

VARIABILITY IN INOCULATION TRIALS

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The Carrington Research Extension Center conducts annual soybean and field pea trials to compare commercial and experimental inoculants of N₂-fixing bacteria to an uninoculated treatment and one or more levels of N fertilizer. Inoculants are supplied by manufacturers and distributors and include peat and liquid (seed applied) and granular (in-furrow) formulations, as well as pre-inoculated seed. Root systems are visually evaluated for nodulation during the growing season and data is collected on grain yield and quality. Treatment effects are sometimes quite small and sometimes relatively large. In 2003, the yield of the best soybean inoculant treatment was 37% higher than the uninoculated check. This difference was not statistically significant at the 5% level of probability. It seems odd that a 37% difference is not significant. However, nodulation and the nitrogen fixation process are very sensitive to environmental conditions. This is frequently evident among the different replicates of a given treatment or even in adjacent plants within a row. All too often, one plant may be well-nodulated and an adjacent plant will be sparsely nodulated. For this reason, 6-10 root systems are examined to determine the nodulation score. These differences may carry over to yield data, especially on a low-N field which does not have the appropriate bacteria established in the soil. Every effort is made to eliminate data from plots affected by non-treatment factors (e.g. deer predation). However, other sources of variability are not as obvious.

Table 1. Soybean inoculation and N fertilizer treatment effects on plant development, NDSU Carrington, 2003.

Treatment	Form	Company	Nodulation	Yield	Seed Oil ¹	Seed Protein ¹	Grain N Yield
			(1-9) ¹	(bu/ac)	(%)	(%)	(lbs/ac)
Control	x	x	6.8	30.5	19.3	31.5	578
N Fertilizer (50 lbs/acre)	x	x	7.5	36.1	19.3	31.7	689
N Fertilizer (75 lbs/acre)	x	x	8.1	35.8	19.5	31.1	669
N Fertilizer (150 lbs/acre)	x	x	8.4	40.6	18.9	33.2	807
HiStick 2	Peat	B. Underwood	5.0	40.2	18.2	35.6	859
HiStick Exp A	Peat	B. Underwood	5.8	40.0	18.4	35.6	854
HiStick 2 + ExpB	Peat	B. Underwood	5.1	36.7	18.3	35.5	783
HiStick 2 + ExpC	Peat	B. Underwood	3.6	41.4	18.2	35.9	890
MicroFix	Peat	B. Underwood	5.6	36.7	18.2	35.8	786
SoySterile	Peat	B. Underwood	4.8	34.9	18.7	34.2	644
HiStick N/T	Peat	B. Underwood	5.5	36.9	18.6	35.2	778
HiStick L N/T	Liquid	B. Underwood	4.8	40.9	18.4	35.3	866
HiStick L N/T + ExpD	Liquid	B. Underwood	4.8	40.7	18.3	35.5	865
HiStick L N/T + ExpE	Liquid	B. Underwood	4.4	40.5	18.3	35.5	863
HiStick L N/T + ExpA Phosphate Solubilizer	Liquid	B. Underwood	4.9	38.7	18.5	35.7	828
HiStick L N/T + ExpB Phosphate Solubilizer	Liquid	B. Underwood	5.0	38.5	18.5	34.8	803
HiStick L N/T + ExpB1 Phosphate Solubilizer	Liquid	B. Underwood	5.1	37.0	18.4	35.4	784
HiStick L	Liquid	B. Underwood	4.9	41.7	18.2	36.3	906
BU Exp H	Liquid	B. Underwood	4.8	41.3	18.0	36.5	904
Nod +	Liquid	B. Underwood	5.5	41.4	18.4	35.4	791
BU Exp J	Liquid	B. Underwood	4.5	37.4	18.2	36.1	809
Exp Nod + Concentrate	Liquid	B. Underwood	4.7	41.6	18.3	36.0	775
Nod + Extender	Pre-inoc.	B. Underwood	5.5	40.5	18.2	35.6	866
Nodulator	Granular	B. Underwood	6.5	40.1	18.8	33.8	812
Nodulator Exp A	Granular	B. Underwood	6.5	39.8	18.8	33.8	809
NodulatorExp B	Granular	B. Underwood	6.3	41.1	18.4	34.9	861
RhizoFlo Exp A	Granular	B. Underwood	5.8	36.0	18.6	34.4	744
RhizoFlo	Granular	B. Underwood	7.0	40.5	18.5	35.4	859
RhizoFlo Exp B	Granular	B. Underwood	5.9	38.0	18.2	35.9	818
CellTech SCI Prelnoc	Pre-inoc.	Nitragin	6.3	39.3	18.1	36.2	854
Soil Implant	Granular	B. Underwood	5.5	40.3	18.1	36.4	879
NRow	Granular	INTX	6.3	39.8	18.0	36.0	687
NTake	Liquid	INTX	5.7	39.1	18.5	34.9	738
ProLiquid	Liquid	Advance	5.5	37.8	18.1	35.8	811
TagTeam	Peat	Philom Bios	5.3	38.9	18.5	34.8	812
CellTech SCI	Liquid	Nitragin	5.1	39.8	18.0	36.4	869
CellTech SCI Exp1	Liquid	Nitragin	4.2	40.6	18.1	36.4	768
CellTech SCI Exp2	Liquid	Nitragin	4.5	34.3	18.0	36.6	752
NitraStik-S	Peat	Nitragin	5.9	35.5	18.6	34.5	734
ApronMaxx	x	x	6.9	30.1	19.5	31.3	566
CellTech SCI + ApronM	Liquid	Nitragin	4.8	38.2	18.2	36.2	829
RizoLiq + ApronMaxx	Liquid	Rizobacter	4.7	39.8	18.4	35.2	808
RizoLiq + ApronM 20May	Pre-inoc.	Rizobacter	5.0	36.2	19.0	33.5	646
Mean			5.6	38.4	18.5	35.0	809
C.V. (%)			17.0	12.3	1.5	2.3	12.4
LSD (0.05)			1.33	NS	0.4	1.2	141
LSD (0.01)			1.75	NS	0.5	1.5	187
¹ 1 = profuse, 9 = no nodules							