

Atlantic Grains Council

Agri-Innovation Project Focused Research for Atlantic Grain and Oilseed Producers Activity 6- Corn & Soybean Field Trials 2016 Summary



Soybean and corn management small plot and on-farm field scale trials were carried out in 2014, 2015 and 2016 under the Atlantic Grains Council Agri-Innovation Project - Focused Research for Atlantic Grain and Oilseed Producers Activity 6 – Soybean and Corn Field Trials. The Cereal and Oilseed research group of the Faculty of Agriculture of Dalhousie University Agricultural Campus in Truro, NS was responsible for the design, setup, seed packaging, data analysis and report preparation. Trials were carried out in all three provinces with the assistance of Agriculture and Agri-Food Canada at the Harrington, PEI site; NBDAA for the Hartland, NB site and Quality Crop Care Inc. in Sussex, NB. Not all trials were at all locations as it was dependent on the ability of site cooperators to carry out the trials. Summaries for each of the trials carried out in 2016 are presented here with details of the trial treatments, trial locations, site information, data collected, summaries of some data and some brief comments on the data. A brief weather summary for 2016 of each site where trials were conducted is found in Table 1. The dates of the weather data presented are from the earliest planting date of any of the trials to the date of the first killing frost at each site.

Table 1. 2016 Weather Summaries for Soybean and Corn Trial Sites – Approximate

| Site | Dates | GDD*(10 C) | CHU** | Precipitation (mm) |
|-----------------|--|------------|-------|--------------------|
| Truro, NS | May 18 th – Sept 26 th | | | |
| Canning, NS | | | | |
| Harrington, PEI | | | | |
| Hartland, NB | | | | |
| Sussex, NB | | | | |

Dates of Trial Planting to Date of First Frost

**Growing degree days (base temperature 10 C)*

***Corn Heat Units*

Soybean Management Trials

The soybean management trials were carried out in the same field at each site. Information for each site including base soil analysis results, plot size, seeding date, management and harvest date is presented in Table 2 for the NS sites and in Table 3 for the PEI and NB sites.

Table 2. 2016 NS Site Information Soybean Trials

| | Truro, NS | Canning, NS |
|---|---|---|
| Previous Crop | Grass Forage | Winter wheat |
| pH | 6.5 | 6.5 |
| Organic Matter (%) | 2.8 | 2.6 |
| P ₂ O ₅ (kg/ha) | 1924 | 1691 |
| K ₂ O (kg/ha) | 384 | 289 |
| S (kg/ha) | 22 | 18 |
| Seeding Date | June 1 st 2016 | May 27 th 2016 |
| Seeding Rate | Seed treatment & N/S Response: 55 seeds/m ² Row Spacing X Population: as per treatments | Seed treatment & N/S Response: 55 seeds/m ² Row Spacing X Population: as per treatments |
| Cultivar | Seed treatment & N/S Response: NSC Jaden RR2Y Row Sacing X Population: PS 0416 R2 & HY 03RY33 | Seed treatment & N/S Response: NSC Jaden RR2Y Row Sacing X Population: PS 0416 R2 & HY 03RY33 |
| Length of Seeded Plot Dist. Between Rows | 6 m (trimmed to 5 m) Seed treatment & N/S Response: 15 cm Row Spacing X Population: 15 or 30 cm | 6 m (trimmed to 5 m) Seed treatment & N/S Response: 15 cm Row Spacing X Population: 15 or 30 cm |
| Dist. Between Plots # of Rows Seeded | 20 cm Seed treatment & N/S Response: 8 Row Sacing X Population: 4 @ 30 cm or 8 @ 15 cm | 20 cm Seed treatment & N/S Response: 8 Row Sacing X Population: 4 @ 30 cm or 8 @ 15 cm |
| Seeding Area | 7.5 m ² | 7.5 m ² |
| Harvest Date | Nov.14 th 2016 | Oct. 20 th 2016 |
| Harvested Area | 7.5 m ² | 7.5 m ² |
| Herbicide Rate and Date | RoundUp Weather Max 2.5 L/ha July 1 st | |

Table 3. 2016 PEI & NB Site Information Soybean Trials

| | Harrington, PEI | Hartland, NB |
|---------------------------------------|---|---|
| Previous Crop | Barley | Corn |
| pH | 6.2 | 6.4 |
| Organic Matter (%) | 2.3 | 5 |
| P ₂ O ₅ (kg/ha) | 626 | 823 |
| K ₂ O (kg/ha) | 292 | 325 |
| S (kg/ha) | | |
| Seeding Date | Seed treatment & N/S Response: June 3 rd Row Spacing X Population: June 17 th | Seed treatment & N/S Response: June 2 nd |
| Seeding Rate | Seed treatment & N/S Response: 55 seeds/m ² Row Spacing X Population: as per treatments | Seed treatment & N/S Response: 55 seeds/m ² |
| Cultivar | Seed treatment & N/S Response: NSC Jaden RR2Y Row Spacing X Population: PS 0416 R2 & HY 03RY33 | Seed treatment & N/S Response: NSC Jaden RR2Y |
| Length of Seeded Plot | 5 m | 7.5 m |
| Dist. Between Rows | Seed treatment & N/S Response: 15 cm Row Spacing X Population: 15 or 30 cm | 15 cm |
| Dist. Between Plots | 20 cm | 20 cm |
| # of Rows Seeded | Seed treatment & N/S Response: 12 Row Spacing X Population: 6 @ 30 cm or 12 @ 15 cm | 6 |
| Seeding Area | 9 m ² | 7.5 m ² |
| Harvest Date | Row Spacing X Population: Nov. 9 th Seed treatment & N/S Response: Nov. 14 th | Seed Treatment: Oct. 20 th N/S Response: Oct. 4 th |
| Harvested Area | 7.6 m ² | 7 m ² |
| Herbicide Rate and Date | Factor July 14 th | RoundUp 2.5 L/ha June 30 th |

Soybean Response to Nitrogen and Sulphur

Introduction / Materials & Methods

The objective of this trial was to evaluate the response of soybeans to nitrogen and sulphur. Questions on the necessity of starter nitrogen has been asked by many growers. In general many growers apply some nitrogen (25-40 kg/ha) as a preplant application with as part of a blend to add recommended P & K. There is some feeling that soybeans may be lacking early N until nodulation occurs. A concern with the application of nitrogen is the effect on nodulation. When nitrogen is readily available soybeans can be less likely to form a symbiotic relationship with the Rhizobium bacteria in the soil which colonizes the roots and fixes nitrogen from the atmosphere and makes it available to the plant. The other nutrient being tested in this trial is sulphur which is becoming a concern in all crops as soil sulphur levels become depleted in the region. The interaction of nitrogen uptake and utilization in the plant in relation to sulphur availability is very important. This trial is comparing the effects of four N levels of 0 to 60 kg/ha N applied as ammonium nitrate and four sulphur levels of 0 to 30 kg/ha applied as K-Mag (Table 4). The trial was carried out on a small plot basis as a factorial randomized complete block design. Treatments were applied post planting by hand broadcasting the appropriate rate of fertilizer over the small plots. The 2550 HU variety, NSC Jaden RR2Y, was the variety used in this test. The test was planted at sites in Truro, NS; Canning, NS; Harrington, PEI and Hartland, NB. Data collected at all sites included plant heights, pod heights, yield, hundred seed weight, protein and oil content. Additional data including stand counts, nodule counts, root assessment and nodule assessment was collected at the NS and PEI sites. Root and nodule assessment was completed at the NB site.

The 2016 season was the third year of this trial. In 2014 this trial was carried out with only three levels each of N & S. It was decided to test one more level of N & S to see if there was any response to these higher rates. Data from the 2016 season is presented here.

Table 4. Soybean N & S Response Treatments

| Factor A – N Level (kg/ha) Applied as AN (34-0-0) | |
|---|----|
| 1 | 0 |
| 2 | 20 |
| 3 | 40 |
| 4 | 60 |
| Factor B – Sulphur Levels (kg/ha) Applied as K-Mag(0-0-22-22) | |
| 1 | 0 |
| 2 | 10 |
| 3 | 20 |
| 4 | 30 |

Results/Conclusions

In 2016 there was a significant yield response to nitrogen levels at the PEI and NB sites (Figure 1). There was a significant response to sulphur at the PEI and Canning NS sites (Figure 2). No significant interaction between nitrogen and Sulphur was found at any site. At the NB site the yield was significantly higher by at least 350 kg/ha with the application of 20, 40 or 60 kg/ha N, which did not significantly differ, than the 0 N treatment. At the PEI site yields were

significantly higher at the 60 kg/ha N rates than with 0 or 20 kg/ha N but not significantly greater than the 40 kg/ha N treatment. The difference between the 0 N treatment and 60 N treatment was 337 kg/ha. At both the PEI and Canning, NS sites yields with the application of 10, 20 or 30 kg/ha S did not significantly differ from one another but were significantly higher than the treatment receiving no Sulphur (0S). The difference was at least 763 kg/ha at the PEI site but only 265 kg/ha at the Canning, NS site. At the PEI, Canning, NS and Truro NS sites where nodule counts were completed on a sample of plants the number of nodules per plant was significantly affected by rate of N application (Figure 3). At the PEI site nodule numbers decreased significantly from the 0 and 20 kg/ha N treatments to the 40 and 60 kg/ha N treatments. At the Canning, NS site the nodule number was significantly less at the 40 and 60 kg/ha N rate than the 0 N treatment but did not significantly differ from the 20 kg/ha N rate. The nodule number decreased significantly from the 0 to 20 and 40 kg/ha N and decreased significantly again at the 60 kg/ha N rate at the Truro, NS site. Sulphur applications resulted in a significant increase in nodule numbers at the PEI and Truro, NS sites. Nodule numbers at 20 or 30 kg/ha S rates were significantly higher than the 0 S treatments at the PEI site and nodule number and nodule size was significantly greater with 10, 20 or 30 kg/ha S than the 0 S treatment at the Truro, NS site. Root mass assessment was significantly affected by S rates at the PEI site. Treatments receiving 20 or 30 kg/ha had a significantly higher visual root mass assessment than the 0 S treatment.

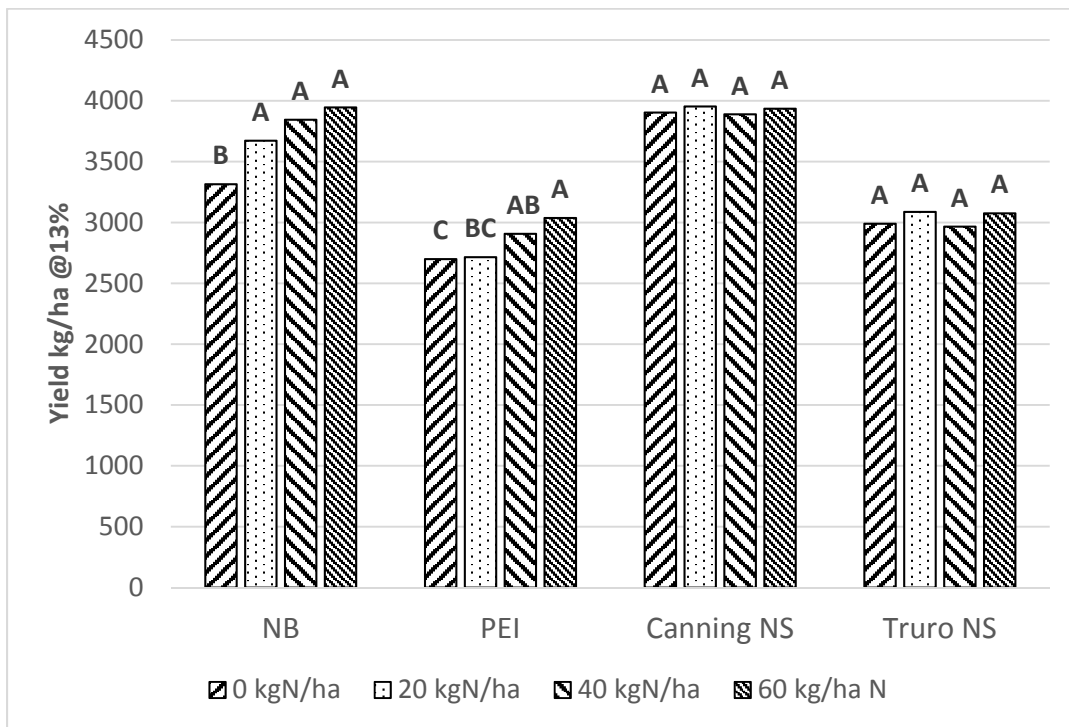


Figure 1. 2016 Soybean Yields at each N level for each Site.

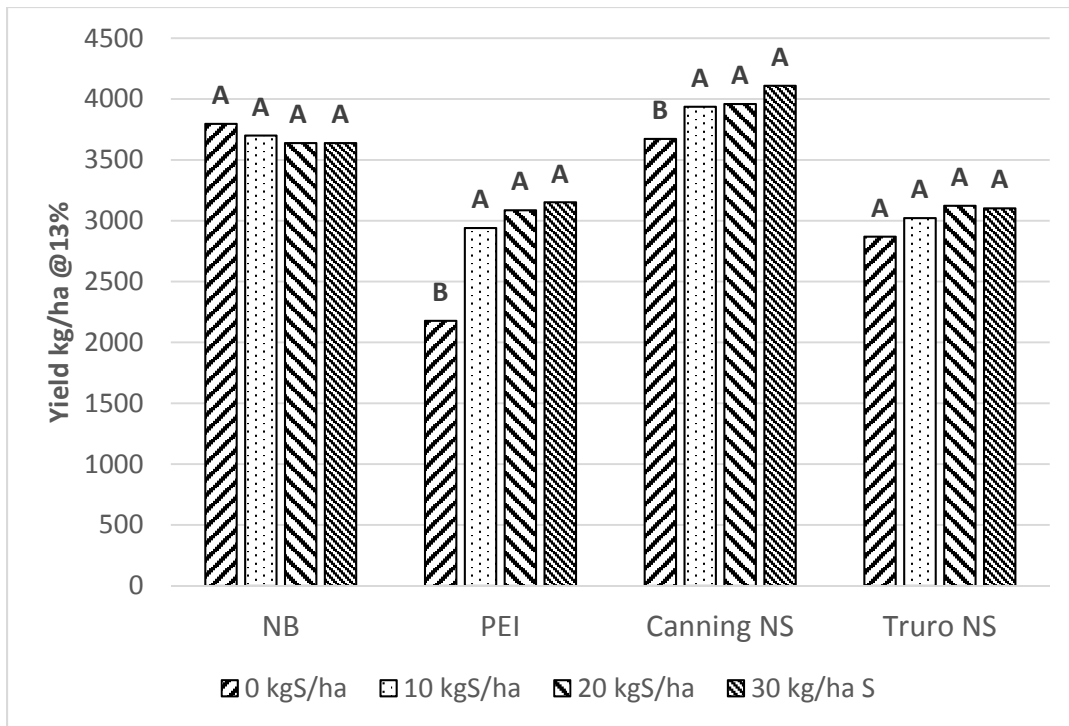


Figure 2. 2016 Soybean Yields at each S level for each site.

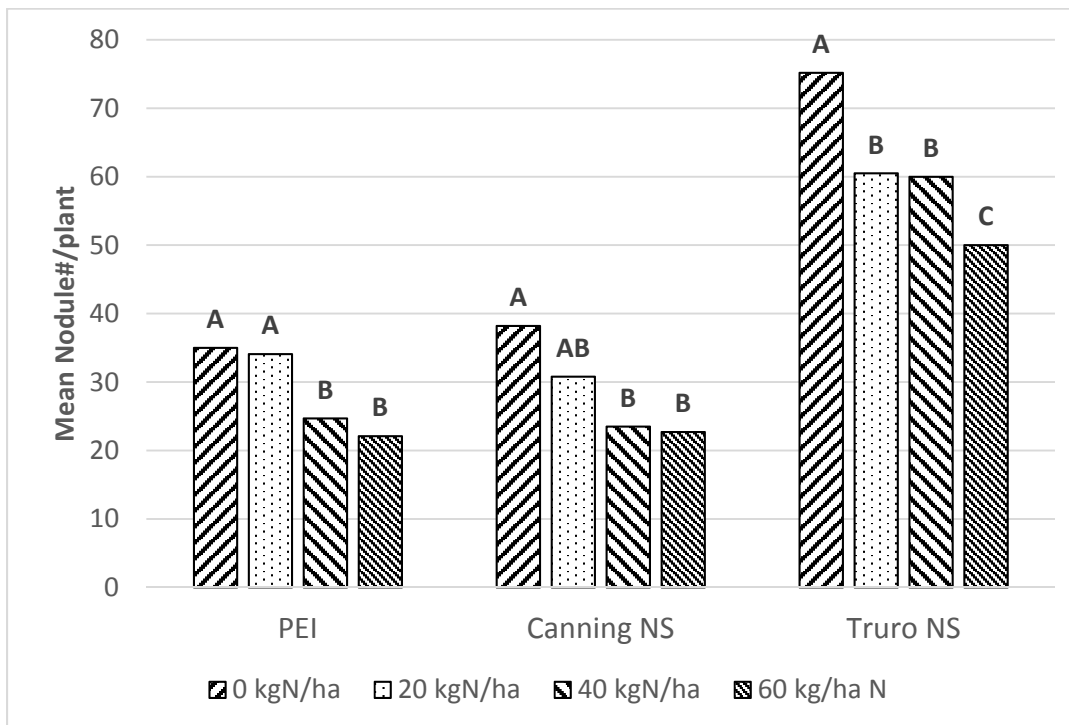


Figure 3. Soybean nodule #'s at each N level for PEI , Canning, NS and Truro, NS sites

Evaluation of Premier Tech (Mycorrhizae or AGTIV) & Monsanto BioAg (JumpStart) Biological Seed Additives on Treated & Untreated Soybeans

Introduction / Materials & Methods

The objective of this trial was to evaluate the response of soybeans with or without a seed treatment applied (Cruiser MAXX™ + Vibrance™) to the addition of the Premier Tech products containing the mycorrhizal powder only or AGTIV Soybean™, which contains both the mycorrhizae and rhizobium inoculant or Monsanto BioAg’s product, JumpStart™, alone or in combination. The mycorrhizal inoculant from premier Tech contains *Glomus intraradices* which claims to increase nutrient absorption, yield and crop quality of soybeans. The Monsanto BioAg product, JumpStart is a phosphate-solubilizing inoculant containing the fungus *Penicillium bilai* which claims to make less available residual soil phosphate immediately available for crop use. The mycorrhizal product and JumpStart were previously tested but the new product AGTIV which contains the rhizobium inoculant was not previously tested. The levels of each factor are shown in Table #5. The variety used in the test was a 2550 HU variety, NSC Jaden RR2Y. This test was planted at sites in Canning, NS, Truro, NS, Harrington, PEI and Hartland NB. The treatments which did receive the AGTIV Soybean product had peat inoculant (Cell-Tech™) added to the seed before seeding. Data collected at all sites included stand counts, nodule assessment, plant heights, pod heights, yield, hundred seed weight, protein and oil content. Nodule counts were completed for the Truro, Canning and PEI sites.

Table 4. Seed Treatments

| | | |
|-------------------------------------|-------------------------------------|-------------------------|
| Factor A – Seed Treatment Applied | | |
| 1 | Check (untreated seed) | |
| 2 | Cruiser Maxx™ + Vibrance™ | |
| Factor B – Biological Seed Additive | | Abbreviation for Graphs |
| 1 | Untreated Check | Check |
| 2 | Premier Tech - Mycorrhizal (GHA297) | PT-MY |
| 3 | Premier Tech - AGTIV™ Soybean | PT-AGTIV |
| 4 | Monsanto BioAg - JumpStart™ | MB-JS |
| 5 | Mycorrhizal (GHA297) + JumpStart™ | PT-MY + MB-JS |
| 6 | AGTIV™ Soybean + JumpStart™ | PT-AGTIV + MB-JS |

Results/Conclusions

Responses to seed treatment and biological seed additives varied among the sites. In general there was no large differences among the treatments but some were statistically significant. There was a statistically significant yield difference between the Cruiser Maxx + Vibrance seed treatment and the untreated seed at the two NS sites only. This difference was only 105 kg/ha at the Truro site and 153 kg/ha at the Canning site. There was no significant response to any of the variables measured with the biological supplemental seed treatments compared to the check at either the Truro or Canning sites. No significant responses of any variables was found between the untreated and Cruiser Maxx treated seed at the NB and PEI sites. Significant yield differences were found among the biological seed additives at both the NB and PEI sites (Figure 4). At the NB site yields on those plots treated with AGTIV Soybean + JumpStart were significantly lower than any of the other treatments. At the PEI site the AGTIV or AGTIV +

JumpStart yielded significantly lower than the check and the Mycorrhizal treatment. At the PEI site the other variable significantly affected by the biological seed additives was the nodule number measured at the R4 growth stage (Figure 5). Although the nodule number was reasonable the average nodule number per plant was significantly lower in the AGTIV + JumpStart treatment than all other treatments except AGTIV alone. The AGTIV alone treatment had significantly less nodules than the check and the Mycorrhizae + JumpStart treatment.

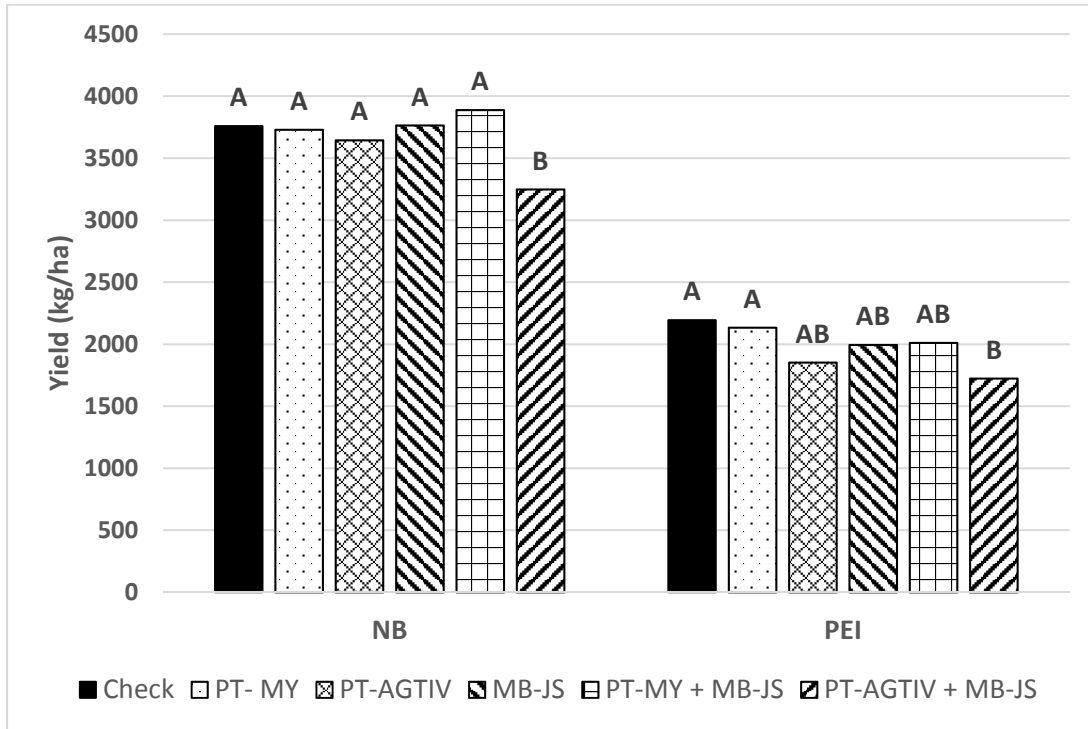


Figure 4. Yield from Biological Supplemental Seed Treatments for NB and PEI sites

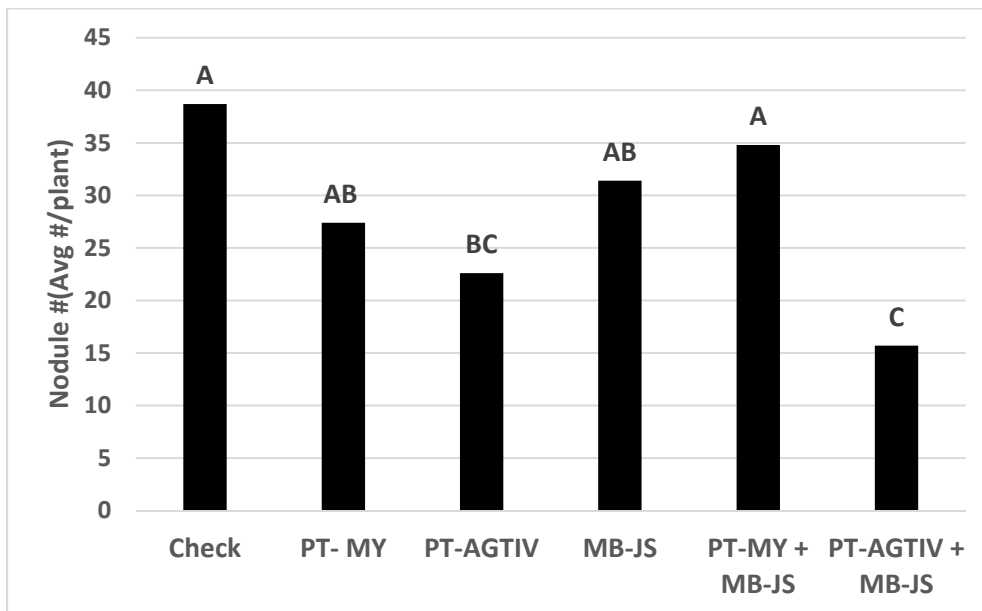


Figure 5. Mean Nodule # per plant with Biological Seed Treatments at PEI site

Soybean Response to Row Spacing & Seeding Rate

The objective of this trial was to evaluate the response of soybean varieties of different plant stature to row spacing and seeding rate. The varieties were chosen based on their abilities to branch with one variety being chosen which exhibits more branching. The seeding rates chosen were based on newer recommendations for lower seeding rates and to duplicate the rates being tested in field scale on-farm trials. The row spacing, seeding rates and varieties tested are presented in Table 5. The trial was carried out on a small plot basis as a split plot randomized block design with row spacing being the main block. The test was planted at sites in Truro, NS, Canning, NS and Harrington, PEI. All seed was treated with the fungicide/insecticide seed treatment, Cruiser Maxx™ + Vibrance™. Seed was inoculated with Cell Tech™ peat inoculant prior to seeding. Data collected at all sites included stand counts, plant heights, pod heights, branch counts, pod counts, yield, hundred seed weight, protein and oil content.

Table 5. 2016 Row Spacing × Seeding rate X Variety Treatments

| Factor A – Row Spacing | |
|-------------------------|--|
| 1 | 15 cm (6’’) |
| 2 | 30 cm (12’’) |
| Factor B – Seeding rate | |
| 1 | 47 seeds/m ² (190,000 seeds/ac) |
| 2 | 40 seeds/m ² (160,000 seeds/ac) |
| 3 | 32 seeds/m ² (130,000 seeds/ac) |
| Factor C - Variety | |
| 1 | PS 0416 R2 |
| 2 | HY 03RY33 |

Results/Conclusions

The stand counts recorded at the Truro, NS and PEI sites showed good differences among the three seeding rates but at the Canning, NS site no difference is seen between the stand counts for the three seeding rates (Figure. 6). This trend expresses itself in the yield results with a similar pattern with the Truro, NS and PEI sites showing slight but statistically significant differences among the seeding rates but no differences at the Canning, NS site (Figure 7). At the Truro, NS site the yields decreased from the 47 to 40 seeds /m² and again from 40 to 32 seeds/m² but the differences were only 149 and 160 kg/ha respectively. At the PEI site yields were significantly higher at the 40 and 47 seeds/m² than at the 32 seeds/m² rate with the difference ranging from 188 to 293 kg/ha. Row spacing only significantly affected yields at the PEI site. Yields were significantly higher at the 30 cm spacing than the 15 cm with yields 341 kg/ha greater at the 30 cm spacing (Figure 8). Varieties significantly differed from one another at the Canning, NS site only with HY 03RY33 out yielding PS 0416 R2 by 381 kg/ha. Row spacing significantly affected the branch number at the Truro, NS site only. There was a trend towards a higher number of branches at the 30 cm row spacing. There was a significant interaction for the pod number between the row spacing and variety at the Truro, NS site. PS 0416 R2 showed no difference in pod number at either row spacing while HY 03RY33 had significantly more pods at the 30 cm row spacing.

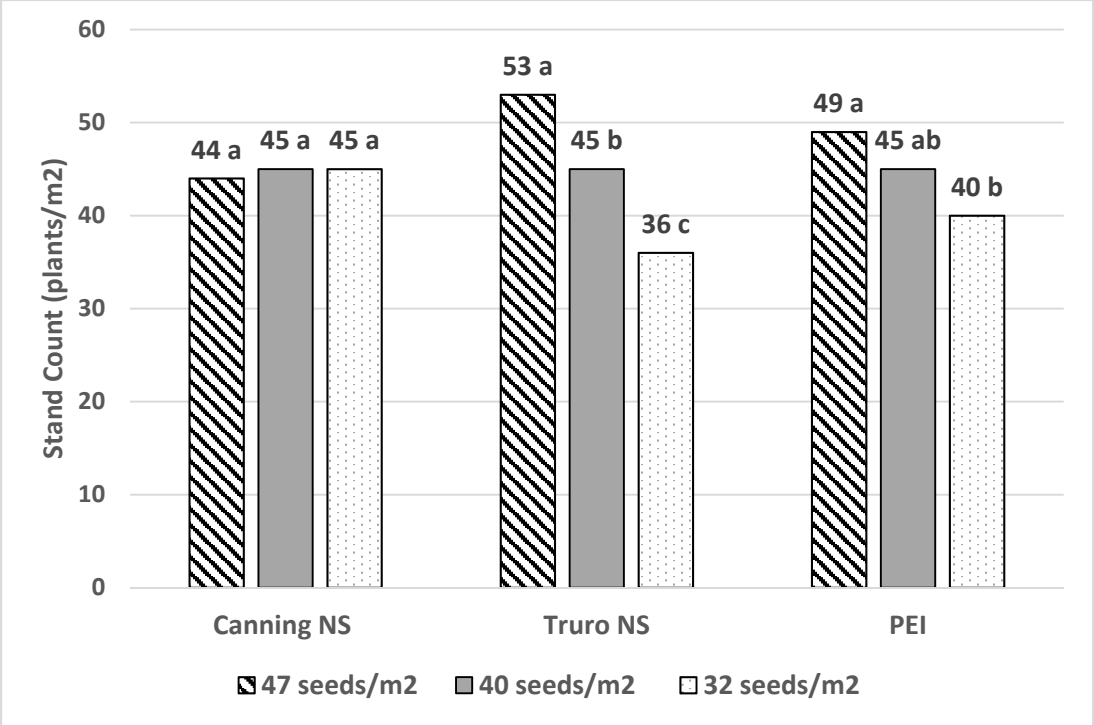


Figure 6. Stand counts at each seeding rate for each site

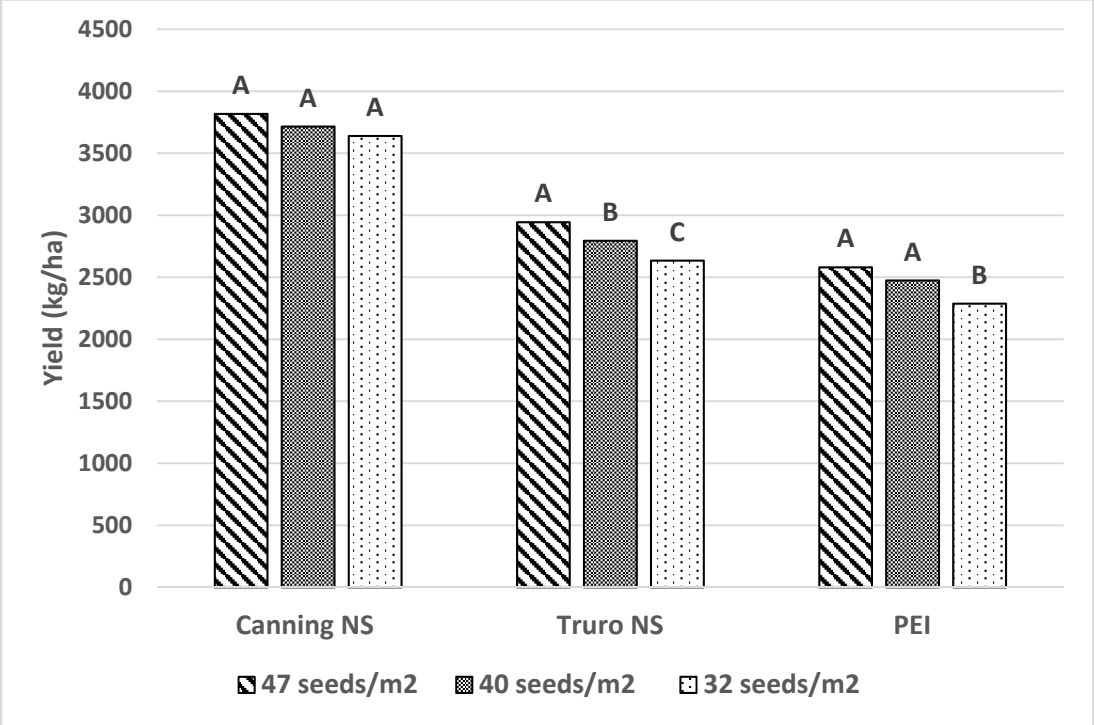


Figure 7. Yields at each seeding rate for each site

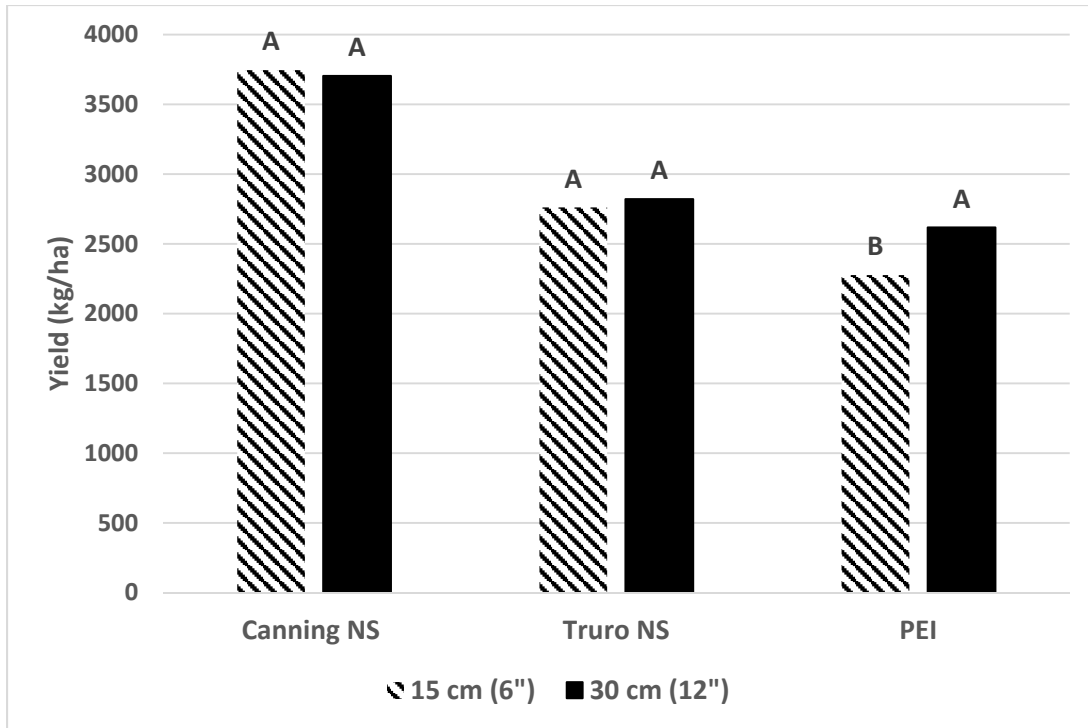


Figure 8. Yields at each seeding rate for each site

Pre-Inoculated vs. Double Inoculated Soybeans

Introduction / Materials & Methods

This trial was repeated for the third year at one location to compare soybean seed that came pre-inoculated from the seed company versus the same seed with additional inoculant added before seeding (double inoculated). The site was in Great Village, NS, on Mike and Amanda Eisses farm on a field which had never had soybeans on it before (virgin). Site information for the site is presented in Table 6. The trial was conducted in alternating replicated (6) strips of pre-inoculated and double inoculated seed seeded by the farm with farm scale equipment. Each strip was approximately 0.11 to 0.16 ha. Data collected included nodule counts, nodule assessment, plant heights, pod heights, branch count, pod count, yield, hundred seed weight, protein and oil content. Yield was measured at harvest by the grower who weighed the seed harvested from a measured strip of each treated area in a weigh wagon. Yield was also determined from hand sampled areas within each strip. The area hand harvested was 1.5m² from three areas within each rep of each treatment.

Table 6. 2016 Pre-Inoculated vs Double Inoculated Trial Site Information

| | |
|--|---|
| | Eisses –Great Village, NS |
| Previous Crop | Grain corn |
| pH | 5.96 |
| Organic Matter (%) | 3.1 |
| P ₂ O ₅ (kg/ha) | 428 |
| K ₂ O (kg/ha) | 213 |
| Seeding Date | May 13 th |
| Seeding Rate | 160,000 Seeds/acre |
| Cultivar | Pioneer P06T28 (Pre-Inoculated with Optimize) |
| Product Used on Double Inoculated Seed | HiStik N/T Inoculant at recommended rate |
| Fertility Applied | 10-18-27 + 0.3 B (AS) 5% S -200 lb/ac |
| Harvest Date | Oct. 20 th |
| Herbicide Rate and Date | RT 540 1.0 L/ha June 19 |

Results/Conclusions

The difference between the pre inoculated vs double inoculated seeded areas was visible during the growing season. The strips planted with seed containing only the pre inoculant appeared paler and were also shorter in height. Yields measured from the strips by the farm cooperator and the yields measured from sampled areas showed significant differences between the pre inoculated and double inoculated treatments (Figure 9). Yields were significantly lower in the pre inoculated seed treatment by approximately 2 t/ha. The number of nodules present were significantly lower on the pre inoculated seed with a mean of approximately 8 nodules with the double inoculated seed compared to less than 1 with pre inoculated seed (Figure 10). Plant heights and pod number were also significantly lower in the pre inoculated seed compared to the double inoculated.

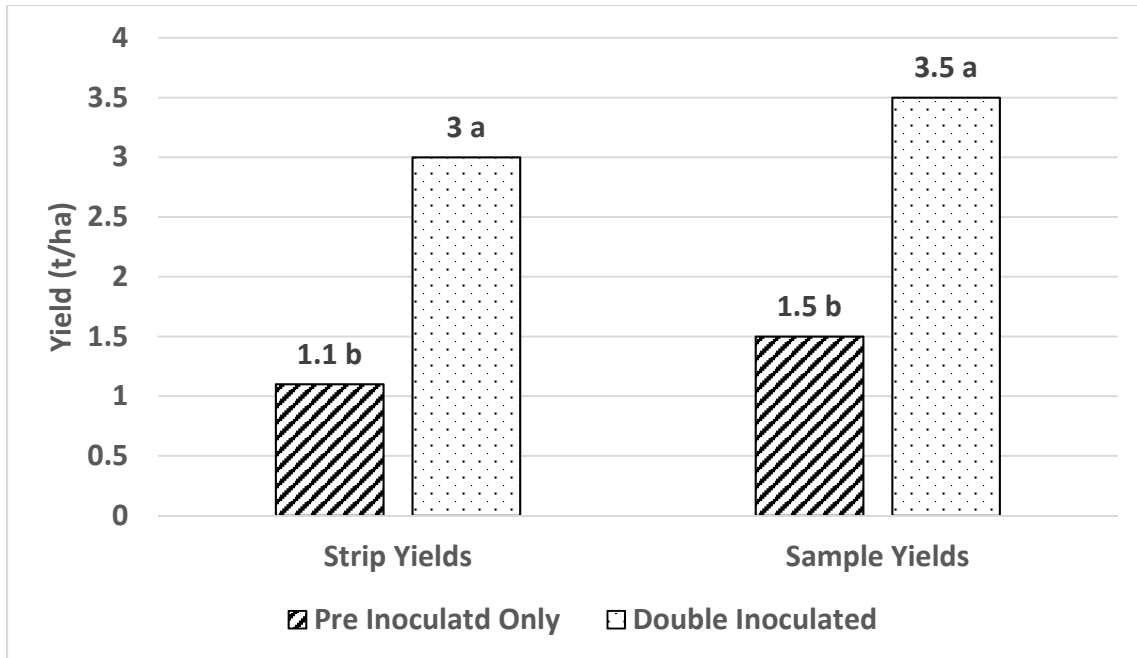


Figure 9. Yields of Pre Inoculated vs Double Inoculated Soybeans for Sampled Areas & Farm Harvested Strips

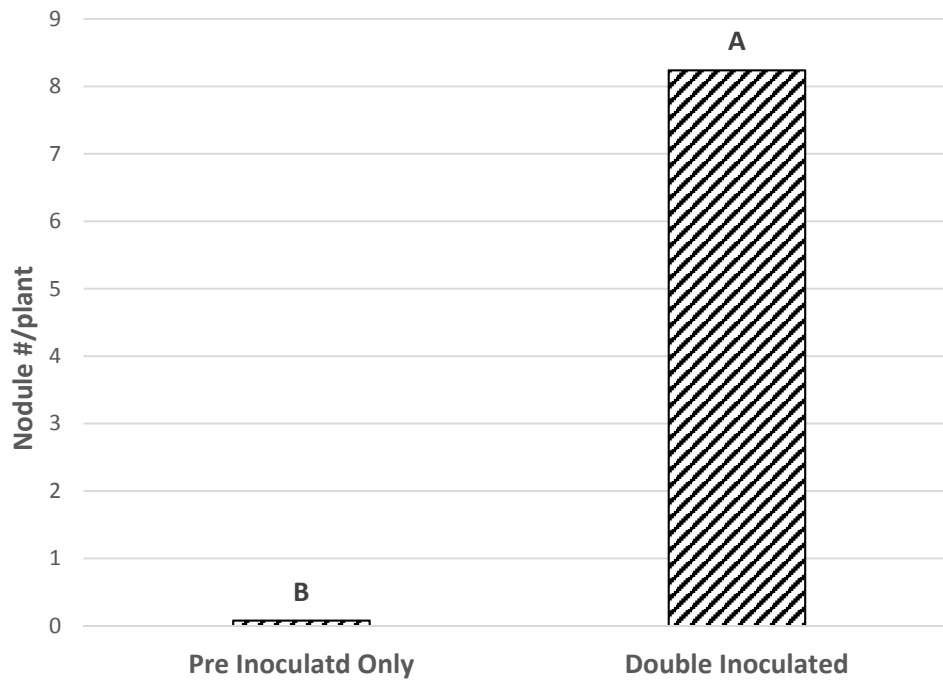


Figure 10. Nodule #'s of Pre Inoculated vs Double Inoculated Soybeans

Corn Management Trials

Corn Fertility Trial – Nitrogen Source & Rates

Introduction / Materials & Methods

The objective of this trial is to compare the effects of nitrogen rate and the source (fertilizer blend) of the nitrogen used as a topdress at the 4-5th leaf stage of the corn for a crop harvested as grain corn. The trials were carried out on grower's fields which where all management is carried out by the grower with the exception of the top dressing which is carried out by hand to the flagged out plots which were 6 rows X 8 m in size. This trial was set up as a randomized complete block design with three or four replications at each site. The trial was repeated for a third year in 2016 at two sites in NS and a thord site in Sussex, NB. Nitrogen rates applied at top dressing were 35, 50 or 70 kg/ha. The N sources were polycoated urea/ESN (43%N) (PC), Urea (U) (46% N) or Ammonium Nitrate (AN) (27% N). The full treatment list is presented in Table 10. All sites were established with the same protocol as far as amount of nitrogen applied as a broadcast before planting and the level of nitrogen banded at planting. Therefore with the 35, 50 or 75 N treatments the plots would have received a total of 135, 150 or 170 kg/ha N. The site locations and details are presented in Table 8. As in 2014 & 2015 the site in Canning, NS had two separate trials; one was in a portion of the field in which the previous winter wheat crop had been under seeded to red clover which was killed off the previous fall compared to the section of the field with no clover under seeded. Data collected included Tissue N analysis from leaf samples taken at approximately the V10 stage, grain yields from 2 rows harvested within each plot and stalk nitrate analysis from samples collected at harvest. Data collected in 2016 is presented here.

Table 7. Corn Fertility Trial Treatments

| Treatment # | Treatment |
|-------------|--------------------|
| 1 | 50N (P = Planter) |
| 2 | 50N (P) + 35N (PC) |
| 3 | 50N (P) + 50N (PC) |
| 4 | 50N (P) + 70N (PC) |
| 5 | 50N (P) + 35N (U) |
| 6 | 50N (P) + 50N (U) |
| 7 | 50N (P) + 70N (U) |
| 8 | 50N (P) + 35N (AN) |
| 9 | 50N (P) + 50N (AN) |
| 10 | 50N (P) + 70N (AN) |

Table 8. Corn Fertility Trial Site information

| | Site | | | |
|---|--|--|--|------------|
| | Truro, NS Dalhousie Ag Campus Field 320 | Canning, NS LFL Field #5 No Clover | Canning, NS LFL Field #4 Red Clover underseeded | Sussex, NB |
| Previous Crop | | Winter Wheat | Winter Wheat (US to Red Clover) | |
| pH | 6.31 | 6.32 | 6.4 | |
| Organic Matter (%) | 3.2 | 2.9 | 2.8 | |
| P ₂ O ₅ (kg/ha) | 756 | 1785 | 1757 | |
| K ₂ O (kg/ha) | 509 | 248 | 241 | |
| Seeding Date | May 27 th 2015 | May 11 th 2015 | May 11 th 2015 | |
| Seeding Rate | 33,000 plants/acre | 32,000 plants/acre | 32,000 plants/acre | |
| Hybrid | PRIDE SEEDS PS2305VT3PRIB | PRIDE SEEDS 5151 | PRIDE SEEDS 5151 | |
| Pre-Plant Fertilizer (Blend & Rate) | 19-19-19 Urea 200 kg/ha | | | |
| Length of Plot # of rows/plot | 8 m 6 | 8 m 6 | 8 m 6 | |
| Fertilizer Banded at Planting | 23-15-10 AN 200 kg/ha | | | |
| Harvest Date | Nov. 16 th 2015 | Nov. 5 th 2015 | Nov. 12 th 2015 | |
| Herbicide Rate and Date | RoundUp Weathermax 1.65 L/ha + PrimeExtra II Magnum 2.5 L/ha June 26 th | Converge 1.67 L/ha Pre emergent | Converge 1.67 L/ha Pre emergent | |

Results/Conclusions