Soybean Production: NDSU Research and Recommendation Update



Greg Endres, Extension area agronomist NDSU Carrington Research Extension Center gregory.endres@ndsu.edu 701-652-2951 A review of selected soybean production management topics: Soil management reduced tillage ○ salt-affected soil • Plant nutrition Special inputs



Conventional vs. <u>no-till</u> soybean yield, Carrington, 2003-14 (12-year average)*



*CREC cropping systems study, E. Aberle

Conventional vs. <u>strip till</u> soybean yield, NDSU, 2005-10 (12 site-years)*



*Carrington, Prosper, Fargo and Moorhead, MN

NDSU Research Summary of Soybean Plant Establishment Factors

Factor	Option A	A Yield > B (%)	Option B	NDSU trials (conducted during 1999-2016)
Tillage system	reduced till	4	conventional till	37



Major crop soil EC threshold

	Previous Studies Threshold Slope (mmhos/cm) (% decline)		NDSU (2013-	Studies -2016)
			Threshold Slope (mmhos/cm) (% decline	
Corn	1.3	12	2.0	12
Soybean	1.9	20	1.1	21
Wheat	3.4	14	4.5	23



source: NDSU Soil Health and Land Management – Economics of Soil Salinity

A review of selected soybean production management topics:

- Soil management
 Plant nutrition
 - Seed inoculation
 - P fertilizer application
- Special inputs

Soybeans need 14 mineral nutrients. ND soils provide adequate amounts for soybean production except N, P, K, S and Fe.



Reference: NDSU Ext circular SF1164 'Soybean soil fertility'

Soybean Plant Nutrition - REVIEW

- Do not apply Nitrogen
 - inoculate seed (Bradyrhizobia japonicum)

• field with no soybean history = yes (history = ?)

- Apply Phosphorus with < medium-testing soils
 - yield response greater with <u>broadcast</u> vs band application
 - <u>no fertilizer directly with the seed</u>
- Apply Potassium if indicated by soil test
- Yield response unlikely with secondary or micro nutrients

Soybean yield among seed inoculation methods, Minot, 2014-15 (4 trial average)*



*No prior history or 4-year gap of soybean production

S. Forster and E. Eriksmoen

Seed inoculation with Bradyrhizobium japonicum

- Continue as long-term practice on field?
- If so, single or 'double' inoculate?

NDSU Research Summary of Soybean Plant Establishment Factors

Factor	Option A	A Yield > B (%)	Option B	NDSU trials (conducted during 1999-2016)
Seed inoculation with soybean history	yes	0.5	no	11

Soybean seed yield with inoculation options on ground with previous soybean production*, Carrington and Wishek, 2015-16 (3 site-years)

		l (bu/A)		
Inoculation (<i>Bradyrhizobium</i> <i>japonicum</i>)	Car2015	Wish2015	Wish2016	3-yr ave.
untreated check	30.8	22.4	57.6	36.9
liquid	28.7	22.2	56.7	35.9
granular	25.3	24.5	56.8	35.5
liq+gran	27.1	25.4	58.0	36.8
LSD (0.05)	NS	NS	NS	

*soybean history for each trial was 2nd previous year

Soybean Establishment Study, CREC, 2011-13: SEED YIELD WITH PLANTING-TIME P FERTILIZER



P = low-med and K = high-VH. 6-24-6 applied as band at planting or broadcast PRE (not mechanically incorporated). Averaged across planting dates and tillage systems (conventional and direct seed).

Soybean Establishment Study, CREC, 2014 and 2016: SEED YIELD WITH PLANTING-TIME P FERTILIZER



P = low (6-7 ppm). 6-24-6 applied at 11.5 gpa broadcast PPI (mechanically incorporated) or at 8 gpa band at planting. Averaged across planting dates and varieties.

NDSU Research Summary of Soybean Plant Establishment Factors

Factor	Option A	A Yield > B (%)	Option B	NDSU trials (conducted during 1999-2016)
P app at planting time	broadcast	0.5	band (away from seed)	7

Soybean yield with IN-FURROW P placement, Carrington, 1998, 2005-10 (8 site-years)*



*In-furrow rates: 45-50 lb/A 11-52-0 or 4-8 gpa 10-34-0; various soil P levels and row spacings.

G. Endres, P. Hendrickson and B. Schatz

Soybean response to low rates of infurrow liquid fertilizer, CREC, 2011

Fertilizer		Stand	Seed yield
Analysis	Rate (gpa)	Plants/A	Bu/A
Untreated check	x	148,100	44.8
10-34-0	2	114,900	41.2
Untreated check	X	131,100	44.1
6-24-6 (low salt)	3	102,300	41.2
LSD (0.05)		30,700	NS

Spring soil analysis: P = 17 ppm (high); K = 235 ppm (high). Soybean planted in 30-inch rows.

NDSU Research Summary of Soybean Plant Establishment Factors (Dec. 2016)

Factor	Option A	A Yield > B (%)	Option B	NDSU trials (conducted during 1999-2016)
Tillage system	reduced till	4	conventional till	37
Previous crop	wheat	5	soybean	6
Planting date (eastern ND)	<pre>< early May</pre>	9	mid May	10
Planting rate (pls/A)	150-175,000	6	100-130,000	43
Row spacing (inches)	14-21	3.5	28-30	24
Seed fungicide	yes	6	no	29
Seed inoculation with soybean history	yes	0.5	no	11
P app at planting time	broadcast	0.5	band (away from seed)	7
Timing of initial weed control	at planting	5	early POST (2- to 4-inch weeds)	8

A review of selected soybean production management topics:

Soil management
Plant nutrition
Special inputs

Soybean response to special inputs¹, Carrington, 2005-12

FERTILIZER

- farmer fertilizer blend
- Quickroots; Liquid sufl/ can/soy mix
- 6-0-0-9 (Zn)
- 9.5-0-0-5-10 (Zn)
- Max-In; Max-In MnNF; Winfield Solutions experimentals
- UAN
- CoRon; zinc
- Micro500; Sure-K
- EB mix
- Sugar
- MicroMix
- Moly

PESTICIDES

- Headline (+ Fastac)
- Stratego Pro/YLD (+ Leverage)
- Priaxor (+ Fastac)
- Quilt Xcel (+ Warrior T)
- Evito (+ Leverage)
- Cobra
- Makaze Yield Pro (GP)

GROWTH PROMOTERS

- Ratchet
- Soil Builder; Ag blend
- Bin Buster XP; KQ-XRN
- X-tra Power; Sugar Mover
- MegaGro; HappyGro
- SeedProd; CropProd
- BTN+; T1
- BioForge; Golden Harvest Plus GA
- NBS
- N-Hibit; ProAct
- Foliar Blend

RR soybean: 2005-06=RG200RR, 2007=NT-0090, 2008-12=DSR0401.

Study partially funded by private industry

Soybean performance with special inputs, Carrington, 2005-12.

				Respor	nse vs. unt check¹	reated
Year	Environment	Number of treatments	Yield of untreated check	Seed yield	Test weight	Protein
			bu/A	bu/A	lb/bu	%
2005		16	36.7	*		
2006	dryland	21	26.2			
2007		15	58.0			
2008		16	47.3	NS		
2009	irrigated	15	51.2		NS	NS
2010	3	19	51.6			
2011		19	42.1	* (-)		
2012		18	56.6	NS		

^{1*}=statistically significant (0.05); NS=no difference in factor compared to untreated check. Details at www.ag.ndsu.edu/CarringtonREC/

Extension Publication A1718

Selected Management Factors for Economically Increasing Soybean Yield



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A1718

Table 3. Yield and net return with main factors in soybean intensive management study, North Dakota, 2008-11.

		Yield (bu/acre) ¹				
	Row Spacin	Row Spacing (inches) Planting Rate (pls/acre)		Special Foliar Inputs		
Trial	14	28	150,000 2	200,000	Yes	No
Study average	49.9ª	48.5	48.5	49.9ª	50.3ª	48.1
Net revenue/acre ²	\$499	\$485	\$435	\$432	\$466	\$481

- ¹ 'a' indicates mean within a factor is statistically significant (LSD=0.05) by trial and study average.
- ² Assumptions: \$10/bu soybean market price; seed costs: \$0.30/1,000 seeds; \$5/acre field application cost; \$32/acre special foliar input cost.



Soybean seed yield with special foliar inputs, Wishek, 2014-16

Foliar product				
	2014	2015	2016	3-yr ave.
untreated check	30.6	22.4	57.9	37.0
Ascend (PGR)	34.1	23.8	59.7	39.2
MAX-IN Ultra ZMB (fertilizer)		23.7	56.9	
Priaxor (fungicide)	41.0	24.8	55.9	40.6
Product combination	31.8	23.9	58.6	38.1
LSD (0.05)	8.0	NS	NS	

Soybean seed yield with special foliar inputs, Minot, 2015-16

Foliar	App timing	Seed	l yield (bu/	/A)
product	and rate (fl oz/A)	2015	2016	2-yr ave.
untreated check	X	44.3	29.2	36.8
Ascend (PGR)	R3/6.4	49.3	28.8	39.1
Nachurs Finish Line (fertilizer)	V3/32	50.1	28.8	39.5
LSD (0.05)		5.2	NS	

Eric Eriksmoen, North Central REC

Hail at CREC on July 9: \leq 30% defoliation in planting date by P app trial



Picture taken July 11



Headline 6 fl oz/A applied July 15 to 2 of 4 reps

Hail-damaged soybean response to 'plant health' foliar fungicides, Carrington, 2011 and 2016

	Crop		Yield ((bu/A)	
Year	stage	Treatment ^a	fungicide	untreated	LSD (0.05)
2011	R2-3	Priaxor (4 fl oz)	43.6	42.1	NS
2011	R2-3	Headline (6 fl oz)	45.4	38.9	**
2016	R1-2	Headline (6 fl oz)	51.8	47.8	NS
2016	R1	5 fungicides ^b	76.7	75.8	NS
average	2		54.4	51.2	

^aApp <7 days after hail damage. Adjuvants were included with fungicides. ^bAverage among Headline, Aproach, Quadris, Evito and Stratego YLD. Yield (80.6 bu/acre) with Headline was statistically [LSD (0.05)=4.2 bu/acre] higher compared to the untreated check.

Summary:

- Consider reduced tillage
- Know your field EC number

yield loss will occur at >1

- Use 'A' factors for plant establishment and nutrition
- Scrutinize use and economics of 'special inputs'

Questions?

