Soybean Inoculation Trial
2002
NDSU Carrington Research Extension Center

A field experiment was conducted at the North Dakota State University Carrington Research Extension Center to evaluate the response of soybean to commercial inoculants and to compare this response to varying levels of soil nitrogen (N).

The trial was sown to soybean cultivar 'Walsh' (Maturity Group 0.0) on 22 May at the rate of 200,000 live seeds / acre in 7" rows. A soil sample the previous fall tested 38 lbs NO_3^--N / acre, with adequate phosphorus. In addition to an absolute control (no inoculum, no N fertilizer), N fertilizer treatments were included to reflect current recommendations that soil N should be at 50 – 75 lbs NO_3^--N / acre. Also, a requested treatment of 250 lbs N in 5 split applications during the growing season was included. Plots measured 10' x 25' and were arranged in a randomized complete block design with four replicates. Weeds were controlled with herbicides and hand weeding. No other pesticides were applied.

After an unusually mild winter, the weather during the 2002 season was relatively dry in late May and June, with scattered periods of quite high temperatures. Plant growth was relatively poor until periodic rains began on 4 July. Nodulation was poor in all treatments into August. This was probably due to a combination of above-normal N mineralization and unfavorable weather conditions. Later in the season, nodulation improved somewhat and was visually rated at the R5 growth stage.

Although soybean had been grown previously in nearby fields, the plot area did not have a known history of soybean, as evidenced by the sparse nodulation in the control treatment (Table 1). Despite a relatively poor year for nodulation, visual nodulation scores indicated that 10 of the 19 inoculation treatments were significantly better than the control. No statistically significant differences among treatments were detected in days to physiological maturity or height. Lodging was greatest in the high-N treatment.

Grain yield and quality parameters also showed no statistically significant differences (Table 2). Again, the unusually poor nodulation observed this year probably precluded greater responses to treatments. Eleven of the inoculant treatments numerically increased grain yield and the high-N treatment was 4 bushels/acre higher than the control.

Growers and technical support personnel frequent ask about the relative efficacy of inoculant formulations. The treatments in this trial were bulked to provide information on this subject. Among the parameters measured, no significant differences were found among the formulations tested: peat, liquid, granular, and preinoculant (Table 3). Doubling the recommended rate of Hi Stick 2 (peat-based) also showed no beneficial effect. Although this was a relatively poor year for drawing conclusions, the data suggest that all formulations perform equally. This finding is encouraging, especially with regard to the preinoculation treatments, which provide needed flexibility in soybean planting.

Table 1. Soybean development in the evaluation of commercial inoculants, NDSU Carrington Research Extension Center, 2002.

Treatment	Brand	Formulation	Visual Nodulation Score (1-9)[1]	Physiological Maturity (DAP)[2]	Height (cm)	Lodging (1-9)[3]
Control	---	---	8.0	109	75	1.8
N Fertilizer (12 lbs/acre)	---	---	6.3	109	75	2.0
N Fertilizer (37 lbs/acre)	---	---	6.3	110	75	2.3
N Fertilizer (250 lbs/acre)[4]	---	---	7.8	111	73	3.0
Biagro10	Biagro	Peat	4.8	110	78	2.3
Cell-Tech 2000	Liphatech	Liquid	3.8	109	74	1.8
Cell-Tech SCI	Liphatech	Liquid	4.5	110	76	1.8
Dry Coat	Becker Underwood	Preinoculated	6.5	111	73	2.0
Experimental Dry Coat	Becker Underwood	Preinoculated	5.5	110	78	1.5
Experimental Hi Coat	Becker Underwood	Preinoculated	4.3	109	75	2.0
Experimental Polymer A	Urbana	Liquid	7.0	110	78	2.5
Hi Stick 2	Becker Underwood	Peat	6.0	110	73	2.3
Hi Stick 2 (2x rate)	Becker Underwood	Peat	5.8	110	69	1.3
Hi Stick L	Becker Underwood	Liquid	7.3	110	71	1.0
N-Take	INTX Microbials	Liquid	5.5	110	74	2.0
N-Row	INTX Microbials	Granular	7.5	109	77	1.8
Mega-Prep	Urbana	Peat	5.5	110	78	2.0
NitraStik-S	Liphatech	Peat	5.8	109	69	1.3
Nod+	Urbana	Liquid	8.0	110	73	1.5
Nod+30	Urbana	Preinoculated	8.0	111	74	1.8
Nodulator	Becker Underwood	Granular	6.8	110	72	1.8
Rhizo-Stick	Urbana	Peat	7.3	110	76	1.8
Soil Implant	Liphatech	Granular	5.0	110	68	1.5
Tag Team	Philom Bios	Peat	6.8	110	74	2.3
Mean	---	---	6.3	110	74	1.9
C.V. (%)	---	---	25.9	1.5	9.2	44.4
LSD (0.05)	---	---	2.0	NS	NS	1.2
LSD (0.01)	---	---	2.6	NS	NS	NS

[1]1 = profuse, 9 = none

[2]Days After Planting

[3]1 = erect, 9 = prostrate

Table 2. Soybean yield performance in the evaluation of commercial inoculants, NDSU Carrington Research Extension Center, 2002.

Treatment	Brand	Formulation	Yield	Test Weight	Seed Weight
			(bushels/acre)	(lbs/bushel)	(g/250)
Control	---	---	39.6	57.7	39.2
N Fertilizer (12 lbs/acre)	---	---	41.3	57.3	40.1
N Fertilizer (37 lbs/acre)	---	---	40.5	57.9	41.0
N Fertilizer (250 lbs/acre)[1]	---	---	43.6	57.5	42.7
Biagro10	Biagro	Peat	40.6	57.6	41.8
Cell-Tech 2000	Liphatech	Liquid	41.0	57.3	40.7
Cell-Tech SCI	Liphatech	Liquid	42.4	57.9	41.4
Dry Coat	Becker Underwood	Preinoculated	42.7	57.8	43.1
Experimental Dry Coat	Becker Underwood	Preinoculated	42.3	57.8	39.8
Experimental Hi Coat	Becker Underwood	Preinoculated	39.6	57.7	40.5
Experimental Polymer A	Urbana	Liquid	42.6	57.3	38.9
Hi Stick 2	Becker Underwood	Peat	39.0	57.8	42.5
Hi Stick 2 (2x rate)	Becker Underwood	Peat	38.0	57.9	40.9
Hi Stick L	Becker Underwood	Liquid	41.0	57.6	41.6
N-Take	INTX Microbials	Liquid	38.3	57.8	40.0
N-Row	INTX Microbials	Granular	37.2	57.5	38.6
Mega-Prep	Urbana	Peat	40.4	57.7	39.5
NitraStik-S	Liphatech	Peat	38.7	57.3	38.9
Nod+	Urbana	Liquid	37.5	57.4	39.0
Nod+30	Urbana	Preinoculated	40.0	57.8	39.6
Nodulator	Becker Underwood	Granular	41.5	57.8	40.5
Rhizo-Stick	Urbana	Peat	38.5	57.6	39.5
Soil Implant	Liphatech	Granular	35.1	57.4	41.4
Tag Team	Philom Bios	Peat	41.1	58.0	40.2
Mean	---	---	40.3	57.6	40.6
C.V. (%)	---	---	11.7	0.7	5.8
LSD (0.05)	---	---	NS	NS	NS

[1]50 lbs N applied as urea at each of 5 times during the season

Table 3. Effect of inoculant formulation on soybean performance in the evaluation of commercial inoculants, NDSU Carrington Research Extension Center, 2002.

Formulation	n[1]	Visual Nodulation Score (1-9)[2]	Physiological Height (cm)	Physiological Maturity (DAP)[3]	Lodging (1-9)[4]	Yield (bushels/acre)	Test Weight (lbs/bushel)	Seed Weight (g/250)
None	16	7.1	74.4	110	2.3	41.2	57.6	40.7
Peat	28	6.0	73.7	110	1.9	39.5	57.7	40.5
Liquid	28	6.3	74.1	110	1.8	40.4	57.6	40.1
Granular	27	6.4	73.6	110	2.3	40.7	57.6	41.1
Preinoculan	20	6.0	73.4	109	1.7	40.3	57.7	40.5
Mean		6.3	73.8	110	1.9	40.3	57.6	40.6
C.V. (%)		28.9	9.2	1.4	48.4	12.3	0.7	6.1
P-value		0.29	0.99	0.92	0.13	0.84	0.72	0.70
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS

[1]Number of observations (plots) in a mean