Saskatchewan AgriARM Applied Research Management

Wheatland Conservation Area Inc.
Swift Current, SK.

Granular inoculant rates and starter nitrogen use in soybean in Saskatchewan

Project #20140384

Start Date: April 1, 2015
End Date: Jan. 15, 2016

ADOPT 2015

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Final Report

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2015 Report

Project Objectives

The objectives of this project are to evaluate and demonstrate various rates of granular inoculant with and without starter nitrogen and show the effect they have on soybean nodulation and yield in Saskatchewan.

Project Rationale

Round-Up Ready soybeans are rapidly increasing in acres, but choosing the correct nitrogen program is essential for ensuring high yields. So far, advice from the industry is to double inoculate, using inoculant both on the seed and applied as granules in the seed row. The reasons for this is that seed applied inoculant only lasts about 30 days. Depending on the time from seed treatment to seeding, and the time it takes for a plant to establish, there may be very poor levels of inoculation under adverse conditions. Also, seed inoculation does not seem to adequately inoculate the branching roots.

Starter nitrogen is known to reduce or delay inoculation due to the plant's preference for non-fixed nitrogen sources. There may be an issue with the combination of single inoculation with the seed and use of starter nitrogen exacerbating problems with inoculation. There may be a combination of granular inoculation rate and starter nitrogen that will improve yields without delaying maturity.

SERF has conducted two years of ADOPT granular inoculant rate trials at Redvers and Halbrite (2013) and Weburn and Halbrite (2014). There was no clear trend or response evident in 2013 at either location due to some issues with flooding and excess moisture. In 2014, there was a good curvilinear trend of increasing yields with increasing rates of granular inoculant up to 12.5 lb/ac application rate. It is important to further demonstrate the effectiveness of double inoculation and the best rates of granular inoculant.

The addition of the starter nitrogen factor will allow us to demonstrate both the potential positive and negative effects of a starter N application. It is possible and even likely that starter N would suppress inoculation, but the effects on yield and maturity are not well established.

Methods

Seed treated with a peat-based inoculant was seeded with various rates of granular inoculant on land that has not had soybeans previously.
Factor 1: 0, 2.5, 5, 7.5, 10, 12.5, 15 lb/ac NRow inoculant
Factor 2: 6 lb/ac N and 25 lb/ac N

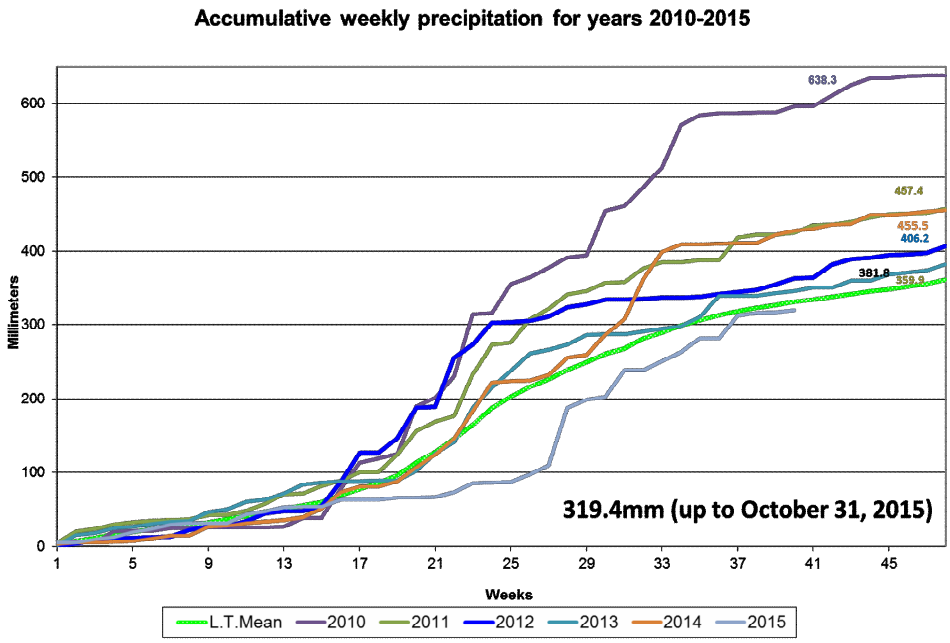
Data collected: Plant emergence, nodulation ratings, visual plant vigor, pod clearance, and yield.

Other field operation notes are as follows:

Variety 23-10RY Seeding rate: 210,000 seeds/ac (70 lbs/ac)
All soybeans had liquid Cell Tech Inoculant (75ml/27kg seed)

01-May	Pre-Seed Burnoff with Clean Start (Credit 360 g ae/acre + Aim @ 30 ml/ac)
11-May	Seeded Trial with Fabro plot drill, 9 openers x 9 inch row spacing, atomjet knife openers
Fertility:	Treatments 1 to 7 received **6 lbs/ac of N and 28 lbs/ac of P** Treatments 8 to 14 received **25 lbs/ac of N and 28 lbs/ac of P**
Inoculant	TagTeam Granular Soybean Inoculant "in Row" at 0, 2.5,5,7.5,10,12.5, and 15 lb/ac *Plus all soybeans had liquid Cell Tech Inoculant (75ml/27kg seed)*
10-Jun	Emergence counts done
24-Jun	Incrop Odyssey @ 17.3g/ac + Poast Ultra @ 190 ml/ac + Merge @ .5 l/100L
14-Jul	Sprayed RT540 @ 0.67 L/ac
25-Sep	Pod clearence measurements taken
30-Sep	Combined (6 Rows)

General Site Conditions

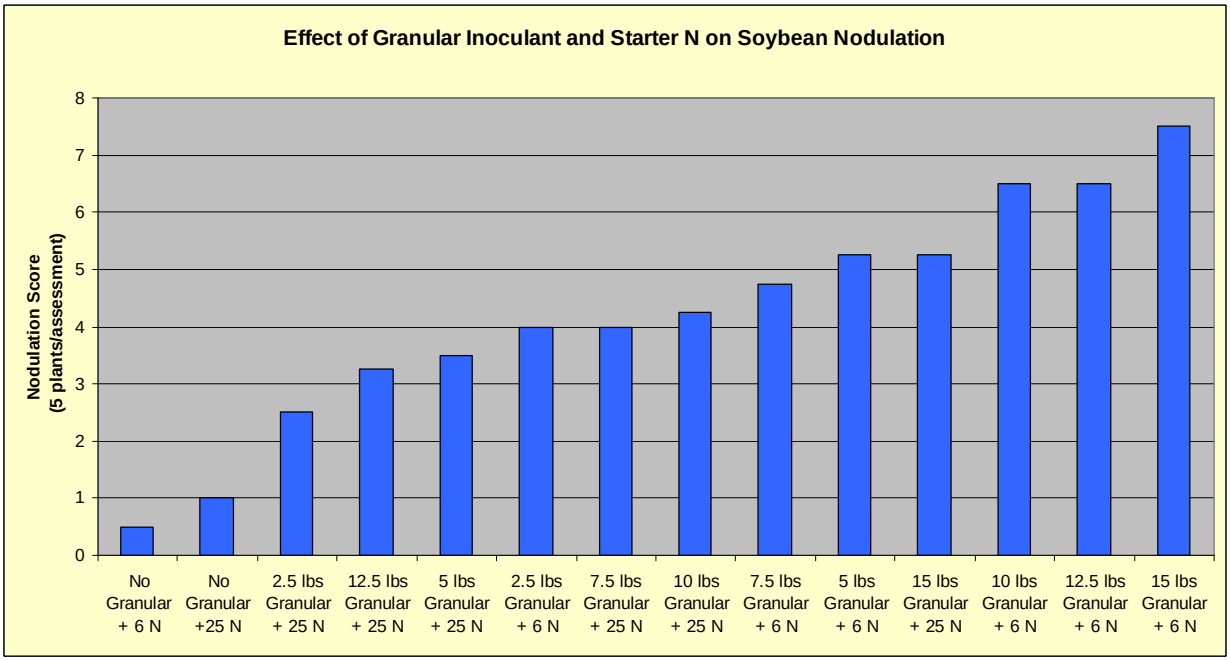


Graph 1. Accumulative weekly precipitation for years 2010-2015.
The site is situated 1 mile south of Swift Current. The soil is classified as a Swinton silty loam. For the most part in 2015, lower than average precipitation in the early growing season had a negative impact for shallow seeded crops. Severe drought like conditions continued through May, June, and July having a negative effect on yield potential and made it difficult to show treatment responses in certain trials. Overall yields for oilseed crops were lower than average due to lack of rain fall. Deeper seeded cereal crops had close to average yields. This was generally the case for area producers who experienced similar conditions resulting in similar yields.

Results

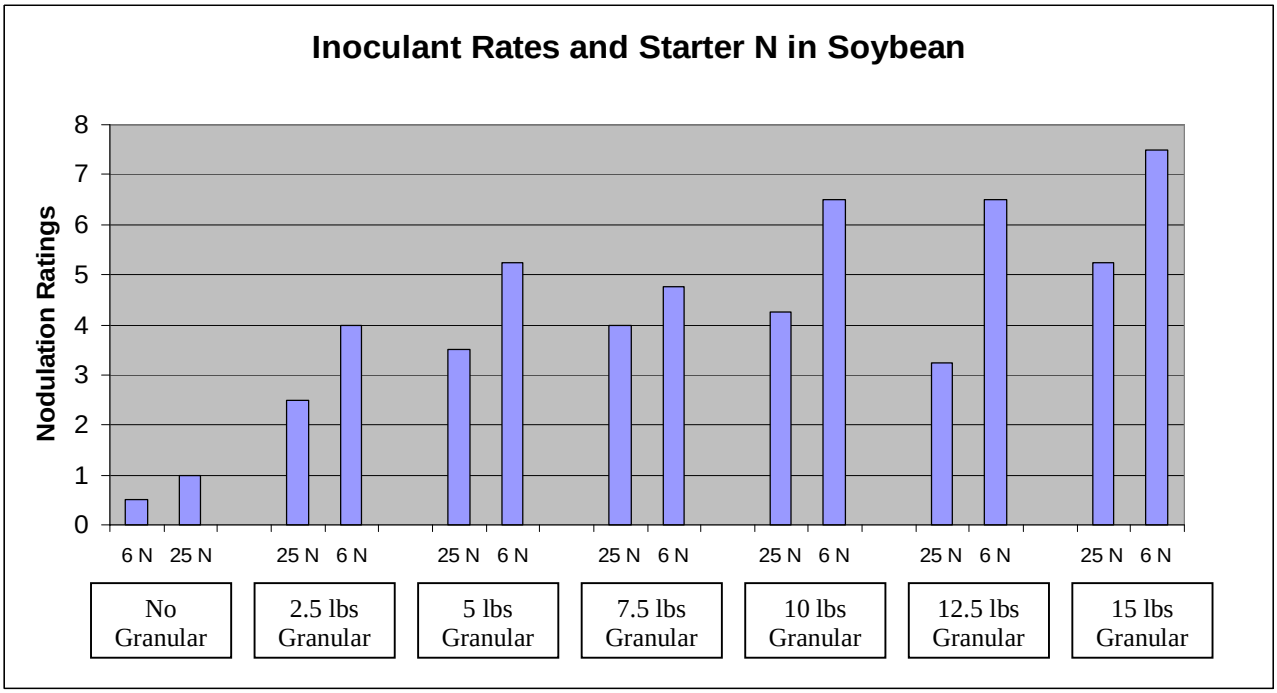
Typically, nodulation rating in pulse crops are low when the crop experiences adversely dry conditions in the spring due to desiccation or dieing off of the rhizobia inoculum. In 2015, at the Swift Current site, this was definitely the case and we saw wide differences in nodulation ratings. Even though all entries in the trial received liquid inoculant, it is believed that very little of this survived the dry spring and had little influence on nodulation or yield. It appears the granular inoculants were much better at surviving the dry spring conditions with the higher rates making a greater contribution to nodulation (Graph 2.).

Graph 2.



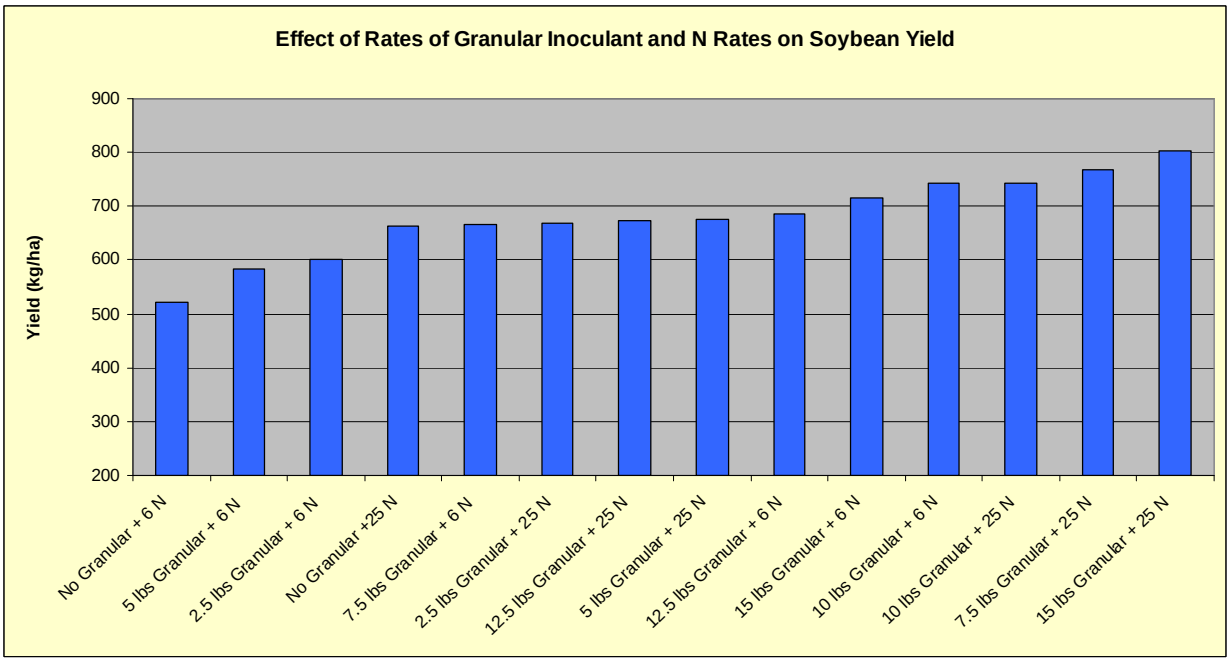
As well, at each granular inoculant rate, we saw a reduction in nodulation when 25 lbs/ac of starter N was applied verses the lower rate of 6 lbs/ac on starter N (Graph 3.). The only exception to this was with the "No Granular" treatment where little nodulation was seen at either N rate. This suggests that the higher rates of starter nitrogen is limiting inoculation due to the plant's preference for non-fixed nitrogen sources.

Graph 3.



In 2015, greater spring nodulation did not necessarily translate directly into greater yield. Even though the higher rates of granular inoculant generally resulted in better yields, there appeared to be a beneficial effect from the higher rates of starter N as well, even though they displayed weaker nodulation than the lower rate of starter N (Graph 4.). This can be explained by the extended drought that persisted through the spring to the end of July. It is likely that over time nodules became less effective and contributed little N fixation to the overall N requirements of the plant. Therefore, the treatments receiving higher rates of starter N would benefit. Evidence of the extended drought can be seen in the overall low yield of the trial, with treatment yields ranging from 520 - 802 kg/ha (about 7.5 -12 bu/ac).

Graph 4.



Conclusions

The nodulation data showed strong treatment responses early in the growing season that indicates not only the requirement to double inoculate, with both seed applied and granular inoculants, but at higher rates. Also, we saw a reduction in nodulation when 25 lbs/ac of starter N was applied verses the lower rate of 6 lbs/ac on starter N. This suggests that the higher rates of starter nitrogen is limiting inoculation due to the plant's preference for non-fixed nitrogen sources. Even though we saw some general trends, we did not see a direct correlation between nodulation and yield in 2015, however, since better nodulation creates the potential for greater yields we can assume under more optimum growing condition, this potential would be realized.

Acknowledgements

We thank the Ministry of Agriculture for all our ADOPT projects including plot signage and verbal acknowledgement at field days and on PowerPoint slides during presentations. This will continue at each venue where an extension activity occurs. We also thank Shannon Chant (Saskatchewan Ministry of Agriculture) for her help.

Summary

The objectives of this project are to evaluate and demonstrate various rates of granular inoculant with and without starter nitrogen and show the effect they have on soybean nodulation and yield in Saskatchewan. Advice from the industry is to double inoculate, using inoculant both on the seed and applied as granules in the seed row. The reasons for this is that seed applied inoculant only lasts about 30 days and seed inoculation does not seem to adequately inoculate the branching roots.

Starter nitrogen is known to reduce or delay inoculation due to the plant's preference for non-fixed nitrogen sources. There may be an issue with the combination of single inoculation with the seed and use of starter nitrogen exacerbating problems with inoculation. There may be a combination of granular inoculation rate and starter nitrogen that will improve yields without delaying maturity. The addition of the starter nitrogen factor will allow us to demonstrate both the potential positive

and negative effects of a starter N application. It is possible and even likely that starter N would suppress inoculation, but the effects on yield and maturity are not well established.

23-10RY soybean was treated with a peat-based inoculant and seeded with varying rates of NRow granular inoculant on land that has not had soybeans previously. The NRow inoculant rates were 0, 2.5, 5, 7.5, 10, 12.5, 15 lb/ac. Starter N was applied at two different rates to each granular treatment at 6 lb/ac N and 25 lb/ac N.

The nodulation data showed strong treatment responses early in the growing season that indicates not only the requirement to double inoculate, with both seed applied and granular inoculants, but at higher rates. Also, we saw a reduction in nodulation when 25 lbs/ac of starter N was applied verses the lower rate of 6 lbs/ac on starter N. This suggests that the higher rates of starter nitrogen is limiting inoculation due to the plant's preference for non-fixed nitrogen sources. Even though we saw some general trends, we did not see a direct correlation between nodulation and yield in 2015. This can be explained by the extended drought that persisted through the spring to the end of July. It is likely that over time nodules became less effective and contributed little N fixation to the overall N requirements of the plant. Therefore, the treatments receiving higher rates of starter N would benefit. Evidence of the extended drought can be seen in the overall low yield of the trial, with treatment yields ranging from 520 - 802 kg/ha (about 7.5 -12 bu/ac). Since better nodulation creates the potential for greater yields we can assume under more optimum growing condition, this potential would be realized.

This project will be promoted during Crop Production Week in Saskatoon in January and locally at Cropportunities 2016 on March 3 in Swift Current (200+ expected participants). This project was promoted on a CKSW radio program called "Walk the Plots" which we broadcast in the summer on a weekly basis. As well this topic was brought to the attention of the group on the Annual Field Day on July 16th (100 participants) as well as a number of smaller individual tours. This topic will also be posted on our website.