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Soybean Double Inoculant Trials

Comparing double vs. single inoculation strategies

Long-term Results (2013 – 2023)

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:

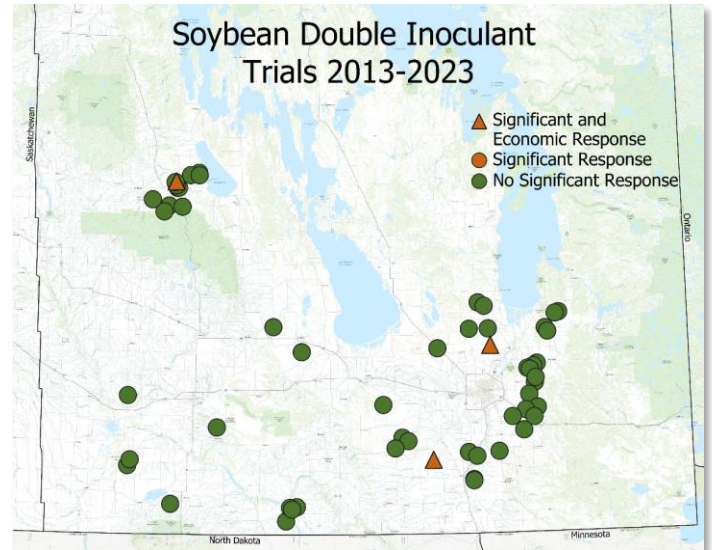
- Nodulation is rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
 - 0 (None) = 0 nodules/plant
 - 1 (Poor) = 1-4 nodules/plant
 - 2 (Fair) = 5-9 nodules/plant
 - 3 (Good) = 10-19 nodules/plant
 - 4 (Excellent) = 20 or more nodules/plant
- Nodulation 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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Soybean Single Inoculant Trials

Comparing a single inoculation strategy vs. none

Long-term Results (2016 – 2023)

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:

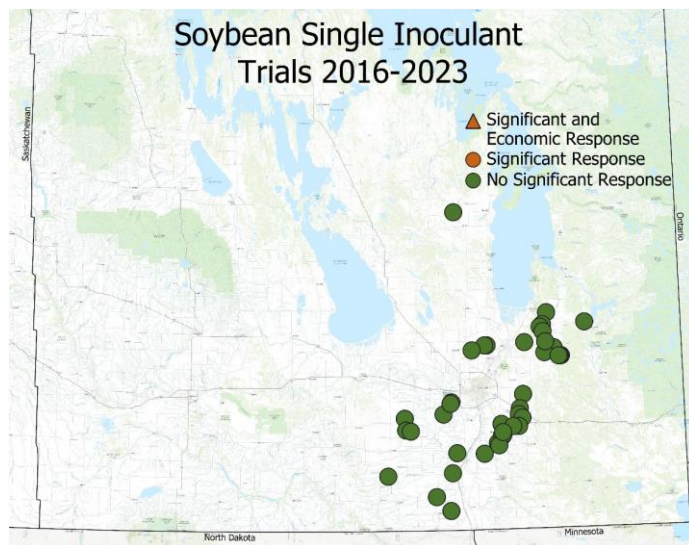
- Nodulation is rated at flowering (R1-R2) by counting the number of pink, active nodules per plant using a 0-4 scale:
 - 0 (None) = 0 nodules/plant
 - 1 (Poor) = 1-4 nodules/plant
 - 2 (Fair) = 5-9 nodules/plant
 - 3 (Good) = 10-19 nodules/plant
 - 4 (Excellent) = 20 or more nodules/plant
- Nodulation 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





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2023 Results

Trial Information:

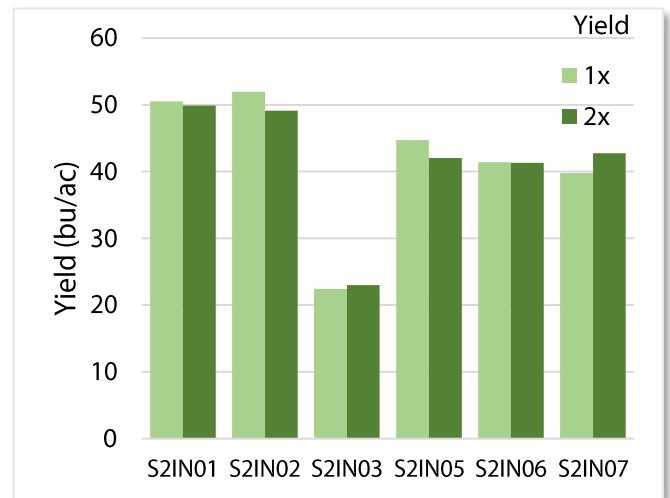
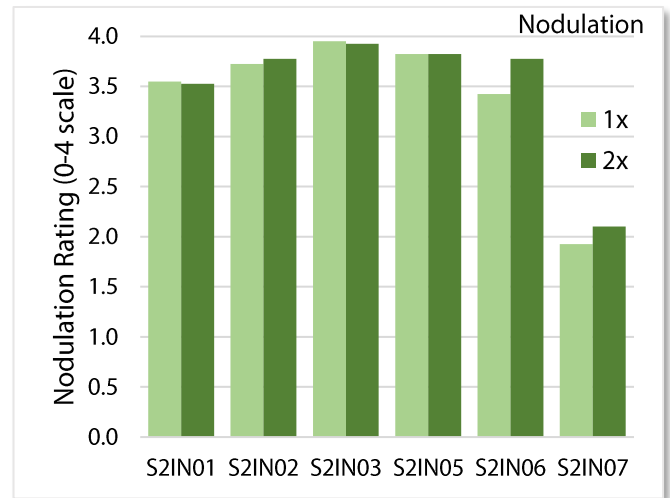
- 6 trials in 2023 comparing double (granular or peat in-furrow + liquid on-seed) vs. single (liquid on-seed alone) inoculant strategies.
- These trials require a minimum field history of two previous soybean crops and the most recent soybean crop within the last four years.

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.



TrialID	----- History -----		Average Nodulation Rating		---- Statistics ----				
	# 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





Soybean Single Inoculant Trials

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2023 Results

Trial Information:

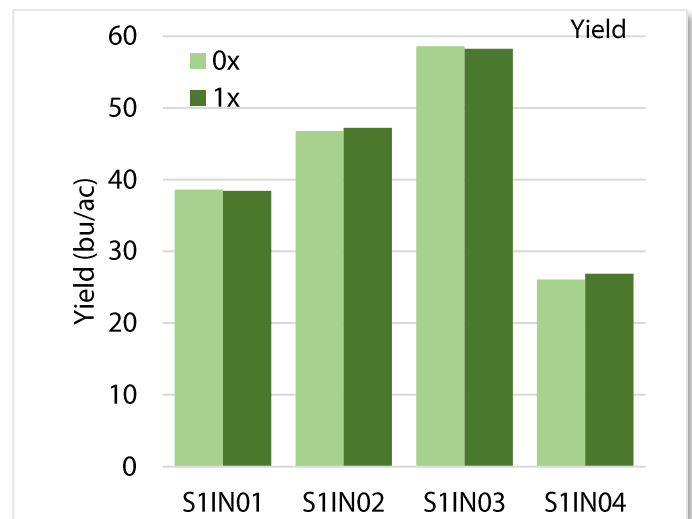
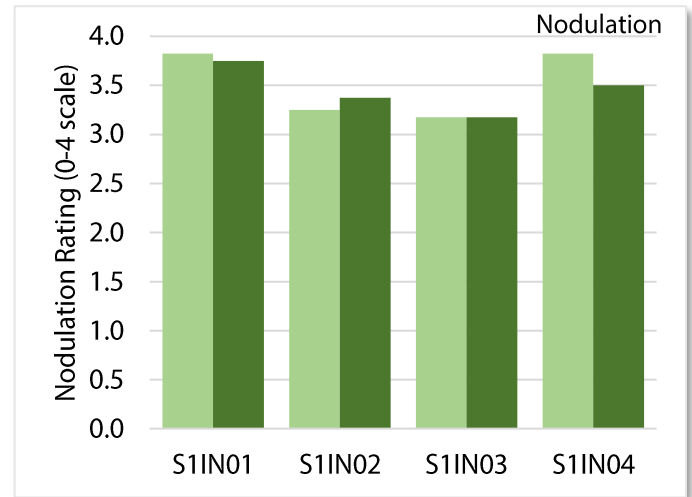
- 4 trials in 2023 compared a single inoculant strategy (one inoculant formulation or placement) vs. no inoculant applied at all.
- These fields had a minimum field history of three previous soybean crops and the most recent soybean crop within the last four years.

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).



TrialID	----- History -----		--- Avg Nod. Rating ---		Nodulation Difference?	p-value	Yield Difference?	---- Statistics ----	
	# previous soybean crops	years since last soybean crop	0x	1x				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



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
chris@manitobpulse.ca · 204-751-0439

