reducing seeding rate by 25% did not decrease yield and could reduce seed costs by up to $250/bag.



In Summary

- <u>All results presented are preliminary</u> as these trials will continue in the 2024 and 2025 field seasons.
- Manitoba canola farmers are successfully achieving the recommended plant population of 5-9 plants per square foot.
- With no significant influence of seeding rate or plant stand on grain yield (within the range tested) there is opportunity for farms to reduce seeding rates to increase profitability per acre.
- Additional considerations: risks associated with low plant populations outside of the scope of this trial include reduced competitiveness against field pests.

For full individual trial reports with all data collected please visit ***Canolagrowers.com***

Canola Seed-Placed Fertilizer Trials

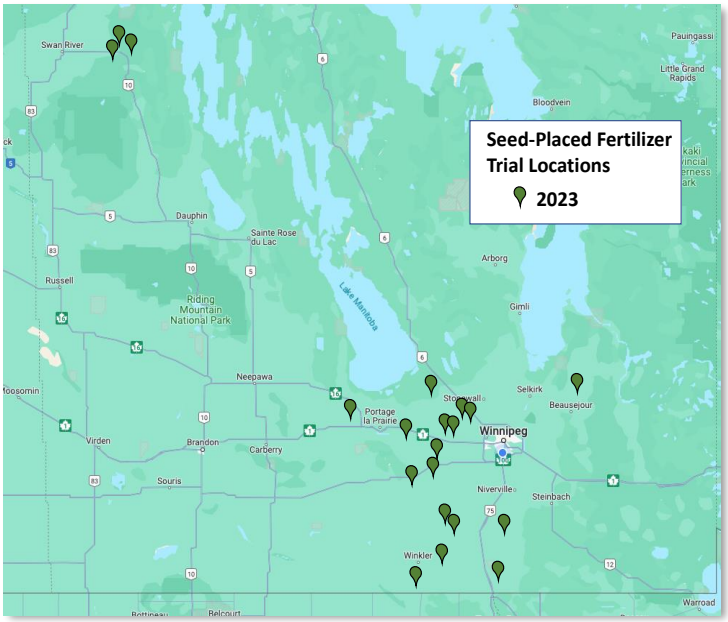
Research Question: Are seed-placed fertilizer (SPF) applications being used across Manitoba safe for canola plant establishment and what are the major factors influencing seed safety?

Treatments

1. No Seed-Placed Fertilizer
2. Standard Seed-Placed Fertilizer Rate (100%)
   Farm Normal
3. High Seed-Placed Fertilizer Rate (150%)

Trial Setup: In this trial each location has one replicate of each treatment.

This is to allow for a wider range of testing environments (soil/rainfall), equipment (row spacing, opener type, seed bed utilization) and agronomic practices (seed-placed fertilizer sources, rates, blends). Allowing for examination of the relationships between these testing factors and seed safety (emergence).



Data Collection: Plant Counts (4 leaf), Emergence %

Supporting Data:

Seed Bed Utilization (SBU) is the amount of seedbed over which fertilizer has been spread and reflects the relative concentration of the fertilizer with the seed. Low SBU (<20%) will poses a higher risk than high SBU (>20%) for seed toxicity.

Seedbed Utilization (%) = (Opener Width / Row Spacing) x 100

Recommendations from Manitoba Agriculture and Canola Council of Canada indicate a maximum of 20-25 lbs. P_2O_5/ac and 10 lbs. S/ac (SBU 15, good moisture) should be applied in the seed row to limit seedling toxicity. There is currently not clear recommendations addressing seed safety of new sources of P and S fertilizers in Manitoba.

Rates of urea fertilizer (lbs. N/ac) safely applied with cereal and canola seed if seedbed soil moisture is good to excellent.(Manitoba Agriculture)

Soil Texture	1 in. spread†			2 in. spread†			3 in. spread†		
	(disc or knife)‡			(spoon or hoe)			(sweep)		
				Row spacing					
	6"	9"	12"	6"	9"	12"	6"	9"	12"
				SBU					
	17%	11%	8%	33%	22%	17%	50%	33%	25%
CANOLA SEED									
Light (sandy loam)	0	0	0	10	0	0	20	10	0
Medium (loam to clay loam)	0	0	0	20	10	0	30	20	10
Heavy (clay to heavy clay)	10	0	0	30	20	10	40	30	20

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Canola Seed-Placed Fertilizer Trials

Preliminary Results (Year 1)

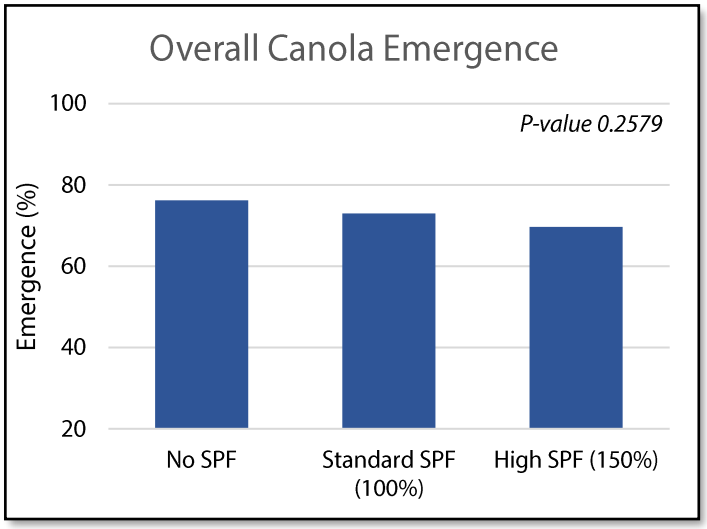
The goal of this trial is to be able to use a large data set (target n=100 over 4 years) to examine relationships between emergence and the factors that influence seed toxicity in canola, such as, spring soil moisture, soil texture, SBU and seed-placed fertilizer rate and sources. After year one we saw that many farms are pushing what are considered "safe" seed-placed fertilizer rates with low SBU. Testing locations in 2023 were concentrated in the Red River Valley with plans to increase testing locations in central and western Manitoba in the following years.

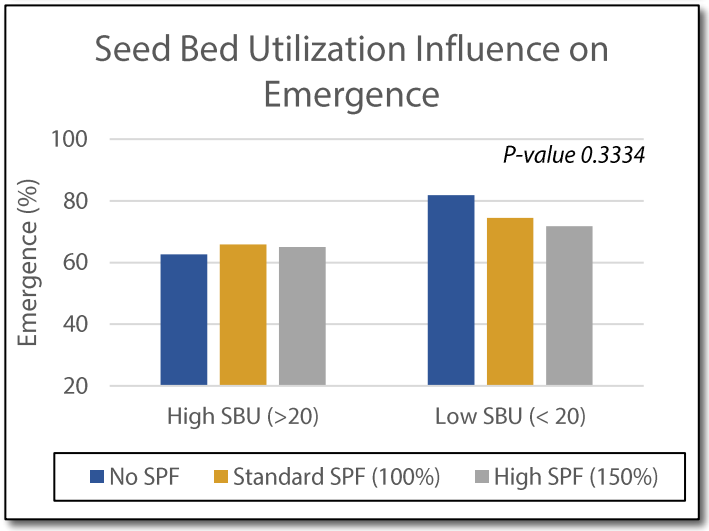
Emergence(%) = (Plants per acre at 4-leaf stage / seeds planted per acre) * 100

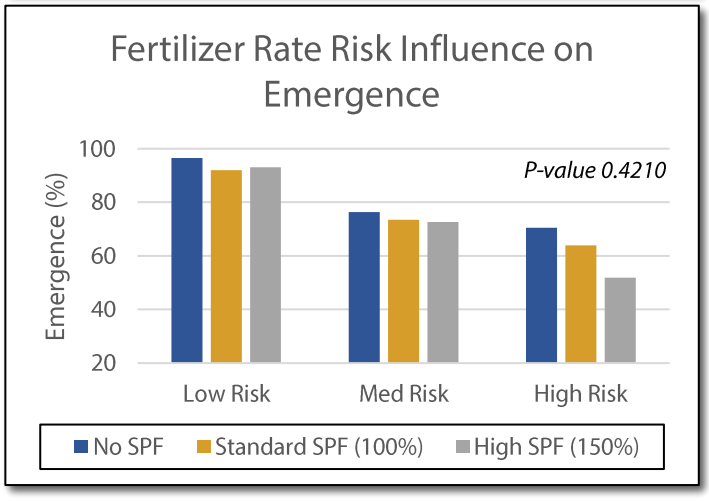
- Overall, there was a slight, non-significant, reduction in emergence as seed-placed fertilizer increased from zero to the high rate of 1.5x the farms standard practice.
- Locations with low SBU (<20%) included all of the sites that were seeded using planters, resulting in higher initial emergence than locations with high SBU (>20%) when no SPF was applied.
- When SBU was low (<20%) increases in SPF showed a trend of increased seed toxicity compared to when SBU high (>20%).

- Each location was categorized based on the farm's standard SPF rates as low, med, or high fertilizer rate risk based on current recommendations for seed safety.
    - High risk = N, P, and S rates are all over the recommended safe levels.
    - Medium risk = N, P, or S rates are over the recommended safe levels.
    - Low risk = N, P, and S are within the recommended safe level.

- As fertilizer rate risk increase from low to high the overall emergence trended lower.
- The largest reductions in emergence with increased SPF rates were seen at locations that fell into the high fertilizer rate risk category.







For more detailed reports with individual location data please visit Canolagrowers.com

BARLEY PLANT GROWTH REGULATOR TRIAL

2023 Results

OBJECTIVE

The purpose of this project was to quantify the impact of Moddus, a plant growth regulator (PGR) on height, lodging, and yield of barley.

TRIAL INFORMATION

- Five on-farm replicated strip trial sites were established in 2023.
- Management practices at each site were consistent across treatments and with the remainder of the field (fertility, seed treatment, weed control, etc.).
- Varieties were selected by producers.
- Data collected: plant height (evaluated at GS 75-85), lodging severity, grain moisture, yield, and grain quality.
- Statistical analyses were conducted only on plant height and yield data.
- Lodging severity was evaluated after PGR application, throughout the growing season.
- Product used: Moddus, applied at the recommended label rate and timing (GS 32).

Table 1. *Summary of site information and management for the 2023 barley PGR use trial sites.*

Site ID	Rural Municipality	Seeding Rate (lbs/ac)	Equipment	Seeding Date	Row Spacing (inches)	Variety
BPGR01	Morris	105	60 ft Disc Drill	13-May-23	10	AAC Synergy (malting)
BPGR02	Oakland-Wawanesa	110	40 ft Hoe Drill	10-May-23	10	AAC Connect (malting)
BPGR03	Woodlands	120	50 ft Disc Drill	16-May-23	7.5	CDC Austenson (feed)
BPGR04	MacDonald	115	60 ft Disc Drill	17-May-23	10	AAC Connect (malting)
BPGR05	Alexander	145	60 ft Air Drill	19-May-23	10	AAC Synergy (malting)

RESULTS

- There were significant differences in plant height at **four out of the five (80 per cent)** sites in 2023. PGR application reduced plant heights at **three of four** sites, where a significant difference in plant height was observed. Barley plant heights were reduced by **7 cm** on average when a PGR was applied.
- No significant differences in yield were observed in barley treated with a PGR compared to the untreated check. Therefore, there was an overall profit loss due to the product cost **($19.50/ac*)**. Significant lodging was observed at BPGR05 in the untreated strips (Figure 1).

Table 2. *Summary of 2023 barley PGR trial site data.*

Site ID	Plant Height (cm)			Lodging (1-9 (flat))		Yield (bu/ac)		CV (%)	P-Value	Statistically Significant @ 95%	Protein (%)		Change in Profit ($/ac) compared to untreated check*
	Treated	Untreated	Difference	Treated	Untreated	Treated	Untreated				Treated	Untreated	
BPGR01	57[A]	53[B]	4	1	1	60.5	58.1	8.91	0.5638	No	12.9	12.5	-19.5
BPGR02	65[B]	80[A]	-15	1	1	89.7	98.1	3.99	0.1102	No	11.2	11.7	-19.5
BPGR03	65[B]	78[A]	-13	1	2	105.7	107.5	1.03	0.0992	No	11.7	11.2	-19.5
BPGR04	55[B]	64[A]	-9	1	1	73.5	68.8	12.89	0.5169	No	10.6	11.2	-19.5
BPGR05	87	88	-1	1	6	136.1	130.3	2.06	0.0595	No	12.9	13.5	-19.5

*Approximate cost of the product only, does not include application costs

Figure 1. *Example of lodging with and without PGR application.*

Credit: Tone Ag

BARLEY PLANT GROWTH REGULATOR TRIAL

Long-Term Results (2020 – 2023)

TRIAL DESCRIPTION

- 16 replicated strip trial sites have been established for this trial type between 2020 - 2023. Only 2022 and 2023 (13 sites) data will be described here.
- Crop management was consistent across all treatments, at each site. Every farmer cooperator used optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management practices could be inconsistent across sites and trial years.
- Soil samples were taken prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- The 2022 and 2023 growing seasons had very contrasting weather conditions. In 2022, there was adequate to excessive rainfall across Manitoba, while in 2023 rainfall was limited, resulting in more water stressed crops.

RESULTS

- Plant heights were significantly different at **10 of 13 sites**, which is approximately **77 per cent** of all sites.
- Only **one** site had a significant yield difference.
- In 2022, **four out of eight** sites had significant differences in lodging severity, with the PGR treated barley having less severe lodging incidents.
- PGR use did not result in higher yields in these on-farm research trials. As well, PGR use did not improve profitability, if yield is the only factor considered to increase profits.

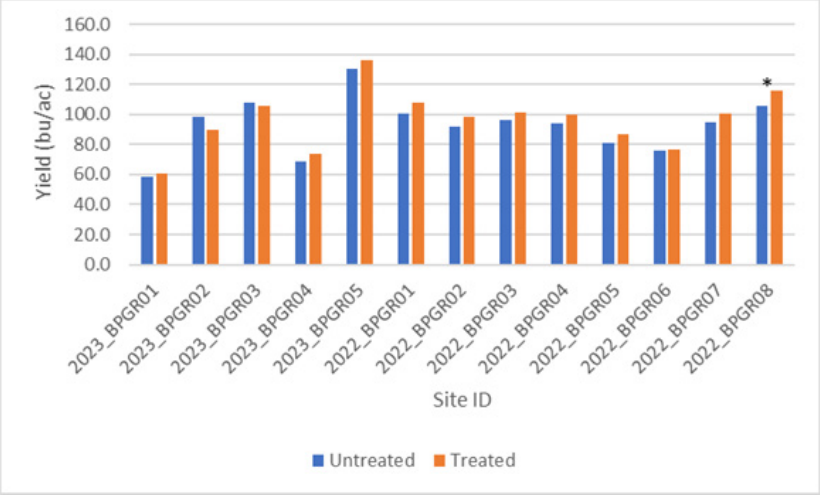


Figure 2. *Mean yields from all sites established between 2022-2023.*

**Indicates sites where significant yield differences were found between treatments.*

RECOMMENDATIONS/WHAT WE LEARNED

- PGRs do have a role in mitigating lodging risks in productive environments. Reducing lodging risks can enhance crop harvestability, yield and reduce the risk of grain quality issues.
- Evaluate factors such as environmental conditions, nitrogen rates, plant stand density, and the variety seeded when making PGR application decisions. In conditions with a low lodging risk, such as during a drought, PGR application probably won't provide a yield or profit increase. As well, PGR application during times of plant stress can cause injury.

BARLEY SEED TREATMENT TRIAL

2023 Results

NEW TRIAL TYPE IN 2023!

OBJECTIVE

The purpose of this project was to quantify the impact of a seed treatment on barley plant stand and yield.

IMPORTANCE OF THIS TRIAL

There are several diseases that can infect barley throughout the growing season, such as loose smut (seed-borne), false loose smut (seed-borne), and root rot (soil-borne). All these diseases can have detrimental affects on barley yield and quality. Seed treatments are viewed as an important practice to control or suppress the diseases mentioned above. However, there are other management practices that can be implemented by producers to assist in disease control, these include selecting resistant varieties, using disease free seed when possible and using crop rotations to reduce inoculum levels. Furthermore, seed treatments can enhance germination, plant emergence, and improve early season plant establishment. Do these products pay for themselves? This trial was designed to test, on a field scale, if they do provide an economic benefit to producers and improve barley plant stands and yields.

Figure 1. *True loose smut in barley*

TRIAL INFORMATION

- Two on-farm replicated strip trial sites were established in 2023. This was the first year conducting this trial type.
- Management practices at each site were consistent across treatments and with the remainder of the field (fertility, seeding rate, weed control, etc.).
- Seed treatments and varieties were selected by the farmer. Malting barley varieties were used at both trial locations.
- Soil samples were taken prior to seeding to optimize fertilizer rates.
- Data collected: Plant stand (evaluated at 1-2 leaf stage), grain moisture, yield, and grain quality.
- Statistical analyses were conducted only on plant stand and yield data.
- Seeding rates at both trial locations were within Manitoba Agriculture's recommended seeding rate of 1.25 – 2.25 bu/ac.
- Treatments: Treated vs untreated

Table 1. *Summary of site information and management for the 2023 barley seed treatment trial sites.*

Site ID	Rural Municipality	Row Spacing (inch)	Seeding Rate (lbs/ac)	Equipment	Seeding Date	Variety
BST01	Morris	10	105	60 ft Disc Drill	13-May-23	AAC Synergy (malting)
BST02	Sifton	12	90	60 ft Hoe Drill	17-May-23	AAC Connect (malting)

Seed treatment types:

- A bioinoculant seed treatment was applied at trial site BST01. **EcoTea™ Dry & Liquid Seed Dressing** covers seeds with microbes such as bacteria, fungi, and protozoa.
- A fungicide seed treatment was applied at trial site BST02. **Raxil Pro**, a seed applied fungicide, has three active ingredients which provide both contact and systemic modes of action.

BARLEY SEED TREATMENT TRIAL

2023 Results (Continued)

RESULTS

- No significant differences in plant stands or yield was found between the treated and untreated strips at both sites. Thus, fungicides and bioinoculants did not influence either yield or plant stand.
- Plant stand densities were below Manitoba Agriculture's recommended 22–25 plants/ft².
- As applying a seed treatment did not improve yield significantly, there was a profit loss of approximately **five dollars an acre*** due to the cost of the products.
- No trends can be distinguished from this data, as only one year of data has been collected.

Table 2. *Summary of 2023 barley seed treatment trial site data.*

Site ID	Rural Municipality	Row Spacing (inch)	Seeding Rate (lbs/ac)	Treatment	Plant Stand (plant/ft²)		Yield (bu/ac)		CV (%)	P-Value	Statistically Significant @ 95%	Cost ($/ac) compared to untreated control
					Treated	Untreated	Treated	Untreated				
BST01	Morris	10	105	EcoTea™ Dry & Liquid Seed Dressing	17	18	60.3	59.5	7.36	0.6069	No	-5
BST02	Sifton	12	90	Raxil Pro	18	19	113.4	119.7	3.65	0.1267	No	-5

*Approximate cost of the product only, does not include application costs

BARLEY SEEDING RATE TRIAL

2023 Results

OBJECTIVE

The purpose of this project was to quantify the agronomic and economic impacts of reducing and increasing targeted plant stands from normal seeding rates in barley.

SITE INFORMATION

- Eight on-farm replicated strip trial sites were established in 2023.
- Three seeding rates were compared. The farmer's normal rate, and one rate more than and less than their normal rate. Seeding rates differed between treatments by 20 – 30 lbs/ac, depending on the site. Seeding rates ranged from 78 lbs/ac – 166 lbs/ac.
- Management practices at each site were consistent across treatments and with the remainder of the field (fertility, seed treatment, weed control, etc.).
- Data collected: plant stand (evaluated at 1-2 leaf stage), lodging, grain moisture, yield, and grain quality.
- Statistical analysis was conducted on plant stand and yield data only.
- Varieties were selected by the farmer.

Site ID	Rural Municipality	Equipment	Seeding Date	Row Spacing (inches)	Variety
BP01	De Salaberry	60 ft Disc Drill	5-May-23	10	CDC Austenson (feed)
BP02	Oakland-Wawanesa	40 ft Hoe Drill	10-May-23	10	AAC Connect (malting)
BP03	Westlake-Gladstone	60 ft Disc Drill	10-May-23	10	CDC Austenson (feed)
BP04	St. Clements	65 ft Disc Drill	10-May-23	10	AAC Synergy (malting)
BP05	St. Francois Xavier	60 ft Disc Drill	15-May-23	10	Claymore (feed)
BP06	MacDonald	60 ft Disc Drill	17-May-23	10	AAC Connect (malting)
BP07	Cartier	30 ft Hoe Drill	20-May-23	8	CDC Churchill (malting)
BP08	Rockwood	60 ft Disc Drill	24-May-23	10	CDC Austenson (feed)

Table 1. *Summary of site information and management for the 2023 barley seeding rate trial sites.*

RESULTS

- There were significant differences in plant stands at three of eight sites in 2023.
- At each site where a significant difference in plant stand was found, the highest seeding rate had the highest plant population.
- When there was a significant difference in plant stand, no significant differences in yield were found between seeding rates.
- Despite no significant difference in plant stand, there was a significant yield difference found at site BP03, with the normal and high seeding rates having significantly higher yields than the low seeding rate.
- Generally, the higher seeding rates did not improve yield and thus, were not as profitable. Seed costs were approximately **$5–10/ac*** more between each seeding rate treatment.

Table 2. *Summary of 2023 barley seeding rate trial site data.*

Site ID	Seeding Rate (lbs/ac)			Plant Stand @ Midseason (plant/ft²)			Yield (bu/ac)			CV (%)	P-Value	Statistically Significant @ 95%	Change in profit ($/ac) compared to normal seeding rate*		
	Low	Normal	High	Low	Normal	High	Low	Normal	High				Low	Normal	High
BP01	106	136	166	23	27	27	81.8	79.1	79.7	2.72	0.2622	No	8.70	0	-8.70
BP02	90	110	130	22^{B}	26^{A}	26^{A}	85.7	86.6	91.2	5.25	0.2752	No	5.60	0	-5.60
BP03	105	130	155	11	13	15	70.7^{B}	76.9^{A}	75.6^{A}	3.05	0.0253	Yes	-7.55	0	-7.55
BP04	105	135	165	24	28	28	81.9	80.2	80.3	1.77	0.2613	No	8.70	0	-8.70
BP05	115	140	165	22^{B}	23^{B}	27^{A}	106.1	105.2	113.3	5.94	0.2264	No	7.25	0	-7.25
BP06	90	115	140	9	10	13	88.2	83.8	90.3	4.00	0.0938	No	7.00	0	-7.00
BP07	80	100	120	13^{C}	16^{B}	20^{A}	87.6	97.8	96.8	7.84	0.1770	No	5.60	0	-5.60
BP08	78	108	138	18	20	21	91.7	92.2	92.0	3.74	0.9831	No	9.10	0	-9.10

*Estimated based on Manitoba Agriculture 2023 Cost of Production Guidelines ($29/ac). Change of profit is due to difference in seed cost only.

BARLEY SEEDING RATE TRIAL

Long-Term Results (2022 – 2023)

SITE DESCRIPTION

- 13 sites for this trial type have been established between 2022 - 2023. The number of sites has increased annually, from five to eight.
- Crop management was consistent across all treatments, at each site. Every farmer cooperator employed optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management strategies could be inconsistent across sites. Seeding equipment depended on the farmer.
- Soil samples were taken prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- Environmental conditions were considerably different each year of the project. Overall, there was considerably more rainfall in 2022 compared to 2023. Crops progressed quickly through their growth stages in 2023, compared to 2022, due high heat and little precipitation.
- Seeding rates ranged from 52 – 180 lbs/ac. Seeding rate treatments differed by 20 – 30 lbs/ac.

RESULTS

- Plant stand density significantly differed **at seven out of 13 sites**, thus, **54 per cent** of sites. Significant yield differences were observed at **one** site. At the site where a significant yield difference was found, the normal seeding rate produced the highest yield.
- Higher seeding rates did impact plant stands, with the highest seeding rate treatment resulting in the highest plant population at **six out of seven** sites where significant plant stand differences were found.
- Higher seeding rates did not result in increased profit at any site location.

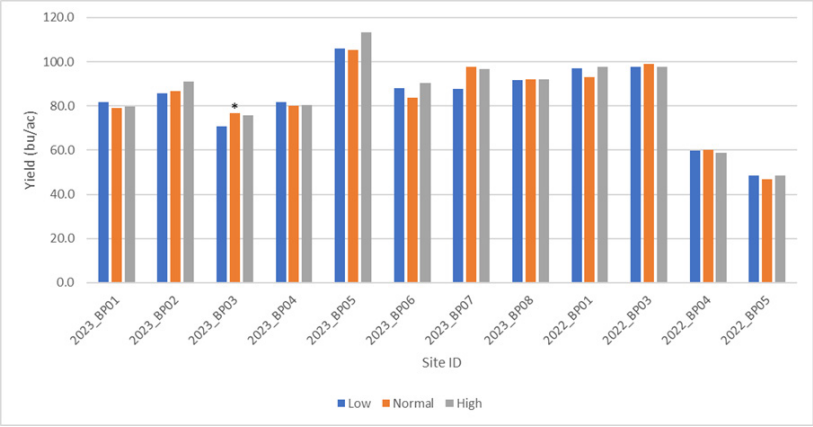


Figure 2. *Mean site yields from all sites established between 2022-2023.*

**Indicates sites where significant yield differences were found between treatments.*

RECOMMENDATIONS/WHAT WE LEARNED

- Farmers are well informed about optimal seeding rates on their farms.
- During drier conditions, increasing seeding rates did not appear to increase yield.
- Seeding rates above the farmer's normal seeding rate did not improve yield or profitability, under the environmental conditions experienced in the 2022 and 2023 growing seasons.

CORN NITROGEN-FIXING BIOLOGICAL PRODUCTS (ENVITA) TRIAL

2023 Results

NEW TRIAL TYPE IN 2023!

NITROGEN REQUIREMENTS IN CORN

Corn has high fertility requirements, and specifically high nitrogen requirements. As nitrogen fertilizer prices have fluctuated drastically over recent years, there is increased interest in finding alternative or supplemental fertility methods to support corn growth and development. Farmers have experimented with nitrogen rates, products, placement and timing in corn, all with the agronomic goal of finding the balance between high yields & quality and economical fertilizer inputs.

John Heard, former soil fertility specialist with Manitoba Agriculture, performed extensive research on nitrogen rates in corn in 2018 and 2019. Based on his research, he determined that the most economic rate of nitrogen (MERN) was from about 1.1 to 1.3 lb of nitrogen for every desired bushel of yield. For example, to achieve 150 bushel corn crop, a cumulative 165 to 195 lbs of nitrogen (soil test N plus applied N) was required in the soil to reach that yield goal.

Table 1. *Most economic nitrogen rate (MERN) for high and low yield potential grain corn crops, across a wide range of costs and crop prices. John Heard, Manitoba Agriculture.*

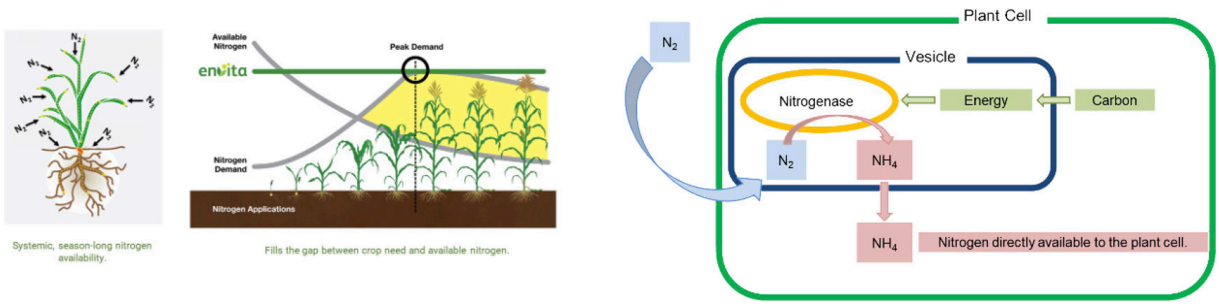
	Corn price $/bu					
N cost per lb N	$6.00	$8.00	$10.00	$6.00	$8.00	$10.00
	High Yield (>130 bu/ac) potential			Lower yield (<130 bu/ac) potential		
	Total N supply lb N/ac (soil nitrate plus fertilizer)					
$0.40	210	230	240	210	215	220
$0.60	205	220	225	195	205	210
$0.80	185	**205**	215	180	**195**	205
$1.00	165	**190**	205	165	**185**	195
$1.20	150	**175**	190	155	**175**	185
$1.40	130	165	180	140	165	180

Values in the above table are for comparative purposes, based on what one anticipates their N costs and crop prices will be. The value is the N supply that maximizes return, but in fact a +/-10 lb N/ac from these values provides within $1/ac of this same return. Remember to subtract your soil test N from these values!

NEW PRODUCT TESTING

Envita is a microbial inoculant, containing the bacteria *Gluconacetobacter diazotrophicus* (Gd), that promises to fix nitrogen for the crop and last throughout the season, giving the crop a consistent source of nitrogen during critical growth periods. It is applicable in-furrow or as a foliar spray, as was demonstrated in all six trials performed in 2023, at a rate of 95 mL/acre (40 acres per jug). Envita can be applied during early vegetative growth stages as a tank mix partner with many leading pesticides registered in Manitoba.

Figure 1. *Envita provides season-long nitrogen availability and "fills the gap" between crop need and available nitrogen.*



Credit: Azotic-NA.com

Corn – Nitrogen Fixing Biological Products Replicated Strip Trial will continue in 2024. Manitoba Crop Alliance would like to hear from farmers interested in participating in this trial in the future.

View protocol for corn – nitrogen fixing biological products trial here!

CORN NITROGEN-FIXING BIOLOGICAL PRODUCTS (ENVITA) TRIAL

2023 Results (Continued)

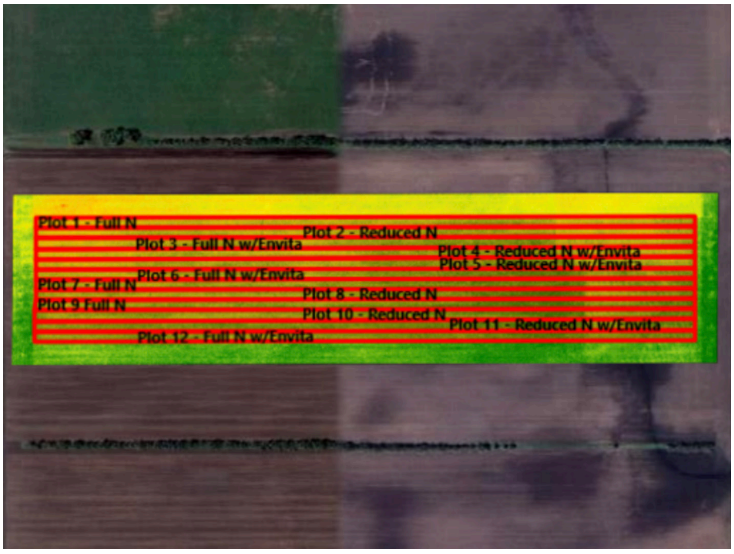
OBJECTIVE

The purpose of this project is to quantify the agronomic impacts of a biological nitrogen-fixing product (Envita) on grain corn for yield and grain quality.

TRIAL INFORMATION

- In 2023, six trial sites were planted across southern Manitoba to determine the impact of using a biological nitrogen-fixing product on two nitrogen rates in grain corn.
- The nitrogen rates will be a check rate and 75% of the check rate, with a minimum reduction in 30 lbs N/ac required.
- Envita to be foliar-applied at 95 mL/acre (40 ac/jug) at V2 – V4 (2 - 4 leaf collars). Envita can be tank mixed with most leading pesticides.
- Plant stand is recorded at early vegetative stages to determine establishment.
- Precipitation was very low for all sites in 2023.

Figure 2. *NDVI Imagery of a corn - biostimulant with overlay of the trial layout.*



Credit: Tone Ag Consulting.

Table 1. *2023 Corn Biostimulant Trial Results To-Date.*

Trial ID	Rural Municipality	Row Spacing (inches)	Planting Rate (plants/ac)	Envita Application (growth stage)	Yield by Treatment (bu/ac) Full N	Reduced N	Full N w/ Envita	Reduced N w/Envita	Precipitation % of Normal	CV %	P-Value	Statistically Significant @ 95%
CRNB01	De Salaberry	22	34,000	V6	127.4	126.8	128.3	126.7	47	1.25	0.6243	No
CRNB02	North Norfolk	30	32,000	V5	166.8	167.0	164.1	163.0	46	3.45	0.6921	No
CRNB03	Ritchot	20	34,687	V5	118.6	109.7	110.6	108.4	55	5.17	0.1219	No
CRNB04	Rockwood	10	34,000	V5	109.5	106.3	105.0	104.9	50	2.46	.2100	No
CRNB05	Springfield	15	36,000	V2	175.5^{A}	161.8^{BC}	169.9^{AB}	154.5^{C}	66	4.53	0.0152	**Yes**
CRNB06	Stanley	30	34,000	V3	230.2	227.5	228.4	227.2	38	2.85	0.9383	No

YIELD AND ECONOMIC RESULTS

In the six sites for the first year of testing, there was one that contributed statistically significant data in final yield. The RM of Springfield site found there to be a yield advantage when applying "full" nitrogen rates (according to their farm), both with and without Envita, over the reduced nitrogen application rates.

At an approximate cost of $580/jug ($14.50/acre), not considering any fertility costs (aside from nitrogen) involved in the trial site, and $6.20 corn there is generally no financial gain in applying Envita to grain corn in 2023. In "Reduced N" treatments, the full nitrogen rate was reduced by an average 30 lbs N/ac, which is recommended on the Envita product label.

Table 2. *Economic analysis comparing Envita applied with full nitrogen rates and reduced nitrogen rates against untreated rates.*

Trial ID	Rural Municipality	Net Profit/Acre Full N	Full N w/ Envita	Reduced N	Reduced N w/ Envita
2023-CRNB01	De Salaberry	$662.90	$653.98	**$686.39**	$671.27
2023-CRNB02	North Norfolk	$916.25	$885.01	**$944.70**	$905.40
2023-CRNB03	Richot	**$608.34**	$544.24	$575.83	$553.27
2023-CRNB04	Rockwood	$545.57	$503.17	**$552.94**	$529.76
2023-CRNB05	Springfield	**$952.05**	$902.83	$912.46	$852.70
2023-CRNB06	Stanley	$1,300.26	$1,274.60	**$1,310.73**	$1,294.37

Envita cost - $14.50/ac
UAN (28-0-0) cost - $560/tonne
Corn Price - $6.20/bu

NOTE: Economic analysis does not include application costs.

FLAX SEEDING RATE TRIALS

2023 Results

OBJECTIVE

The purpose of this project is to quantify the agronomic and economical impacts of three different flax seeding rates in alternating strips across the field.

TRIAL INFORMATION

- In 2023, eight trial sites were seeded across southern Manitoba to determine the best rates in relation to the farmer's normal practices. Three seeding rates are compared: the farmer's "normal" rate, "normal" minus 10 lbs/ac and "normal" plus 10 lbs/ac. The farmer chooses the rates, so they are not the same from trial to trial.
- Flax is generally seeded at 35 – 40 lbs/acre, in normal conditions, for maximum yield on the Prairies.
- Plant stand is recorded at growth stage 4 (third pair of true leaves unfolded) to determine establishment.
- Precipitation was very low for all sites except Dauphin in 2023. The higher yielding locations show good rainfall data for June.

Table 1. *Equipment, variety and seeding dates for 2023 flax seeding rate trials.*

Trial ID	RM	Equipment	Seeding Date	Row Spacing	Variety
2023-FP01	St. Clements	65 Disc Drill	14-May-23	10"	WestLin 72
2023-FP02	De Salaberry	50 ft Hoe Drill	16-May-23	10"	CDC Rowland
2023-FP03	Rockwood	47 ft Air Drill	16-May-23	10"	AAC Marvelous
2023-FP04	Dauphin	60 ft Hoe Drill	19-May-23	10"	CDC Sorrel
2023-FP05	Louise	30 ft Hoe Drill	19-May-23	10"	CDC Rowland
2023-FP06	Morris	60 ft Disc Drill	22-May-23	10"	CDC Glas
2023-FP07	Wallace-Woodworth	60 ft Hoe Drill	22-May-23	12"	CDC Rowland
2023-FP08	Victoria	30 ft Hoe Drill	30-May-23	7.5"	CDC Dorado

RESULTS

There were no statistically significant yield results observed in the 2023 flax seeding rate sites. There were significant differences in plant stand density at four out the eight trial locations. At each trial location where a significant difference in plant density was found, the highest seeding rate had the highest plant stand density. However, there were no significant differences in yield found between seeding rates, even when there was a significant difference in plant stand density. Higher seeding rates did not improve yields, and thus, were a disadvantage in terms of profit due to higher seed costs.

Low seeding rate yields were generally equivalent to the higher rates, therefore economically advantageous in comparison to the normal and high rates.

Table 2. *Summary of 2023 flax seeding rate trial yield results by site-year.*

Trial ID	Rural Municipality	Row Spacing	Planting Rate			Plant Stand @ Midseason			Yield			CV	P-Value	Statistically Significant @ 95%
			Low	Med	High	Low	Med	High	Low	Med	High			
		inch	lbs/ac			/ft^2			bu/ac			%		
FP01	St. Clements	10	40	50	60	44^A	53^B	59^C	26.3	25.0	24.5	9.44	0.5968	No
FP02	De Salaberry	10	46	56	66	50	48	52	8.6	8.9	8.4	2.66	0.3173	No
FP03	Rockwood	10	36	46	56	49^A	60^B	64^B	20.9	21.3	20.3	4.67	0.3604	No
FP04	Dauphin	10	40	50	60	26^A	33^B	40^C	24.2	24.9	25.3	9.22	0.7947	No
FP05	Louise	10	40	50	60	30	27	31	30.9	33.3	30.7	5.25	0.2287	No
FP06	Morris	10	45	55	65	47^A	56^B	67^C	24.1	24.5	23.9	5.38	0.7937	No
FP07	Wallace-Woodworth	12	35	56	70	30	46	56	46.9	44.9	46.8	2.78	0.1240	No
FP08	Victoria	7.5	39	50	59	39	49	52	32.7	32.8	32.6	2.65	0.8339	No

FLAX SEEDING RATE TRIALS

Long-term Results (2022 – 2023)

TRIAL INFORMATION

- 13 site years have been conducted from 2022 – 2023; one more year of trial data in 2024.
- Three seeding rates compared using farmer's traditional practice vs +/- 10 lbs/acre, at the farmer's discretion.
- Management practices in the trial are consistent with the remainder of the field (fertility, weed control, etc.)
- Soil samples are taken in each field prior to seeding and performed by Tone Ag Consulting.

SUPPORTING DATA

- Plant stand is evaluated at growth stage 4 (third pair of true leaves unfolded) to determine establishment.
- Environmental conditions were difficult for flax in 2022 and 2023, with low precipitation being a direct cause of poor stand establishment and some lower yields.

RESULTS

- Plant stand density significantly differed at six out of 13 sites thus, 46 per cent of sites. Out of all trials, none had significant yield differences.
- Higher seeding rates did not result in higher yields.
- Higher seeding rates only resulted in a profit in two site years.

RECOMMENDATIONS/WHAT WE LEARNED

- Farmers are well informed about optimal seeding rates on their farms.
- During drier conditions, increasing seeding rate does not appear to benefit yield.

Table 3. *2022-23 Flax Seeding Rate Economic Analysis by site-year.*

Trial ID	Seed Rate (check, lb/ac)	Seed Cost/Acre			Yield			Net Profit/Acre (Seed Costs)		
		Low	Med	High	Low	Med	High	Low	Med	High
		$/ac			bu/ac			$/ac		
22-FP01	40	$14.46	$19.29	$24.11	38.2	38.2	35.7	**$569.23**	$564.41	$521.39
22-FP02	55	$21.70	$26.52	$31.34	45.5	45.6	46.6	$673.54	$670.25	**$680.71**
22-FP03	45	$16.88	$21.70	$26.52	43.8	43.3	43.5	**$652.39**	$639.93	$638.16
22-FP04	56	$27.00	$34.71	-	35.1	36.1	-	$509.33	**$516.89**	-
22-FP05	46	$17.36	$22.18	$27.00	7	6	6.1	**$89.60**	$69.50	$66.21
23-FP01	50	$19.29	$24.11	$28.93	26.3	25	24.5	**$382.58**	$357.89	$345.43
23-FP02	56	$22.18	$27.00	$31.82	8.6	8.9	8.4	**$109.23**	$108.99	$96.53
23-FP03	46	$17.36	$22.18	$27.00	20.9	21.3	20.3	$301.99	**$303.29**	$283.18
23-FP04	50	$19.29	$24.11	$28.93	24.2	24.9	25.3	$350.49	$356.36	**$357.66**
23-FP05	50	$19.29	$24.11	$28.93	30.9	33.3	30.7	$452.87	**$484.72**	$440.17
23-FP06	55	$21.70	$26.52	$31.34	24.1	24.5	23.9	$346.55	**$347.84**	$333.85
23-FP07	56	$16.88	$27.00	$33.75	46.9	44.9	46.8	**$699.76**	$659.07	$681.35
23-FP08	50	$18.80	$24.11	$28.45	32.7	32.8	32.6	**$480.85**	$477.08	$469.68

Median Seed cost - $27/bu

Flax Price - $15.28/bu

NOTE: Economic analysis does not include application costs.

SUNFLOWER PLANTING RATE TRIALS

2023 Results

OBJECTIVE

The purpose of this project is to quantify the agronomic and economical impacts of plant populations in confection and oilseed sunflowers.

TRIAL INFORMATION

- In 2023, seven trial sites were planted across southern Manitoba to determine best rates in relation to the farmer's normal practices. Three planting rates are compared: the farmer's "normal" rate, "normal" minus 3,000 plants/ac and "normal" plus 3,000 plants/ac. The farmer chooses the rates so they are not necessarily the same from trial to trial.
- Sunflower is generally planted at 16,000 – 20,000 plants/acre, depending on confection or oilseed, for maximum yield on the Prairies.
- Plant stand is recorded at V2 (first two leaves at least 4 cm in length) to determine establishment.
- Precipitation was very low for all sites in 2023. Site SFLP07 in the RM of Stuartburn had normal to above normal accumulated rainfall in June and July, which was unusual for 2023.

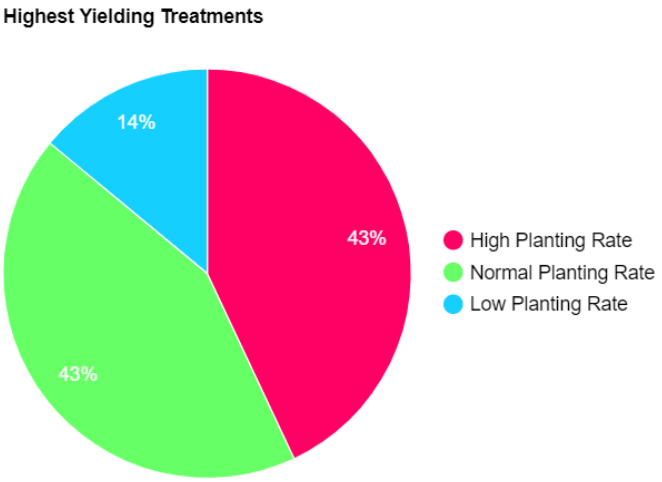
Table 1. *Equipment, variety and seeding dates for 2023 sunflower planting rate trials.*

Trial ID	RM	Equipment	Seeding Date	Row Spacing	Variety
2023-SFLP01	Rhineland	60 ft Planter	13-May-23	30	Panther DMR
2023-SFLP02	St. Francois Xavier	40 ft Planter	16-May-23	30	N4HM354
2023-SFLP03	Brokenhead	60 ft Planter	19-May-23	20	N4HM354
2023-SFLP04	Emerson-Franklin	55 ft Planter	20-May-23	20	CP455E
2023-SFLP05	St. Andrews	40 ft Planter	20-May-23	30	P63ME80
2023-SFLP06	Tache	60 ft Planter	23-May-23	20	P63ME80
2023-SFLP07	Stuartburn	40 ft Planter	25-May-23	30	P63HE60

RESULTS

2023 sunflower planting rate sites did show significant differences between treatments and respective yields. Yields were found to be average to below average in the sites, which does not necessarily reflect provincial yields overall. Three out of seven (43 per cent) sites yielded best in the high planting rate. Another 43 per cent of the sites yielded best in the normal planting rate. There was one site (14 per cent) that yielded best in the low planting rate. This trial was the one that received the most precipitation throughout the growing season.

At the time of publication, there was one site unharvested (2023-SFLP08) in the Rural Municipality of Richot.



Check out the results of all of MCA's Research on the Farm trials here

SUNFLOWER PLANTING RATE TRIALS

Long-term Results (2021 – 2023)

TRIAL INFORMATION

- 20 trials from 2021 – 2023.
- Three planting rates compared using farmer's traditional practice vs +/- 3,000 plants/acre, at the farmer's discretion.
- Management practices in the trial are consistent with the remainder of the field (fertility, weed control, etc.)
- Soil samples are taken in each field prior to planting and performed by Tone Ag Consulting.
- Plant stand is evaluated at V2 (first two leaves at least 4 cm in length) to determine establishment.

RESULTS

- Highest yields over the course of three growing seasons do not give conclusive results for best planting rates on a broad spectrum.
- 2022 had more precipitation than "normal", and high planting rates had best net profit 60% of the time.
- 2021 and 2023 were drier than "normal". Low planting rates had best net profit 33% of the time, normal planting rates had best net profit 40% of the time, and high planting rates had best net profit 27% of the time.

RECOMMENDATIONS/WHAT WE LEARNED

- Farmers are educated on good planting rates for their farms.
- In dry conditions, it is hard to predict whether increasing or decreasing planting rates will return a significant profit.
- Full economic analysis, including complete input costs for the growing season, should be recorded for true results.

Table 3. *2021-23 Sunflower Planting Rate Economic Analysis by site-year.*

	Trial ID	Seed Rate (check, lb/ac)	Seed Cost/Acre			Yield			Net Profit/Acre (Seed Costs)		
			Low	Med	High	Low	Med	High	Low	Med	High
			$/ac			lb/ac			$/ac		
OIL	2021-SFLP01	22,000	$29.36	$34.00	$38.64	**2,170**	1,910	2,143	$708.44	$615.40	$689.98
	2021-SFLP02	23,000	$30.91	$35.55	$40.18	3,293	**3,305**	3,305	$1,088.71	$1,088.15	$1,083.52
	2021-SFLP03	25,000	$34.00	$38.64	$43.27	2,516	**2,870**	2,812	$821.44	$937.16	$912.81
	2021-SFLP04	25,000	$34.00	$38.64	$43.27	**2,058**	1,981	1,995	$665.72	$634.90	$635.03
	2021-SFLP05	22,000	$29.36	$34.00	$38.64	1,498	**1,613**	1,571	$479.96	$514.42	$495.50
	2021-SFLP08	23,000	$27.82	$35.55	$41.73	1,191	1,220	**1,222**	$377.12	$379.25	$373.75
	2022-SFLP01	23,000	$30.91	$35.55	$40.18	1,285	**1,421**	1,338	$405.99	$447.59	$414.74
	2022-SFLP02	24,000	$32.45	$37.09	$41.73	2,220	2,271	**2,365**	$722.35	$735.05	$762.37
	2022-SFLP03	24,000	$32.45	$37.09	$41.73	2,018	2,136	**2,219**	$653.67	$689.15	$712.73
	2022-SFLP04	22,500	$30.14	$34.77	$39.41	2,661	**2,778**	2,512	$874.60	$909.75	$814.67
	2022-SFLP05	22,000	$29.36	$34.00	$38.64	1,598	1,626	**1,650**	$513.96	$518.84	$522.36
	2023-SFLP02	22,000	$29.36	$34.00	$38.64	1,614	1,635	**1,765**	$616.24	$620.00	$667.36
	2023-SFLP03	23,000	$30.91	$35.55	$40.18	1,945	**2,026**	1,948	$747.09	$774.85	$739.02
	2023-SFLP04	22,000	$29.36	$34.00	$38.64	2,682	**2,774**	2,769	$882.52	$909.16	$902.82
	2023-SFLP05	22,000	$29.36	$34.00	$38.64	1,460	**1,539**	1,505	$467.04	$489.26	$473.06
	2023-SFLP06	25,000	$34.00	$38.64	$43.27	2,110	2,216	**2,410**	$683.40	$714.80	$776.13
	2023-SFLP07	25,000	$34.00	$38.64	$43.27	**1,582**	1,474	1,451	$503.88	$462.52	$450.07
NON-OIL	2021-SFLP06	18,000	$24.00	$28.80	$33.60	**3,156**	2,912	3,039	$1,238.40	$1,136.00	$1,182.00
	2021-SFLP07	16,500	$21.60	$26.40	$31.20	2,768	2,796	**3,058**	$1,085.60	$1,092.00	$1,192.00
	2023-SFLP01	16,000	$21.12	$25.60	$30.72	1,683	1,701	**1,791**	$652.08	$654.80	$685.68

Median Seed cost (OIL) - $340/bag or $0.0015/seed
Median Seed cost (NON-OIL) - $320/bag or $0.0016/seed
OIL Price - $0.34/lb
NON-OIL Price - $0.40/lb
NOTE: Economic analysis does not include application costs.

Table 2. *Precipitation at sunflower planting rate trials: 2021 – 2023*

	Trial ID	Precipitation % Normal
OIL	2021-SFLP01	81
	2021-SFLP02	68
	2021-SFLP03	76
	2021-SFLP04	63
	2021-SFLP05	86
	2021-SFLP08	61
	2022-SFLP01	147
	2022-SFLP02	153
	2022-SFLP03	150
	2022-SFLP04	113
	2022-SFLP05	117
	2023-SFLP02	58
	2023-SFLP03	65
	2023-SFLP04	44
	2023-SFLP05	67
	2023-SFLP06	48
	2023-SFLP07	86
NON-OIL	2021-SFLP06	54
	2021-SFLP07	83
	2023-SFLP01	36

WHEAT ENHANCED EFFICIENCY FERTILIZER TRIAL

2023 Results

OBJECTIVE

The purpose of this project was to quantify the agronomic and economic impact of enhanced efficiency fertilizer (EEF) usage on wheat for yield and grain quality.

TRIAL INFORMATION

- Two on-farm replicated strip trial sites were established in 2023.
- Management practices at each site were consistent across treatments and with the remainder of the field (fertility, seed treatment, weed control, varieties, etc.).
- Data collected: plant stand (evaluated at 1-2 leaf stage), lodging, grain moisture, yield, and grain quality.
- Statistical analyses were conducted only on plant stand and yield data.

Table 1. *Summary of site information and management for 2023 wheat EEF trial site.*

Site ID	Rural Municipality	Seeding Rate (lbs/ac)	Equipment	Seeding Date	Row Spacing (inches)	Variety
WN01	Brokenhead	95	60 ft Disc Drill	4-May-23	10	AAC Starbuck VB (CWRS)
WN02*	North Norfolk	120	55 ft Air Drill	10-May-23	7.5	Bolles

Note: *No data collected due to hail damage. Canada Western Red Spring, CWRS.

Product Types:

- Excelis Maxx contains both a nitrification inhibitor and urease inhibitor, therefore, it reduces nitrogen loss by disrupting and delaying leaching, denitrification, and volatilization pathways.

RESULTS

- There were no significant differences in plant stands in 2023.
- No significant yield differences were observed between treatments. There was a profit loss due to the product price, when EEFs were utilized.
- In the 2023 growing season, there was a profit increase when reduced nitrogen rates were used.
- Higher nitrogen rates tended to have higher protein levels.

Table 2. *Summary of the 2023 wheat EEF trial site data.*

Site ID	Product	Treatment	Plant Stand (plant/ft²)	Yield (bu/ac)	Grade	CV (%)	P-Value	Statistically Significant @ 95%	Protein (%)	TWT (kg/hL)	Falling Number	Cost ($/ac)*	Change in profit ($/ac) compared to full N rate
WN01	Excelis Maxx	Full N	25	83.9	1	11.87	0.1397	No	15.4	66	320	207	0
		Reduced N	20	86.3	1				14.7	67	284	162	45
		Full N + Excelis Maxx	22	84.5	1				15.2	65	285	226.7	-19.70
		Reduced N + Excelis Maxx	24	83.8	1				14.8	67	290	177.6	29.4

Note: Costs based on May 2023 price of 46-0-0 at $960/tonne and EFF at $93/tonne.*

WHEAT ENHANCED EFFICIENCY FERTILIZER TRIAL

Long-Term Results (2022 – 2023)

TRIAL DESCRIPTION

- Three replicated strip trial sites have been established for this trial type between 2022 - 2023. Only two sites were taken to harvest.
- Crop management was consistent across all treatments, at each site. Every farmer cooperator used optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management practices could be inconsistent across sites and trial years.
- Soil samples were taken prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- The 2022 and 2023 growing seasons had very contrasting weather conditions. In 2022, there was adequate to excessive rainfall across Manitoba, while in 2023 rainfall was limited, resulting in more drought stressed crops.

RESULTS

- Over the 2022 and 2023 growing seasons **zero** sites had a significant yield difference.
- There were **zero** significant differences in plant population across treatments.

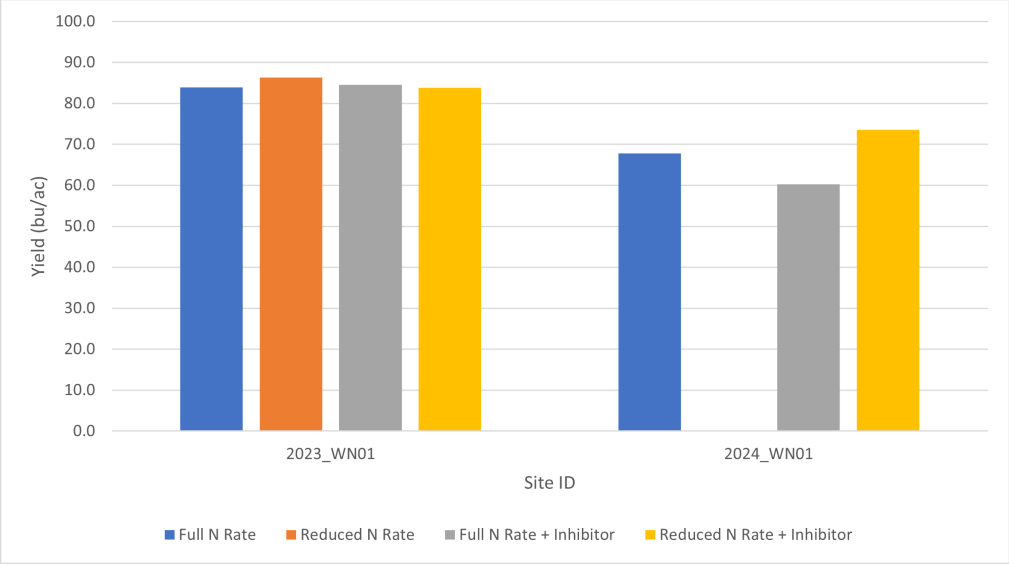


Figure 1. *Mean site yields from all sites established between 2022–2023. Note: N, nitrogen.*

RECOMMENDATIONS/WHAT WE LEARNED

- The addition of EEFs did not improve spring wheat yields or profits the 2022 and 2023 growing.
- EEFs have been found to reduce nitrogen loss, especially when conditions are conducive to high rates of nitrogen loss. This can result in more nitrogen being available to the crop when these conditions are present. High-risk conditions include when there is excess soil moisture, or when urea fertilizer is surface broadcasted, and a subsequent rainfall is not received.

WHEAT – FUNGICIDE MANAGEMENT OF FUSARIUM HEAD BLIGHT TRIAL

Results 2023

OBJECTIVE

The purpose of this project was to quantify the impact of fusarium head blight (FHB) on the quality of harvested grain. The trial compared producer's normal fungicide application at the recommended rate and timing to a fungicide application 3 to 5 days after the recommended timing, and an untreated check.

SITE INFORMATION

- Three on-farm replicated strip trial sites were established in 2023.
- Site management practices were consistent across treatments and with the remainder of the field (fertility, weed control, etc.).
- Data collected: Yield and wheat grain quality factors.
- Statistical analyses were conducted on all variables.
- Wheat varieties were selected by the farmer.

Table 1. *Summary of site information and management for the 2023 wheat FHB fungicide trial sites.*

Site ID	Equipment	Seeding Date	Seeding Rate (lb/ac)	Fungicide Application Date		Row Spacing (inches)	Variety	FHB Resistance
				Early	Late			
WFHB01*	52 ft Air Drill	7-May-23	126	20-June-23	04-July-23	10	AAC Brandon (CWRS)	MR
WFHB02	35 ft Hoe Drill	10-May-23	132	30-June-23	05-July-23	10	Prosper (CNHR)	I
WFHB03	60 ft Disc Drill	16-May-23	120	03-July-23	06-July-23	7.5	AAC Hockley (CWRS)	MR

Note: *No data collected due to hail damage. Canada Western Red Spring, CWRS; Canada Northern Hard Red, CNHR; Intermediate, I; Moderately, MR.

RESULTS

- No significant differences in yield, protein, and TWT were observed between treatments. Very dry conditions and low precipitation when plants were most susceptible resulted in a reduced FHB risk. This would have played a significant role in the lack of response to fungicide application. No significant differences were observed between wheat quality factors, such as DON and Falling Number.
- There was no economic advantage of applying a fungicide to suppress FHB in the 2023 growing season. There was a loss of profit due to product costs, as there was no significant yield increase. This would be approximately **$19/ac***.

Table 2. *Summary of 2023 wheat FHB fungicide trial site data.*

Site ID	Rural Municipality	Fungicide Product	Treatment	Yield (bu/ac)	CV (%)	P-Value	Statistically Significant @ 95%	Protein (%)	TWT (Kg/hL)	Falling Number (Sec)	DON	Change of profit ($/ac) compared to untreated*
WFHB02	Tache	Prosaro XTR	Early	90.7	4.44	0.4725	No	14.9	64	280	<0.3	-19.5
			Late	88.4				14.8	64	275	<0.3	-19.5
WFHB03	Grey	Prosaro XTR	Early	77.8	7.09	0.9979	No	15.8	67	321	<0.3	-19.5
			Late	81.5				15.8	67	344	<0.3	-19.5
			Untreated	78.0				15.4	67	300	<0.3	0

Note: DON, deoxynivalenol; TWT, test weight. *Estimated product cost. Does not include application costs.

WHEAT – FUNGICIDE MANAGEMENT OF FUSARIUM HEAD BLIGHT TRIAL

Long-Term Results (2018 – 2023)

SITE DESCRIPTION

- 25 replicated strip trial sites have been established for this trial type between 2018 – 2023.
- Crop management was consistent across all treatments, at each site. Every farmer cooperator used optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management strategies could be inconsistent across sites and trial years.
- Soil samples were taken prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- Wheat quality tests were conducted on a subset of harvested grain for all treatments and sites.

RESULTS

- Significant yield differences have been found at five of the 25 wheat FHB fungicide trial sites conducted between 2018–2023
- Between 2018 – 2023 **five of the 25** sites had statistically significant yield responses to fungicide application or **25 percent** of sites.
- The yield response was uneconomical at **two of the five** sites where significant yield responses were observed. Foliar fungicide application was economical at **three of the five** sites, with the increase in yield covering the cost of product.
- Yield increases could also be due to the control of other diseases as fungicides can control multiple diseases.

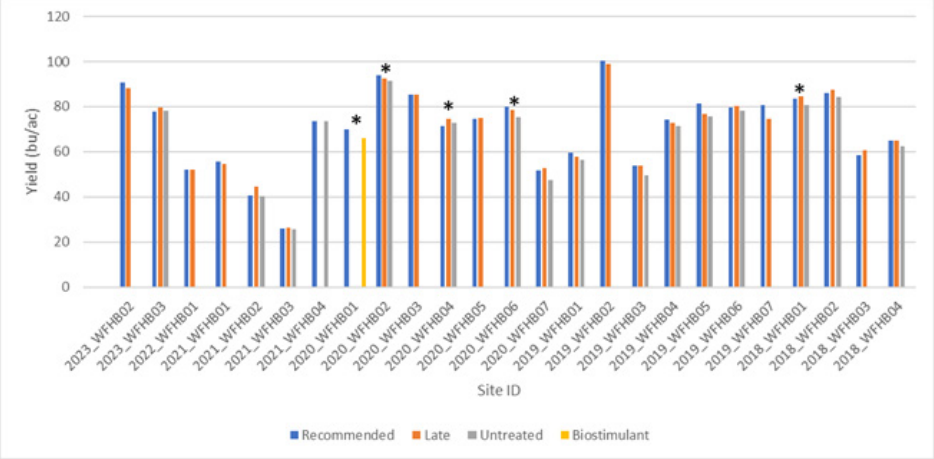


Figure 1. *Mean site yields from all sites established between 2018–2023.*

**Indicates sites where significant yield differences were found between fungicide application treatments.*

RECOMMENDATIONS/WHAT WE LEARNED

- Foliar fungicide application did not increase yield at most sites tested.
- FHB can have devastating effects on wheat yield and quality. When making fungicide application decisions consider the disease triangle (host, pathogen, and environment).
  - Assess crop staging and disease susceptibility. This will allow you to better improve spray timing and enhance fungicide effectiveness.
  - Understand the disease rating of your selected variety.
  - Assess environmental conditions. Hot and humid conditions, with frequent rainfall will increase FHB risk and disease incidence.
  - Consult Manitoba Agriculture FHB risk maps to help understand the risks in your area. Maps are produced daily between the start of winter wheat flowering to the end of spring wheat flowering.

WHEAT SEED TREATMENT TRIAL

2023 Results

OBJECTIVE

The purpose of this project was to quantify the impact of a using a seed treatment on spring wheat.

TRIAL INFORMATION

- Four on-farm replicated strip trial sites were established in 2023. This was the third year conducting this trial type.
- Management practices at each site were consistent across treatments and with the remainder of the field (fertility, seeding rate, weed control, etc.).
- Data collected: plant stand (evaluated at 1-2 leaf stage), lodging, grain moisture, yield, and grain quality.
- Statistical analyses were conducted only on plant stand and yield data.
- Seed treatments and varieties were selected by the farmer. Canadian Western Red Spring (CWRS) and Canada Prairie Spring Red (CPSR) wheat varieties were grown in this trial.
- Treatments: treated vs. untreated seed

Table 1. *Summary of site information and management for 2023 wheat seed treatment trial sites.*

Site ID	Rural Municipality	Row Spacing (inch)	Seeding Rate (lbs/ac)	Equipment	Seeding Date	Variety
WST01	Wallace-Woodworth	12	100	60 ft Air Drill	6-May-23	AAC Wheatland VB (CWRS)
WST02*	De Salaberry	10	126	52 ft Air Drill	10-May-23	AAC Brandon (CWRS)
WST03	Cartwright-Roblin	12	99	44 ft Air Drill	19-May-23	CS Accelerate (CPSR)
WST04	Argyle	12	125	56 ft Air Drill	22-May-23	AAC Hodge (CWRS)

*Note: Canada Western Red Spring, CWRS; Canada Prairie Red Spring, CPSR. *Hail event resulted in no yield data collected.*

Seed treatment types:

- Fungicide seed treatments were applied at two sites. Fungicide products applied had multiple active ingredients, to protect against seed-borne and soil-borne diseases. A seed treatment with a fungicide and insecticide component was applied at WST04. A microbial inoculant seed treatment was applied at WST03.

RESULTS

- No significant differences in plant stands were observed between the untreated and treated strip plots. Plant stands at two of the four sites fell within the provincial recommendation of 23-28 plants/ft^2.
- There was a significant difference in yield observed at WST01, with the treated seed having a higher yield than the untreated seed. The yield difference was **2.4 bu/ac**, and it was found to be economically viable.

Table 2. *Summary of the 2023 wheat seed treatment trial site data.*

Site ID	Treatment	Plant Stand (plant/ft^2)		Yield (bu/ac)		CV (%)	P-Value	Statistically Significant @ 95%	Change in profit ($/ac) compared to untreated check*
		Untreated	Treated	Untreated	Treated				
WST01	Insure Cereal FX4	23.2	23.7	91.7^B	94.1^A	0.84	0.0216	Yes	16.41
WST03	Quickroots	29.8	29.6	79.9	83.1	5.22	0.3657	No	-5
WST04	Cruiser Vibrance Quattro	31.83	31.72	52.2	51.7	2.83	0.7296	No	-5

**Cost of product only, this does not include application costs. Wheat price based on spring 2023.*

Table 3. *2023 Economic analysis of sites that showed significant yield differences.*

Site ID	Seed Treatment	Yield (bu/ac)		Yield Diff (bu/ac)	Cost* ($/ac)	Wheat Price**	Benefit ($/ac)
		Untreated	Treated				
WST01	Insure Cereal FX4	91.7	94.1	2.4	6.44	9.52	**16.41**

**Cost of product only, this does not include application costs **Wheat price based on spring 2023.*

WHEAT SEED TREATMENT TRIAL

Long-term Results (2021-2023)

TRIAL INFORMATION

- 23 sites for this trial type have been established between 2020 – 2023.
- Crop management was consistent across all treatments, at each site. Every farmer cooperator used optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management strategies could be inconsistent across sites.
- Soil samples were taken prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- Weather conditions differed substantially across the three project years. For example, in 2021, drought and lack of soil moisture led to significantly reduced yields, while in 2022 there was excess moisture, which delayed seeding.

RESULTS

- There was **one** site with a significant difference in plant stand density across all project years (data not shown). At this site, treated seed had a significantly higher plant stand density compared to the untreated seed.
- Significant differences in yield were found at **three of the 23** sites from 2021–2023, thus, **13 per cent** of total sites. In both cases the treated seed had a higher yield than the untreated checks.

Figure 1. *Mean site yields from sites established between 2020–2023.*

**Indicates sites where significant yield differences were found between treatments.*

RECOMMENDATIONS/WHAT WE LEARNED

- Understanding factors such as seed source, variety resistance rating, field disease history and length and diversity of crop rotations will help you evaluated disease risk and need for seed treatments. Use a similar strategy to determine if an insecticide seed treatment is necessary.
- As spring weather conditions vary by year, a broad-spectrum seed treatment can help mitigate disease risk.

WHEAT SEEDING RATE TRIAL

2023 Results

OBJECTIVE

The purpose of this project was to quantify the agronomic and economic impacts of a reduced and an increased targeted plant stand of a normal seeding rate in spring wheat.

TRIAL INFORMATION

- 12 on-farm replicated strip trial sites were established in 2023. Seeding rates ranged from 60 lbs/ac – 160 lbs/ac. Differences between seeding rate treatments were between 20 – 40 lbs/ac, depending on the trial.
- Data collected: plant stand (evaluated at 1-2 leaf stage), lodging, grain moisture, yield, and grain quality.
- Statistical analyses were conducted only on plant stand and yield data.

Table 1. *Summary of site information and management for 2023 wheat seeding rate trial sites.*

Site ID	Rural Municipality	Row Spacing (inch)	Equipment	Seeding Date	Variety
WP01	Brokenhead	10	60 ft Disc Drill	3-May-23	AAC Starbuck (CWRS)
WP02	Wallace-Woodworth	12	60 ft Air Drill	6-May-23	AAC Wheatland (CWRS)
WP03	Brokenhead	6	30 ft Press Drill	10-May-23	AAC Viewfield (CWRS)
WP04	Rhineland	9	45 ft Air Drill	12-May-23	AAC Brandon (CWRS)
WP05	Springfield	7.5	50 ft Disc Drill	13-May-23	AAC Viewfield (CWRS)
WP06	MacDonald	7.5	42.5 ft Disc Drill	13-May-23	Faller (CNHR)
WP07	Morris	10	60 ft Disc Drill	15-May-23	AAC Brandon (CWRS)
WP08	Brokenhead	10	60 ft Hoe Drill	16-May-23	AC Carberry (CWRS)
WP09	Morris	10	60 ft Disc Drill	15-May-23	AAC Brandon (CWRS)
WP10	Argyle	12	56 ft Hoe Drill	15-May-23	AAC Brandon (CWRS)
WP11	Dauphin	10	70 ft Air Drill	19-May-23	CS Accelerate (CPSR)
WP12	Piney	10	45 ft Air Drill	23-May-23	Faller (CNHR)

Note: Canada Western Red Spring, CWRS; Canada Prairie Red Spring, CPSR; Canada Northern Hard Red, CNHR.

RESULTS

- There were significant differences in plant stands at eight out the 12 sites in 2023. At each site where a significant difference in plant stand was found, the highest seeding rate had the highest plant population.
- No significant differences in yield were found between seeding rates, even when there was a significant plant stand difference.
- Higher seeding rates did not improve yields, and thus, were a disadvantage in terms of profit due to higher seed costs. Seed costs were approximately **$5–12/ac*** more between each seeding rate treatment.

Table 2. *Summary of the 2023 wheat seeding rate trial site data.*

Site ID	Seeding Rate (lbs/ac)			Plant Stand @ Mid-season (plant/ft²)			Yield (bu/ac)			CV (%)	P-Value	Statistically Significant @ 95%	Change in profit ($/ac) compared to normal check		
	Low	Normal	High	Low	Normal	High	Low	Normal	High				Low	Normal	High
WP01	75	95	115	22.2^{B}	25.0^{B}	31.4^{A}	79.1	77.6	78.1	1.58	0.2716	No	5.67	0	-5.67
WP02	80	100	120	25.6	22.8	23.6	83.4	86.5	85.0	2.83	0.3847	No	5.67	0	-5.67
WP03	60	90	120	23.5	24.9	37.7	70.2	74.8	71.7	3.95	0.1419	No	8.50	0	-8.50
WP04	80	100	120	18.6^{B}	21.1^{A}	21.3^{A}	74.7	76.5	75.7	2.1	0.3686	No	5.67	0	-5.67
WP05	60	80	100	12.5^{B}	15.8^{A}	18.4^{A}	83.0	83.2	82.8	0.76	0.6869	No	5.67	0	-5.67
WP06	120	140	160	21.5^{B}	22.8^{AB}	25.4^{A}	44.8	45.8	43.2	7.44	0.5663	No	5.67	0	-5.67
WP07	90	120	150	24.1	28.5	30.8	51.5	54.0	48.4	7.82	0.2265	No	8.50	0	-8.50
WP08	80	100	120	18.0	16.5	20.8	57.7	57.6	57.4	1.73	0.8598	No	5.67	0	-5.67
WP09	95	117	138	27.2	32.6	30.0	52.4	52.2	54.4	4.18	0.3651	No	5.95	0	-5.95
WP10	90	120	150	19.3^{C}	21.6^{B}	27.3^{A}	68.2	67.9	67.5	1.17	0.4854	No	9.07	0	9.07
WP11	96	128	160	29.0^{C}	36.4^{B}	45.0^{A}	60.0	61.8	62.6	3.77	0.3343	No	8.50	0	-8.50
WP12	80	120	160	15.3^{B}	19.7^{A}	21.8^{A}	79.0	79.8	80.5	3.59	0.8000	No	11.90	0	-11.90

*Estimated based on Manitoba Agriculture's 2023 Cost of Production Guidelines ($34/ac). Change of profit is due to difference in seed cost only.

SPRING WHEAT SEEDING RATE TRIAL

Long-Term Results (2020 – 2023)

TRIAL DESCRIPTION

- 26 sites of this trial type have been conducted between 2020 - 2023.
- Every farmer cooperator employed optimized management practices for their operation (i.e. tillage, fertilizer rate, row spacing etc.), therefore management strategies could be inconsistent across sites. Seeding equipment depended on the farmer.
- Soil sampling was conducted prior to seeding to optimize fertilizer rates.

SUPPORTING DATA

- Seeding rates ranged from 60 lbs/ac – 180 lbs/ac.

RESULTS

- Significant differences in plant stands where observed at **13 out of 26 sites**, thus, **50 per cent** of sites. Out of all sites, **three or 12 per cent** of sites had significant yield differences. Sites where significant yield differences were found, the lowest seeding rate produced the highest yield.
- Higher seeding rates did impact plant density. The high seeding rate treatment resulted in higher plant stand populations at **13 out of the 13** sites where differences in plant density was observed.
- Higher seeding rates did not result in higher yields. As well, higher seeding rates did not result in a profit at any trial location.

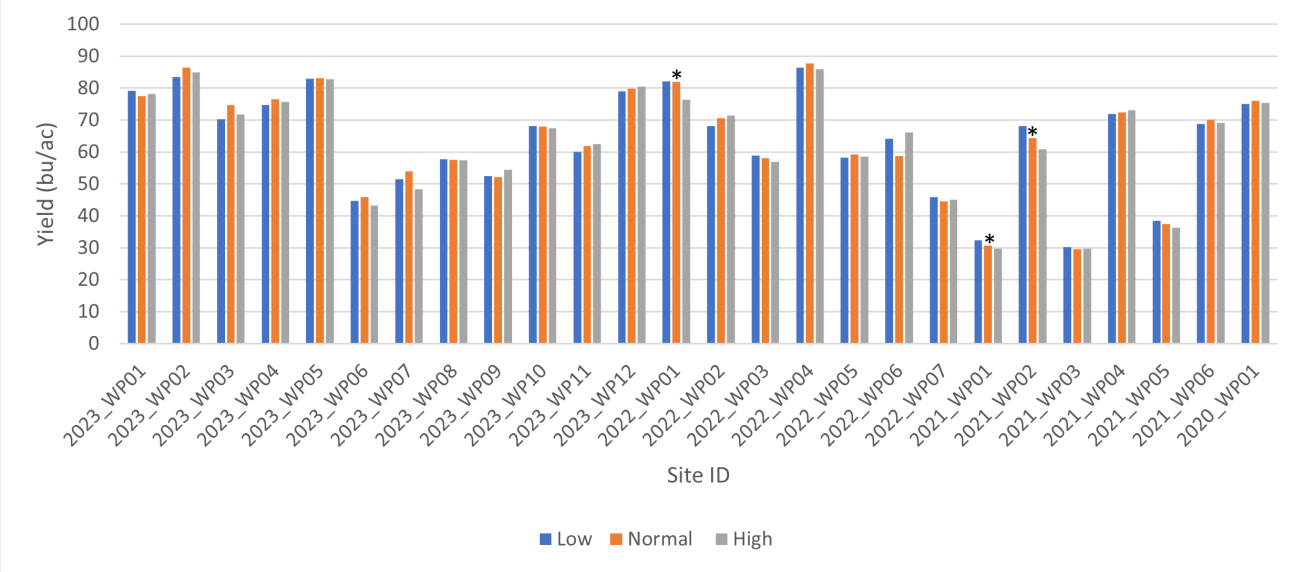


Figure 1. *Mean site yields from all sites established between 2020-2023.*

**Indicates sites where significant yield differences were found between seeding rate treatments.*

RECOMMENDATIONS/WHAT WE LEARNED

- Farmers are well informed about optimal seeding rates on their farms.
- During drier conditions, increasing the seeding rate did not increase yield. Although, results from small plot trials have suggested using higher seeding rates in dry conditions to minimizing seed mortality risks and maintain recommended plant populations.

THANK YOU!

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