Assessing New Soybean BioStacked Inoculant Technology

Purpose:

Soybeans require a significant amount of nitrogen to produce a high yielding crop. A 50 bu/ac crop requires 210 lbs/ac of nitrogen. At present about 60% of Ontario soybeans receive an annual application of inoculants. Research conducted with older inoculant formulations confirmed that yield gains were inconsistent and very small if the field had successfully grown soybeans in the past.

Advances in technology have provided new soybean inoculants called “pre-inoculants”. These products contain highly efficient strains of bacteria and “extenders” that prolong the viability of inoculants. Seed can be treated before it is delivered to the farm. Reduced inoculation procedures at planting time and excellent coverage are significant advantages to the grower, compared to traditional drill box application. These high quality inoculants provide between 800,000 and 1,400,000 bacterial cells per seed, much higher concentrations than were previously available.

Researchers from Ohio State found yield gains to be common in productive fields with a history of soybeans. The average yield response from 64 Ohio trials was 1.9 bu/acre from all inoculants tested. Some states such as Michigan, Indiana, and North Dakota have also found average gains ranging from 1.0 to 2.7 bu/ac in fields with a history of soybeans. Other regions have found little or no gains from inoculants. This study is designed to assess the possible yield gains of using an inoculant on fields in Ontario with a history of soybeans.

Methods:

Field scale trials were established across Ontario to determine possible yield benefits to the use of an inoculant on fields that had previously grown soybeans. Thirty eight trials were conducted across a wide geographic area in 2007, 2008, and 2009. (Figure 1) These sites provided a range of soil types, growing conditions and yield potentials. Trials were replicated twice and sometimes three times with a minimum length for each treatment of 1000 feet. All trials included the following treatments:

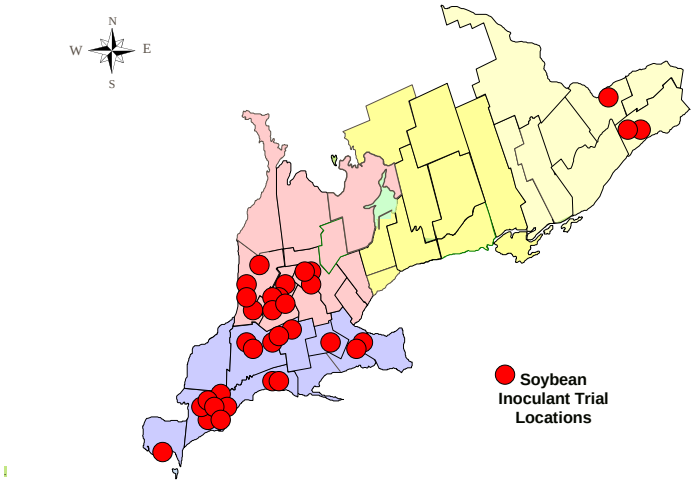
1. Untreated Check
2. Cell Tech SCI
3. HiStick Liquid + Liquid Extender (2007)
   HiStick NT + Extender (2008,09)

Fields were treated as a whole when applying herbicides, fertilizers, and tillage practices. Crop inputs were applied perpendicular to the direction of the inoculant treatments.

Field trials were weighed with a calibrated weigh wagon. Seed samples were collected and assessed for size and grade. Seed samples were also analyzed for oil and protein content by the University of Guelph, using near infrared reflectance (NIR). At each field site soil samples were collected at planting time. A standard soil test analysis was conducted as well as a PSNT nitrogen test. Both nitrate and ammonium levels were assessed along with the usual soil test values.

In addition, sufficient topsoil was removed from each site to permit a bioassay of the nodulation potential of the existing *Bradyrhizobium japonicum* populations indigenous at that field test location in 2007.

Figure 1. 2007- 2009 Soybean Inoculant Trial Locations



Results:

Table 1: Field Scale Soybean Response to Inoculants:

Year	County	Yield in bu/ac			Average Inoculant Response	Average Nitrate (ppm)	Average Ammonium (ppm)	pH
		Untreated	Cell	Hi Stick				
2009	Elgin	53.76	55.00	54.32	**0.90**	11.48	0.95	7.7
2009	Elgin	51.26	54.15	50.48	**1.05**	13.39	1.10	7.4
2009	Perth	46.42	47.86	47.06	**1.04**	19.06	1.55	7.4
2009	Huron	37.53	41.00	42.80	**4.37**	15.35	1.35	7.7
2009	Middlesex	44.70	44.85	48.33	**1.88**	16.90	0.90	7.1
2009	Essex	48.25	48.55	54.50	**3.28**	10.18	1.15	7.0
2009	Kent	71.73	71.89	70.83	**-0.36**	17.00	1.45	6.8
2009	Kent	42.43	45.45	42.45	**1.52**	13.94	1.71	6.9
2009	Kent	62.70	66.50	64.60	**2.85**	13.84	1.10	7.3
2009	Middlesex	43.74	.	46.25	**2.51**	.	.	7.7
2008	Middlesex	50.03	52.70	51.37	**2.01**	19.91	1.05	7.7
2008	Huron	55.83	53.30	55.27	**-1.55**	14.08	2.26	7.6
2008	Perth	53.59	56.17	54.11	**1.55**	21.92	1.81	7.6
2008	Middlesex	40.15	39.75	40.85	**0.15**	10.08	2.21	7.2
2008	Huron	56.88	57.90	58.91	**1.52**	12.79	1.41	7.8
2008	Wellington	48.17	50.34	49.70	**1.85**	20.31	1.45	7.5
2008	Dundas	47.20	47.60	46.85	**0.02**	.	.	.

2008	Perth	53.73	54.78	57.96	**2.64**	12.86	1.41	7.8
2008	Lambton	50.50	50.25	50.50	**-0.13**	22.97	3.11	6.4
2008	Kent	54.85	56.70	55.00	**1.00**	24.10	.	7.5
2008	Kent	48.85	51.55	50.70	**2.28**	9.88	.	7.1
2008	Kent	54.05	55.90	55.75	**1.78**	21.66	.	7.4
2007	Huron	35.36	34.74	33.81	**-1.08**	6.26	1.52	7.9
2007	Huron	43.09	44.12	43.55	**0.74**	9.47	1.17	7.8
2007	Middlesex	34.14	34.54	34.54	**0.40**	14.59	1.13	7.8
2007	Perth	33.96	36.51	35.28	**1.93**	10.72	2.86	7.4
2007	Perth	24.02	23.53	24.99	**0.24**	16.07	3.32	7.6
2007	Wellington	34.88	33.02	34.88	**-0.93**	12.38	1.80	6.9
2007	Niagara	31.66	35.15	33.37	**2.60**	12.23	1.28	6.9
2007	Wellington	29.24	29.84	28.44	**-0.10**	16.09	2.08	7.5
2007	Dundas	48.85	47.90	47.70	**-1.05**	22.81	.	.
2007	Kent	44.80	47.20	49.50	**3.55**	.	.	.
2007	Brant	14.90	15.10	15.00	**0.15**	6.54	2.18	6.1
2007	Perth	24.87	28.05	27.06	**2.69**	15.03	0.85	7.6
2007	Perth	34.21	41.67	39.91	**6.58**	19.12	1.53	7.4
2007	Russell	43.80	43.80	42.40	**-0.70**	.	.	.
2007	Kent	57.80	58.60	58.10	**0.55**	8.69	1.14	7.7
2007	Kent	51.00	50.70	51.40	**0.05**	20.48	1.65	.

P-value for overall treatment effect = <0.0001

Least square means estimates:

Untreated 46.07 bu/ac
Cell Tech 47.37 bu/ac
HiStick NT 47.27 bu/ac

Cell Tech differs from check P < 0.0001; Histick differs from check p = 0.0002

Cell Tech did not differ from Histick (p = 0.75).

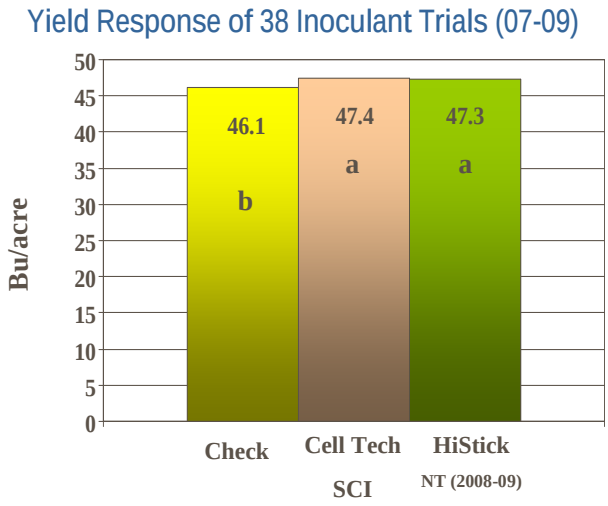
Statistically significant yield differences were found between the untreated and the inoculant treatments. No statistical difference was found between the two inoculants. No statistical differences were found in oil or protein content of the seed.

A correlation between soil ammonium and yield response was found. If the soil had a high level of nitrogen the likelihood of a positive yield response was smaller.

Summary:

Yield differences were found between the untreated and the inoculant treatments. (See Figure 2) No statistical difference was found between the two inoculants. The average statistical yield gain of the inoculants compared to the untreated control was 1.25 bu/ac across the three years. At a selling price of $10.00/bu and a yield gain of 1.25 bu/ac a return of $9.17/acre would be realized when using an inoculant (Assuming a cost of $3.33/ acre for the inoculant). Table 1 shows the individual trial results. It should be noted that the average yield gain in 2009 was higher than the previous two years. The

yield gain in 2009 was 1.8 bu/ac. This is probably due to the fact that 2009 was a very cool growing season.



Values followed by the same letter are not significantly different at the 5% confidence level.

Next Steps:

Further studies will be designed to assess possible yield correlations to soil nitrogen levels, pesticide seed treatment use, and soil potassium levels.

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