Pea Inoculant/Nitrogen Trials 2023-24 Ridgetown Campus

Evaluation prepared for the Ontario Processing Vegetable Growers

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Experimental Design:

The pea inoculant/nitrogen trials were set up as a factorial design with four replications using the pea cultivars Tyne and Nitro. There were two treatment factors applied to both cultivars: inoculant and nitrogen. Each factor was either present or absent at the following rates:

Table 1. Rate of Nitrogen and Inoculant when present

Nitrogen	56.04 kg/ha or 50 lbs/acre
Inoculant	0.3kg/ha or 0.268 lbs/acre

This resulted in 4 different treatments within one trial:

1) Inoculant with no nitrogen
2) Inoculant with nitrogen
3) No inoculant with no nitrogen
4) No inoculant with nitrogen

Each treatment plot was 8.0 m long and established using a 12-row Wintersteiger cone seeder with row spacing of 18 cm. The statistical analysis program SAS was used to perform all analyses using the GLIMMIX procedure. The Shapiro-Wilk test was conducted to test normality, and the residual plots were utilized to test the assumptions of variance (ie. Random, homogenous, and independent). The means of the variables tested were separated using the Tukey HSD test with a confidence interval of $\alpha=0.05$; means followed by the same letter are not different. Complete experiments for both cultivars were established twice during the season in an attempt to correspond with early and late planting dates used by the industry.

The following data was collected:

i) Days to harvest
ii) Canopy Height (average of two heights within a plot)
iii) Yield (lbs/acre)
iv) Sieve distribution from 500g sample
v) Peas/pod (averaged across 10 plants within a plot)
vi) Nodule rating (refer to Table 4.)

Field Management:

In both years the fields received a pre-plant burndown of glyphosate, followed by cultivation before planting. The herbicide program used, as well as planting and harvest dates of the trials can be found in Table 2. The Pea Nodulation rating (Manitoba Pulse Soybean Growers) was completed just prior to the crop flowering. A cumulative rating score was given based on the visual assessment of plant growth and vigour, nodule colour and number, and nodule position for 10 pea plants within a plot (refer to Table 4.)

Table 2. Planting/Harvest dates and herbicide program for pea population trials for 2 years.

Year	Planting Date	Harvest Dates	PRE Herbicide Application	POST Herbicide Application
2023	*Early*- May 6 *Late*- June 2	*Tyne Early*- July 13 *Nitro Early*- July 6 *Tyne Late* -Aug 2 *Nitro Late*- Aug 1	Dual II Magnum	Assure and Basagram
2024	*Early*- April 26 *Late*- June 4	*Tyne Early*- June 30 *Nitro Early*-June 27 *Tyne Late* – Aug 7 *Nitro Late*- Aug 1	Dual II Magnum	*Early*-N/A * *Late*-MCPA amine 300

*a POST application was unable to be applied due to the field being too wet to use a field sprayer; hand weeding was implemented instead.

Tenderometer readings were taken from subsamples which were collected as the plots matured; the target harvest tenderometer value was 110 psi. At harvest, a sample of peas from 8 rows x 2.0 m long (2.88m^2) were harvested per plot and shelled using a stationary pea sheller. From the harvest area, 2 readings of plant height were recorded. The sample weight of threshed peas was used to calculate yield, and a subsample of 500 g was hand-sieved through a set of steel pea sieves to determine pea size distribution (refer to Table 3 for sieve sizes).

Table 3. Sieve sizes

SIEVE SIZE	**DIAMETER OF CIRCULAR OPENING IN MM (INCHES)**	
	Will not pass through	Will pass through
1	-	7.1 (18/64)
2	7.1 (18/64)	7.9 (20/64)
3	7.9 (20/64)	8.7 (22/64)
4	8.7 (22/64)	9.5 (24/64)
5	9.5 (24/64)	10.3 (26/64)
6	10.3 (26/64)	11.1 (28/64)

Table 4. Assessing Field Pea Nodulation using a cumulative score adapted by the Manitoba Pulse Soybean Growers (https://www.manitobapulse.ca/2019/06/assessing-field-pea-nodulation/)

			Your Score
Plant Growth and Vigour	Plants green and vigorous	5	
	Plants green and relatively small	3	
	Plants slightly chlorotic (less green)	2	
	Plants very chlorotic	1	
Nodule Colour and Number	Greater than five clusters of pink pigmented nodules	5	
	Three to five clusters of predominantly pink nodules	3	
	Less than three clusters of nodules, or whitish/greenish nodules	1	
	No nodules, or white/green nodules	0	
Nodule Position	Crown and lateral root nodulation	3	
	Generally crown nodulation	2	
	Generally lateral nodulation	1	

11-13 = Effective Nodulation 7-10 = Less Effective Nodulation 1-6 = Unsatisfactory

Results and Conclusions:

A cumulative analysis of variance for the years 2023 and 2024 was conducted using SAS software and the Tukey-Kramer test was utilized to separate the treatment means with significant differences. Across all 4 trials none of the ratings of plant height, pods/plant and yield resulting in significant differences, however the trends are as follows. For average plant height all trials had taller standing plant heights when nitrogen or inoculant were present. When considering pods/plant, both cultivars in the late trials and the cultivar Tyne in the early planting demonstrated similar pod/plant counts. Only the cultivar Nitro in the early planted trial averaged 1 more pot per plant when nitrogen was present, when compared to treatments without nitrogen (Table. 7).

Throughout all 4 trials the yields were higher when nitrogen was not present. When looking at both the late plantings for Nitro and Tyne, yields were higher when inoculant was present than without. The trend of higher yields with inoculant present occurred in the early planting of Nitro, however the early planting of Tyne had the opposite result. The early planting of Tyne was the only trial that resulted in an increase in yield (200lbs/ acre) when inoculant was not present (Table 5.) However, all yield differences were not statistically significant.

When using the nodulation rating system (Table 4) all treatments resulted in effective nodulation except the late planting of Tyne. In this trial, all treatments that included nitrogen whether with or without inoculant had less effect nodulation (Table 10.)

Table 5. Tyne inoculant trial early means for plant height, pods/plant, peas/pod and yield for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Plant Height	Tenderometer	Pods/Plant	Yield
Main Effect	(cm)	(average)	(#)	(lbs/acre)
Nitrogen	NS	-	NS	NS
0 lbs/acre	52.9	128	5.4	4535.6
50 lbs/acre	58.8	119	5.3	3784.7
Inoculan*t*	NS	-	NS	NS
0 lbs/acre	54.2	125	5.4	4275.5
0.268 lbs/acre	57.6	123	5.3	4044.8
N x IN interaction	NS	-	NS	NS

[a-b] Means within column followed by the same letter are not different according to Tukey's HSD at α=0.05.

* Significant at P<0.05, respectively; NS, not significant at the P=0.05 level.

Days to harvest, 2023-65, 2024-67; average= 66 days to harvest

Table 6. Tyne inoculant early planting trial sieve size distribution and nodule cumulative rating by treatments; for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Percent sieve size distribution							Nodule Rating
Treatments	<6	6	5	4	3	2	1	Avg. Score
1. IN, no N	0.84	6.31	32.79	38.92	15.62	3.50	1.49	12
2. IN, N	1.62	7.11	29.69	37.31	16.69	4.80	2.20	12
3. No IN, no N	0.87	6.17	35.03	37.69	14.52	3.56	1.51	12
4. No IN, N	0.99	6.68	32.79	37.41	15.76	3.87	1.84	11

Treatment 1-Inoculant with no nitrogen; 2-Inoculant with nitrogen; 3-No inoculant with no nitrogen; 4-No inoculant with nitrogen.

Table 7. Nitro inoculant trial early means for plant height, pods/plant, peas/pod and yield for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Plant Height	Tenderometer	Pods/Plant	Yield
Main Effect	(cm)	(average)	(#)	(lbs/acre)
Nitrogen	NS	-	NS	NS
0 lbs/acre	32.0	108	5.7	4883.13
50 lbs/acre	33.2	108	6.6	4742.52
Inoculant	NS	-	NS	NS
0 lbs/acre	31.7	109	6.0	4785.24
0.268 lbs/acre	33.5	107	6.4	4840.40
N x IN interaction	NS	-	NS	NS

[a-b] Means within column followed by the same letter are not different according to Tukey's HSD at α=0.05.

* Significant at P<0.05, respectively; NS, not significant at the P=0.05 level.

Days to harvest, 2023-62, 2024-61; average= 61.5 days to harvest

Table 8. Nitro inoculant early planting trial sieve size distribution and nodule cumulative rating by treatments; for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Percent sieve size distribution							Nodule Rating
Treatments	<6	6	5	4	3	2	1	Avg. Score
1. IN, no N	0	0.01	0.35	2.14	27.82	49.83	19.51	12
2. IN, N	0	0	0.17	2.80	28.67	46.70	21.16	11
3. No IN, no N	0	0	0.05	2.57	30.22	47.23	20.03	12
4. No IN, N	0	0	0.12	2.14	26.44	51.03	19.82	11

Treatment 1-Inoculant with no nitrogen; 2-Inoculant with nitrogen; 3-No inoculant with no nitrogen; 4-No inoculant with nitrogen.

Table 9. Tyne inoculant trial late means for plant height, pods/plant, peas/pod and yield for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Plant Height	Tenderometer	Pods/Plant	Yield
Main Effect	(cm)	(average)	(#)	(lbs/acre)
Nitrogen	NS	-	NS	NS
0 lbs/acre	30.4	140	4.5	4809.0
50 lbs/acre	31.3	137	4.8	4644.1
Inoculant	NS	-	NS	NS
0 lbs/acre	29.4	139	4.5	4630.4
0.268 lbs/acre	32.3	138	4.8	4822.7
N x IN interaction	NS	-	NS	NS

[a-b] Means within column followed by the same letter are not different according to Tukey's HSD at α=0.05.

* Significant at P<0.05, respectively; NS, not significant at the P=0.05 level.

Days to harvest, 2023-65, 2024-67; average= 66 days to harvest

Table 10. Tyne inoculant late planting trial sieve size distribution and nodule cumulative rating by treatments; for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Percent sieve size distribution							Nodule Rating
Treatments	<6	6	5	4	3	2	1	Avg. Score
1. IN, no N	0.51	4.75	25.69	40.96	21.56	4.33	1.67	12
2. IN, N	0.66	5.59	28.35	40.77	18.75	3.81	1.50	10
3. No IN, no N	0.27	4.91	29.35	38.81	20.90	3.83	1.35	12
4. No IN, N	0.86	5.48	28.30	39.38	19.29	4.50	1.58	10

Treatment 1-Inoculant with no nitrogen; 2-Inoculant with nitrogen; 3-No inoculant with no nitrogen; 4-No inoculant with nitrogen.

Table 11. Nitro inoculant trial late means for plant height, pods/plant, peas/pod and yield for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Plant Height	Tenderometer	Pods/Plant	Yield
Main Effect	(cm)	(average)	(#)	(lbs/acre)
Nitrogen	NS	-	NS	NS
0 lbs/acre	22.8	117	5.6	4369.5
50 lbs/acre	24.8	110	5.7	4032.5
Inoculant	NS	-	NS	NS
0 lbs/acre	22.9	115	5.7	4103.4
0.268 lbs/acre	24.8	112	5.6	4298.6
N x IN interaction	NS	-	NS	NS

[a-b] Means within column followed by the same letter are not different according to Tukey's HSD at α=0.05.

* Significant at P<0.05, respectively; NS, not significant at the P=0.05 level.

Days to harvest, 2023-59, 2024-60; average= 59.5 days to harvest

Table 12. Nitro inoculant late planting trial sieve size distribution and nodule cumulative rating by treatments; for two site years at the University of Guelph Ridgetown Campus (2023,2024).

	Percent sieve size distribution							Nodule Rating
Treatments	<6	6	5	4	3	2	1	Avg. Score
1. IN, no N	0.00	0.04	1.18	7.03	30.29	39.85	21.00	12
2. IN, N	0.00	0.06	1.08	7.05	29.49	39.41	22.16	13
3. No IN, no N	0.00	0.00	0.88	6.62	29.38	43.28	19.20	12
4. No IN, N	0.00	0.03	0.99	6.96	31.35	39.94	20.00	11

Treatment 1-Inoculant with no nitrogen; 2-Inoculant with nitrogen; 3-No inoculant with no nitrogen; 4-No inoculant with nitrogen.