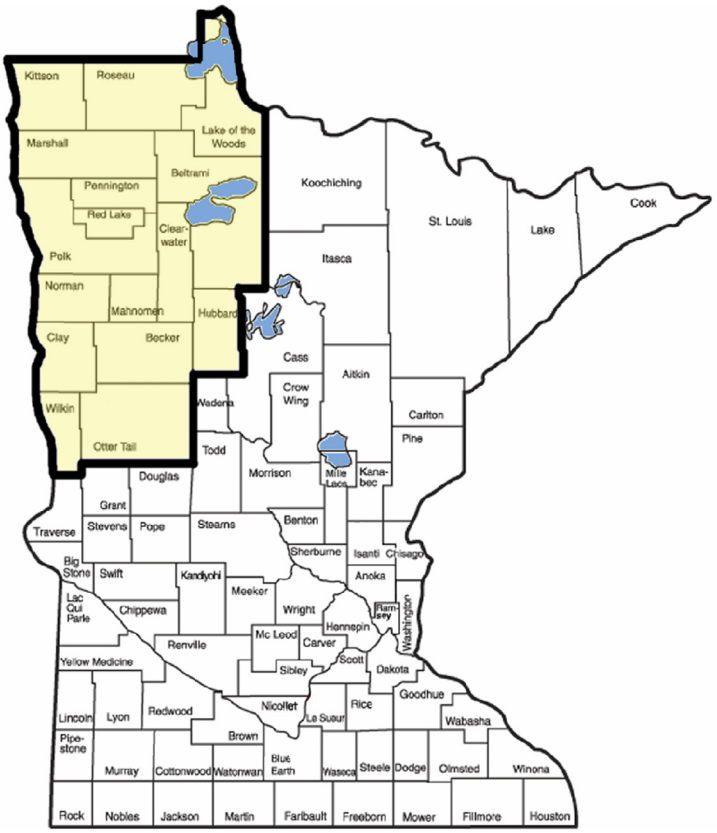


On-Farm Cropping Trials Northwest and West Central Minnesota

University of Minnesota Extension

2009 Minnesota Wheat Research Review

This is the second year the 2009 Research Review and On-Farm Cropping Trials have been combined into one booklet. Up until last year, these reports have been published separately.

On-Farm Cropping Trials

The mission of the NWROC is to contribute, within the framework of the Minnesota Agricultural Experiment Station (MAES) and the College of Food, Agricultural, and Natural Resource Sciences to the acquisition, interpretation and dissemination of research results to the people of Minnesota, with application to the knowledge base of the United States and World. Within this framework, major emphasis is placed on research and education that is relevant to the needs of northwest Minnesota, and which includes projects initiated by Center scientists, other MAES scientists and state or federal agencies.

Contributors to the On-Farm Trials include: Russ Severson, Extension Educator, Extension Regional Office, U of M Crookston, rseverso@umn.edu; Doug Holen, Extension Educator, Extension Regional Office, Fergus Falls, holen009@umn.edu; Phillip Glogoza, Extension Educator, Extension Regional Office, Moorhead, glogo001@umn.edu; Ray Bisek, Extension Educator, Mahnomen and Norman Counties, Mahnomen, bisek001@umn.edu; Charla Hollingsworth, Extension Plant Pathologist, NW Research/Outreach Center, Crookston; Jochum Wiersma, Small Grain Specialist, Crookston, wiers002@umn.edu; Paul Porter, Agronomy/Plant Genetics, Roseville, pporter@umn.edu; Bobby Holder, Soil Scientist, Crookston, bholder@mail.crk.umn.edu; Ian MacRae, Extension Entomologist, Crookston, macra002@umn.edu; Carlyle Holen, IPM Specialist, Crookston, cholen@umn.edu; Howard Person, Extension Educator, Pennington and Marshall Counties, Thief River Falls, perso005@umn.edu; Jim Orf, Dept Agronomy & Plant Genetics, St. Paul, orfxx001@umn.edu; Jeff Coulter, Extension Agronomist, Dept of Agronomy, St. Paul, coult077@umn.edu; Paul R. Peterson, Extension Agronomist-Forages, St. Paul, peter072@umn.edu; Albert Sims, Soil Scientist, Crookston, simsx008@umn.edu; Jim Stordahl, Extension Educator, Polk County, strodahl@umn.edu; Dan Kaiser, Extension Soil Scientist, St. Paul, dekaiser@umn.edu

This project was made possible thanks to the hard work of many people. This includes farmers, County and Regional Extension Educators, and specialists who conducted these trials, and their names are listed.
Previous On-Farm Cropping Trials booklets can be found at
http://www.nwroc.umn.edu/Cropping_issues/NW_Crop_trials/On_Farm_Trials.htm.

2009 Wheat Research Review

Researchers submit progress reports on projects funded partially or in full by the committee's recommendation. Research progress is communicated to the public. Crop scientists participate in a research reporting session held each year that is open to the public. The Council feels this committee has been an efficient vehicle for not only prioritizing wheat checkoff funds, but also in improving the dissemination of results.Better practices to plant better wheat is our goal. To that end, we encourage your input on this committee, and your feedback on the wheat research projects that are funded by the Minnesota Wheat Checkoff.

Members of the 2009 Small Grains Research & Communications Committee include Kenneth Asp, Minnesota Wheat Council; David Boehm, Northern Plains Regional Mgr.; Mike Bruer, Minnesota Wheat Council; David Garrett, AgriMaxLLC; Doug Holen, U of M Regional Extension Service; Peter Hvidsten; Carol Ishimaru, U of M Dept of Plant Pathology; Brian Jensen, Minnesota Wheat Council; Mark Jossund, Minnesota Wheat Council; Brian Lacey, MN Barley; Rhonda K. Larson, Minnesota Wheat Council; Scott Lee; Dean Maruska, Bayer CropScience; Larry J. Smith, University of Minnesota; Brian Sorenson, Northern Crops Institute; David Torgerson, Minnesota Wheat; Kyle Vig; Jochum Wiersma, U of M Small Grains Specialist; Neil Wiese; Dave Willis, Agassiz Crop Management; Marv Zutz, Minnesota Barley.

Information about the committee and previously funded research can be found online at www.smallgrains.org. Click on the Research tab.

Table of Contents - On-Farm Cropping Trials For NW & WC MN

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Alfalfa Variety Evaluation Seeding 2008 — Otter Tail County

Cooperator: John Wold **Nearest Town:** Underwood
Soil Type: Silty clay loam **Tillage:** Chisel plow and field cultivator
Previous Crop: RR Soybeans **Planting Date:** 21 May 2008
Row Width: 6 inches
Fertilizer: 10-21-08 260 units/ac K (0-0-60)
08-19-09 units/ac 18N, 46P, 60K, 45S, .5B
Weed Management: 06-25-08 Raptor @ 4 oz + HC COC @ 1 pt + 28% @ 2 qt
07-01-08 Hand weed plots
Insecticide: 06-23-09 Warrior II at 2 oz/ac for alfalfa weevil
Harvest Date: 2008 = August 13
2009 = June 2, July 7, August 11 and October 23
Experimental Design: Randomized Complete Block (4 replications)
Plot Size: 3 feet by 20 feet

Purpose of Study:
Evaluate yield potential of commercial and experimental alfalfa varieties in west-central Minnesota.

Results:
Total-season yields the year after seeding averages 3.0 ton DM/ac, with top-performing varieties yielding 13% more than the average of checks. Stands of all entries are excellent an dare expected to yield more next year.

Company	Entry (by total yield) Variety	2009 Harvests (tons DM/acre) 2-Jun	7-Jul	11-Aug	23-Oct	Total	1- Yr Total	Relative Yield 1-Yr % of Checks
Forage Genetics	DKA43-13	1.27	0.91	0.57	0.49	3.24	3.24	113
Forage Genetics	LIGHTNING IV	1.26	0.92	0.53	0.51	3.21	3.21	113
Garst (Syngenta)	6431	1.28	0.90	0.52	0.47	3.17	3.17	111
Cal/West	PGI 459	1.24	0.89	0.53	0.49	3.15	3.15	110
W-L Research	WL 363HQ	1.23	0.87	0.55	0.50	3.15	3.15	110
Pioneer	55V48	1.26	0.86	0.55	0.48	3.14	3.14	110
NuTech Seed	VELOCITY	1.22	0.86	0.52	0.49	3.09	3.09	108
Garst (Syngenta)	6417	1.12	0.79	0.48	0.44	2.82	2.82	99
Mustang	420 PLUS	1.07	0.80	0.48	0.46	2.81	2.81	98
W-L Research	WL 343HQ	1.04	0.75	0.44	0.44	2.67	2.67	94
	Checks							
	5312	1.21	0.82	0.50	0.46	2.99	2.99	105
	ONEIDA VR	1.14	0.82	0.49	0.50	2.94	2.94	103
	VERNAL	1.09	0.76	0.39	0.40	2.63	2.63	92
	Mean...3 Checks	1.15	0.80	0.46	0.45	2.85	2.85	100
	Mean	**1.20**	**0.85**	**0.51**	**0.48**	**3.04**	**3.04**	**106**
	Range	0.42	0.24	0.18	0.18	0.95	0.95	33
	LSD 5%	0.22	0.14	0.11	0.17	0.56	0.56	20
	CV %	12.7	12.0	15.7	25.3	13.0	13.0	13.0

For Additional Information:
Doug Holen

Project Funding Provided by:
Private Seed Companies

Alfalfa Variety Evaluation Trial 2006-2009 — Otter Tail County

Cooperator: Paul Beckman
Nearest Town: Underwood
Soil Type: Silty loam
Tillage: Chisel Plow and Field Cultivator
Previous Crop: Wheat
Planting Date: 17 May 2006
Row Width: 6 inches
Fertilizer: Spring Applied Dairy Manure
09/12/07 = 160 units K (0-0-60)
10/08/08 = 130 units K (0-0-60)
Weed Management: 06/07/06 Raptor @ .031 lbs + COC @ 1 qt + 28% @ 2qt
Insecticide: 06/30/08 Warrior @ 2.6 oz/ac for alfalfa weevil
06/22/09 Warrior II @ 2 oz/ac for alfalfa weevil
Harvest Date: 2006 = July 27 and October 6
2007 = June 1, July 6 and September 12
2008 = June 10, July 8, August 13 and October 8
2009 = June 2, July 7, August 11 and October 19
Experimental Design: Randomized Complete Block (4 replications)

Purpose of Study:
Evaluate yield potential of commercial and experimental alfalfa varieties in west-central Minnesota.

Results:
Final-production-year yields averaged only 3.2 ton DC/ac and ranged from 2.9 to 3.7 ton/ac. Three-year-total yields of the top-performing varieties exceeded check varieties by 1.5 ton/ac. Stands of all entries remained relatively good despite four consecutive years of fall cutting.

Entry (by total yield)		% Stand	% Stand	2009 Harvests				2009	2008	2007	3-Yr	Relative 3-Yr Yield
Company	Variety	05/10/08	05/09/09	06/02/09	07/07/09	08/11/09	10/19/09	Total	Total	Total	Total	as % of Checks
				ton DM/acre								
America's Alfalfa	AMERISTAND 407TQ	85	78	1.34	1.01	0.68	0.40	3.44	5.28	5.71	14.43	113
Doebler's	PERFORM	88	84	1.45	1.04	0.75	0.46	3.70	5.10	5.50	14.29	112
Dairyland	MAGNUM VI	78	74	1.28	1.00	0.69	0.51	3.48	5.02	5.62	14.11	110
Pioneer	54V46	89	81	1.38	1.02	0.71	0.40	3.50	4.99	5.44	13.92	109
NK Brand	GENOA	81	80	1.36	0.96	0.64	0.43	3.39	4.73	5.47	13.59	106
W-L	WL 343 HQ	90	81	1.24	0.97	0.68	0.35	3.24	4.75	5.22	13.20	103
Garst	6400 HT	81	78	1.20	0.92	0.65	0.38	3.15	4.51	5.32	12.98	101
Garst	6415	86	80	1.18	0.93	0.61	0.40	3.11	4.67	5.15	12.93	101
Garst	6443 RR	81	75	1.20	0.96	0.65	0.39	3.20	4.61	5.13	12.94	101
Trelay	PHABULOUS III	90	83	1.16	0.96	0.64	0.37	3.13	4.50	5.01	12.64	99
Garst	6200 HT	79	73	1.13	0.87	0.59	0.38	2.97	4.32	5.20	12.48	97
Pioneer	53Q30	75	66	1.06	0.88	0.61	0.39	2.93	4.07	4.95	11.96	93
	Checks											
	5312	88	78	1.26	0.84	0.60	42.00	3.10	4.73	5.53	13.36	104
	ONEIDA VR	83	75	1.16	0.89	0.61	41.00	3.07	4.42	5.03	12.51	98
	VERNAL	76	71	1.15	0.88	0.52	37.00	2.92	4.51	5.16	12.59	98
	Mean...3 Checks	82	75	1.19	0.87	0.57	0.40	3.03	4.55	5.24	12.82	100
	Mean Total	**83**	**77**	1.23	0.94	0.64	7.83	3.21	**4.72**	**5.34**	13.17	103
	LSD 5%	12	12	0.20	0.11	0.10	0.12	0.46	0.64	0.55	1.45	11
	CV	9.9	10.8	11.6	8.1	11.2	19.7	9.9	9.7	7.3	7.7	7.7

For Additional Information:
Doug Holen

Project Funding Provided by:
Private Seed Companies

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Alfalfa/Grass Mixture Evaluation — Otter Tail County

Cooperator:	John Wold
Nearest Town:	Underwood
Soil Type:	Medium
Tillage:	Conventional
Previous Crop:	Wheat
Planting Date:	29 August 2008
Variety:	3 alfalfa varieties, alone and with 2 varieties of each of 9 grass species
Mix Planting Rates:	Alfalfa: '4S419' and 'Spredor 4' 15 lb/ac, 'Rebound 5.0' 10 lb/ac Grasses: Bromegrass 10 lb/ac; Fescue, Festulolium & Perennial Ryegrass 8 lb/ac; Orchard grass and Reed canarygrass 6 lb/ac; Timothy 4 lb/ac
Row Width:	7 inches, alfalfa and grass drilled in same rows
Fertilizer:	3 October 2008: 20 lb N, 55 lb P, 170 lb K per acre 26 August 2009: 55 lb N, 60 lb S, 4 lb B, & 625 lb ENP per acre
Harvest Population:	3 feet (5 rows) x 17 feet
Harvest Dates:	2009 = June 11, July 10, August 26, October 19
Experimental Design:	Split plot with 2 replications, alfalfa variety whole plots, grass species subplots

Purpose of Study:

Evaluate the forage yield, species compatibility, forage quality, and persistence of mixtures of alfalfa with various perennial cool-season grasses on-farm.

Results:

First-production-year yields over 4 harvests averaged 2.4 ton DM/ac, and ranged from 1.9 for alfalfa/timothy to 2.6 for alfalfa alone. Total-season yields were unaffected by alfalfa variety. In mixtures, season-average alfalfa percentage ranged from 45% with timothy to 76% with reed canarygrass, perennial ryegrass, and tall fescue. Season-average RFQ was similar and of 'dairy quality' for all treatments, averaging 175. Season-average fiber digestibility (NDFD) was greatest for alfalfa/meadow fescue mixtures and least for alfalfa alone and alfalfa/perennial ryegrass mixtures.

See Tables on next page

For Additional Information:
Doug Holen, Paul Peterson, Phil Glogoza

Project Funding Provided by:
Midwest Forage Association

Alfalfa/Grass Mixture Evaluation — Otter Tail County *(continued)*

Table 1. ***Yields and species composition of alfalfa/grass mixtures at Underwood. 2009***

Mixture (Averaged over 3 AlfVar and 2 GrsVar)	**DM Yld** *t/ac*	**2009 Mixture Total/Avg. Alfalfa %**	**Grass** *%*	**11-Jun DM Yld** *t/ac*	**11-Jun Grass** *%*	**10-Jul DM Yld** *t/ac*	**10-Jul Grass** *%*	**26-Aug DM Yld** *t/ac*	**26-Aug Grass** *%*	**19-Oct DM Yld** *t/ac*	**19-Oct Grass** *%*
Alfalfa Alone	**2.61**	**97**	0	**0.33**	0	**0.91**	0	**0.76**	0	0.61	0
Alf/Meadow Bromegrass	**2.51**	68	29	**0.33**	18	0.81	31	**0.69**	**33**	**0.69**	35
Alf/Reed Canarygrass	**2.51**	77	21	**0.34**	5	**0.86**	37	**0.69**	21	0.61	21
Alf/Perennial Ryegrass	**2.51**	77	20	**0.28**	6	**0.83**	27	**0.69**	19	**0.71**	28
Alf/Tall Fescue	**2.45**	75	23	**0.34**	10	**0.84**	18	0.61	22	**0.66**	41
Alf/Orchardgrass	**2.44**	66	32	**0.28**	11	0.81	26	**0.68**	**33**	**0.68**	**59**
Alf/Meadow Fescue	2.40	67	30	**0.31**	16	**0.84**	29	0.65	**32**	0.60	44
Alf/Festulolium	2.38	61	37	**0.30**	20	**0.83**	42	0.53	**40**	**0.72**	46
Alf/Smooth Bromegrass	2.30	65	33	**0.28**	27	0.78	39	0.62	28	**0.62**	38
Alf/Timothy	1.87	45	**54**	0.25	**58**	0.65	**61**	0.36	**32**	0.60	**64**
LSD(0.05)	0.21	7	6	0.07	6	0.09	7	0.10	10	0.11	11
Overall Average	*2.40*	*70*	*28*	*0.30*	*17*	*0.82*	*31*	*0.63*	*26*	*0.65*	*38*

Bolded value indicates statistical similarity to the largest value within the same data column.

Table 2. ***Relative forage quality (RFQ), fiber digestibility (NDFD), and relative feed value (RFV) of alfalfa/grass mixtures at Underwood. 2009***

Mixture (Rebound 5.0 with 1 GrsVar per GrsSpc)	**2009 Average**			**11-Jun**			**10-Jul**			**26-Aug**			**19-Oct**		
	RFQ	**NDFD** *%NDF*	**RFV**	**RFQ**	**NDFD** *%NDF*	**RFV**	**RFQ**	**NDFD** *%NDF*	**RFV**	**RFQ**	**NDFD** *%NDF*	**RFV**	**RFQ**	**NDFD** *%NDF*	**RFV**
Alf/Meadow Bromegrass	179	51	**173**	226	59	201	156	50	149	151	46	**157**	213	53	**207**
Alf/Festulolium	179	**55**	162	**228**	59	201	153	52	141	135	**50**	131	225	**62**	197
Alf/Timothy	177	**55**	164	199	55	184	139	51	133	139	46	143	229	**63**	**199**
Alf/Reed Canarygrass	176	51	**170**	**243**	59	**217**	149	50	144	146	45	151	205	52	198
Alf/Perennial Ryegrass	175	48	**172**	**242**	59	**215**	145	47	143	145	43	**154**	220	51	**216**
Alf/Tall Fescue	175	**55**	159	211	56	189	157	**53**	143	143	**50**	138	199	**60**	177
Alfalfa Alone	174	46	**177**	**237**	58	**213**	147	47	147	149	40	**164**	209	43	**223**
Alf/Smooth Bromegrass	171	52	161	201	58	177	147	**53**	135	141	47	143	213	52	**207**
Alf/Orchardgrass	171	54	157	**239**	58	**213**	153	51	143	137	47	139	195	**60**	170
Alf/Meadow Fescue	171	**58**	151	205	57	185	153	**55**	140	143	**53**	133	201	**66**	165
LSD(0.05)	NS	4	12	16	NS	14	NS	3	NS	NS	5	11	NS	10	25
Overall Average	*175*	*52*	*165*	*223*	*58*	*199*	*150*	*51*	*142*	*143*	*47*	*145*	*211*	*56*	*196*

Bolded value indicates statistical similarity to the largest value within the same data column.

For Additional Information:
Doug Holen, Paul Peterson, Phil Glogoza

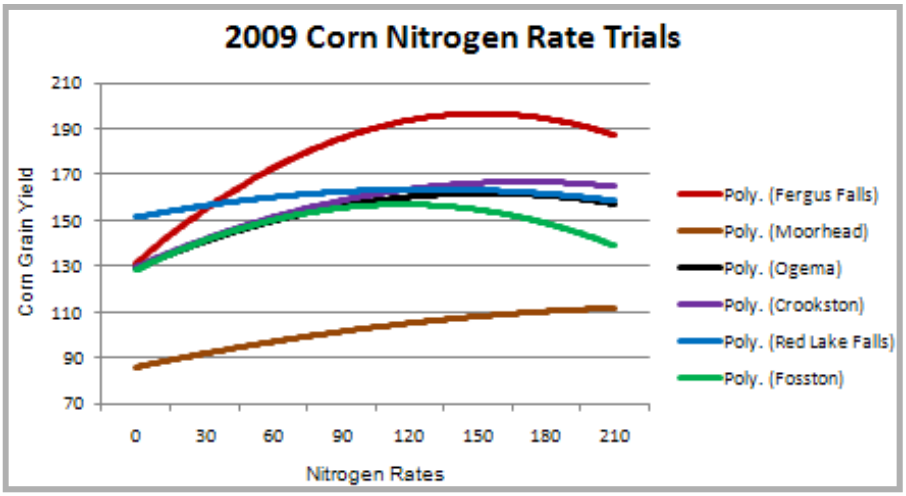
Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

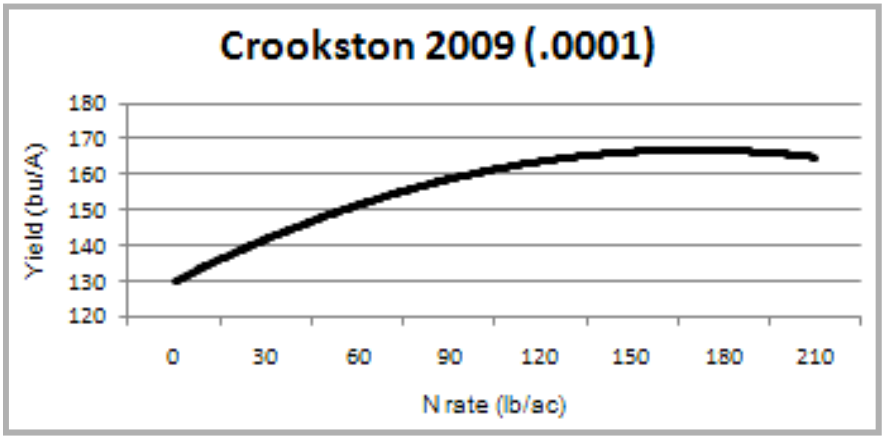
2009 Corn Nitrogen Rate Fertility Trials in Northwest & West-Central Minnesota

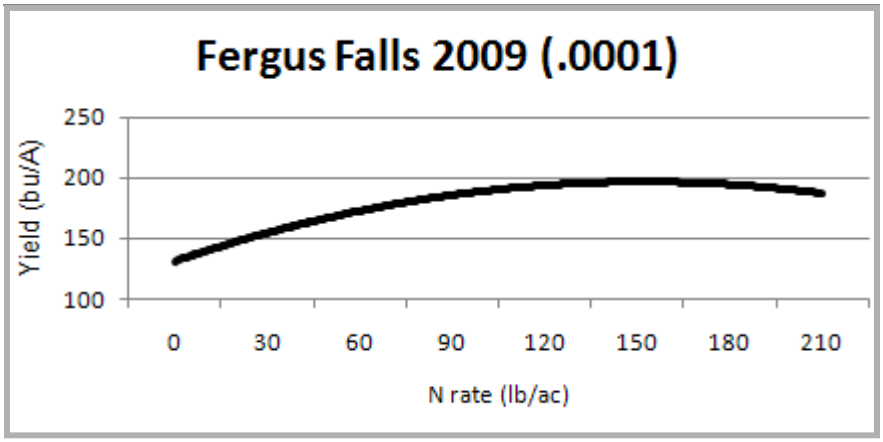
Project Leaders: Russ Severson & John Lamb
Cooperators: U of M NW Research & Outreach Center, U of M Soil Water & Climate Dept., Regional Extension Educators, Local Extension Educators and Farmer Cooperators

Experimental Design: RCB with four replications

2009 Corn Grain Yields at Eight Nitrogen Rates and Six Locations in Northwest & West-Central Minnesota.







Purpose of Study:

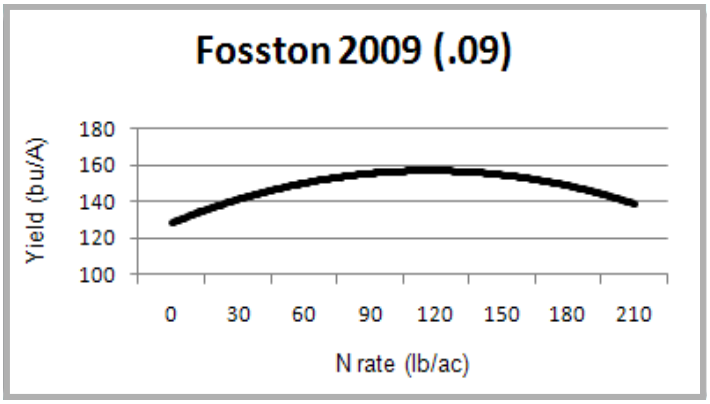
In 2009 Extension Educators in northwest Minnesota received funding from the Minnesota Corn Research and Promotion Council to conduct Nitrogen Rate Fertility Trials at six locations, located north of Interstate 94, to increase the data base for the new University of Minnesota nitrogen guidelines and validate the applicability of the N guidelines to this region of the state. The sites were established at Fergus Falls, Moorhead, Ogema, Fosston, Red Lake Falls, Crookston.

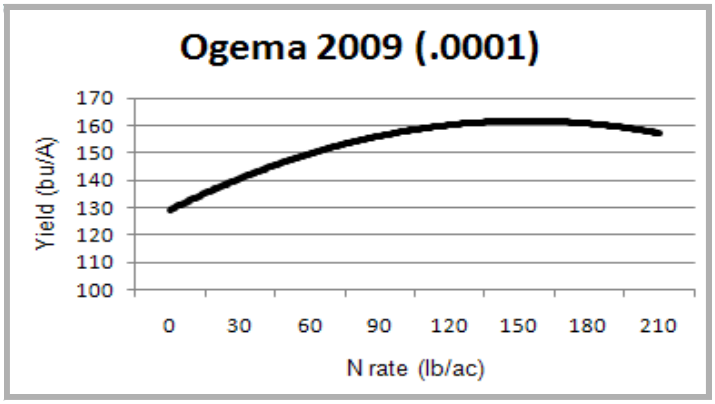
The nitrogen rate trials were established in corn growers' production fields with fertilizer nitrogen rates of 0, 30, 60, 90, 120, 150, 180 and 210 pounds of nitrogen per acre with the treatments replicated four times. P, K & Zn were added to each site at sufficient rates.

For additional information:
Russ Severson

Partnership/Funding:
Minnesota Corn Research and Promotion Council with assistance from the NW Research and Outreach Center

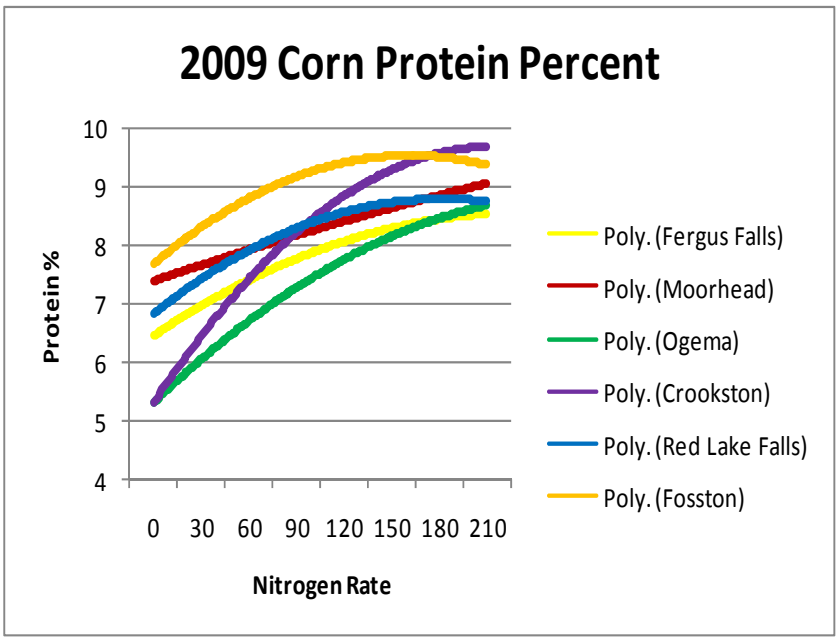
2009 Corn Nitrogen Rate Fertility Trials in Northwest & West-Central Minnesota *(continued)*





Results:

The six locations were harvested October 19-29 with fifteen linear feet of each of the two center rows hand harvested, dried and shelled using a stationary corn-sheller. Variables such as grain yield, protein percentage, oil percentage, starch percentage, moisture percentage and bushel weight were measured using a NIR analyzer at the NW Research & Outreach Center. Significant nitrogen responses were measured at four of the six locations in 2009 as illustrated in the location yield graphs. Protein percentage was also significantly impacted by nitrogen fertility rate at all locations.



The Economic Optimum Nitrogen Rate Analysis, statistical significance, previous crop and soil test values are listed in Table 1(next page).

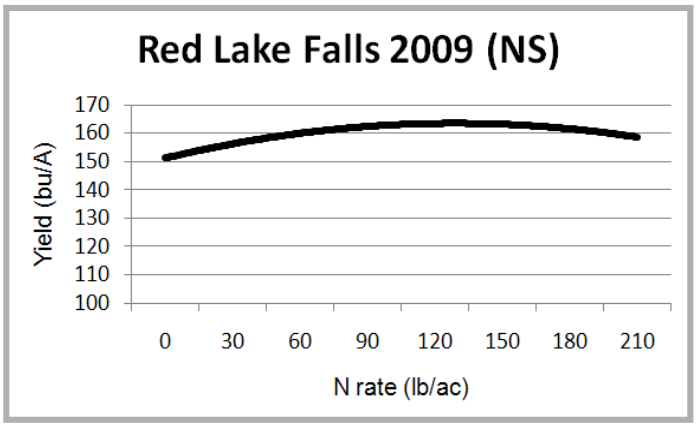
The Moorhead site suffered severe water damage when the Buffalo River flooded the plot area in June resulting in much lower yields than normal and a wind-storm caused severe lodging at the Fosston site. Basal stalk nitrate samples were harvest from each plot of each location for later analysis of the residual nitrated nitrogen remaining following the growing season. These results will be available later on.

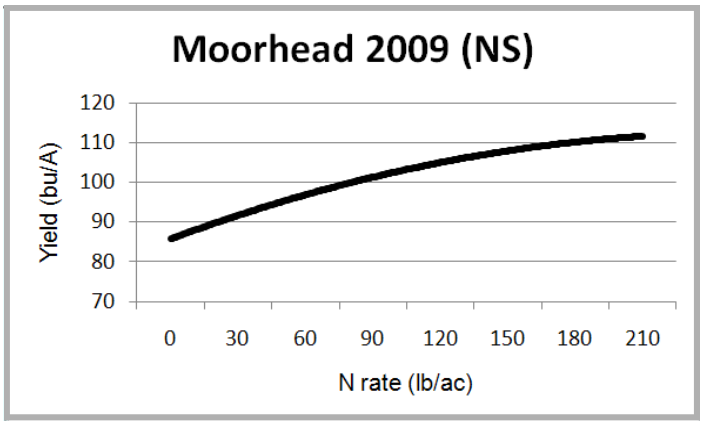
For additional information:
Russ Severson

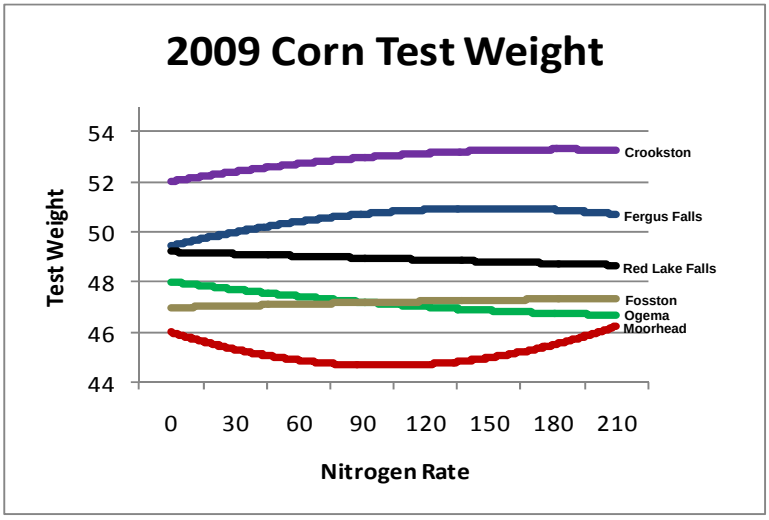
Partnership/Funding:
Minnesota Corn Research and Promotion Council with assistance from the NW Research and Outreach Center

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

2009 Corn Nitrogen Rate Fertility Trials in Northwest & West-Central Minnesota *(continued)*







Results (Continued)

Test weight in pounds per bushel was measured on each plot at each location as may be seen in the adjacent graph. There were statistically significant differences in test weight at the Fergus Falls, Ogema, Crookston and Red Lake Falls locations. Moorhead and Fosston locations did not show a significant difference in test weight. This could have been a result of the environmental damage each of these two sites endured.

Table 1. ***Statistical significance, Economic Optimum Nitrogen Rate and Soil Test Value and previous crop at each location.***

Location	Crookston	Ogema	Red Lake Falls	Fergus Falls	Moorhead	Fosston
Significance	0.0001	0.0001	NS	0.0001	NS	0.0891
EONR*	126.7	111.8	40.1	99.1	131.2	68.7
Soil Test N Lb/A 0-24”	44	77	50	26	60	37
Previous Crop	Soybean	Sugarbeet	Soybean	Soybean	Wheat	Soybean

* Ecomonic optimum nitrogen rate (EONR) at a 0.1 ratio of nitrogen price (0.35) / corn price ($3.50)

Research Cooperators: Russ Severson, John Lamb, Doug Holen, Jim Stordahl , Phil Glogoza, Randy Nelson and Ray Bisek

Farmer Cooperators: Bill, Eric & Nick Zurn, Gary Purath, Ken & Chris Hove, Elliot & Eric Solheim, Phil & Dan Jennnen and Tim Thompson.

2009 Corn Zn Rate Trials — Polk County

Cooperator: Elliot & Eric Solheim
Nearest Town: Beltrami
Soil Type: Clearwater loam
Tillage: Field cultivator
Previous Crop: Soybean
Planting Date: 17 May 2009
Harvest Date: 19 October 2009
Experimental Design: Randomized Complete Block (4 replications)

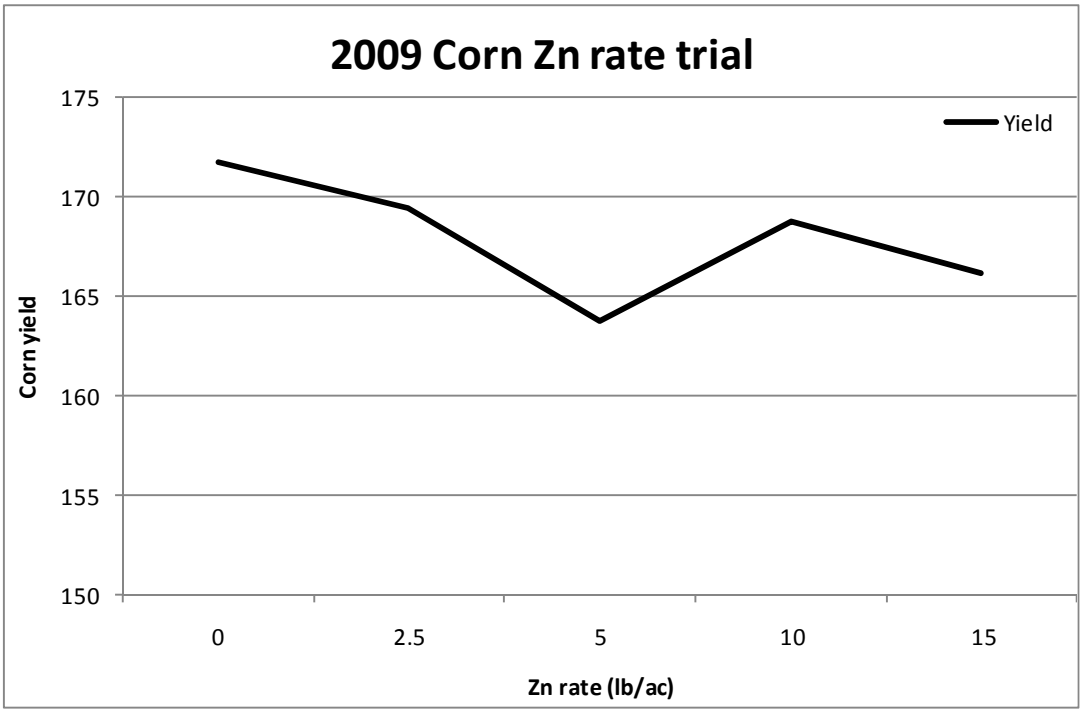
Purpose of Study:

U of M calibration and correlation data on zinc is very limited in northern Minnesota. Additional information is needed on the response of the newer corn genetics to zinc fertility. There are many fields in the northern region testing less than .5 ppm Zn.

Results:

The zinc rate trial was established in a corn growers' production fields with fertilizer zinc rates of 0, 2.5, 5, 10, & 15 pounds of zinc per acre with the treatments replicated four times. The zinc source was 36% zinc sulfate which was broadcast and incorporated prior to planting. N, P, & K were added to the site at sufficient rates. Zinc fertilizer response is suspected with a soil test of .5 ppm zinc or less. Unfortunately, this corn site had a zinc soil test level of 1.36 ppm, so no yield response to zinc was observed as illustrated in Figure 1.

Figure 1. Corn yield response to zinc fertilizer rates at Beltrami



For Additional Information:
Russ Severson & Dan Kaiser

Research assistance provided by
the NW Research and Outreach Center, Crookston

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Corn Response to Plant Population and Hybrid Maturity in West-Central Minnesota

Location: University of Minnesota West-Central Research and Outreach Center at Morris, MN (Stevens County)
Soil: Doland McIntosh silt loam, 8.2 pH, high soil test P and K
Previous Crop: Corn
Tillage: Disk-chisel in the fall, followed by field cultivator in the spring
Fertilizer: 150 lb N/ac as urea - broadcast and incorporated in the spring
Row Width: 30 inches
Planting Date: 6 May 2009
Hybrids: DKC42-91, DKC46-60, and DKC50-44 - all had resistance to corn rootworm, European corn borer, and glyphosate
Harvest Date: 12 November 2009

Research Methods:

The experimental design was a split plot arrangement in a randomized complete block with four replications. Main plots were three hybrids. Subplots were six final plant populations, established by over-planting followed by hand-thinning at the five leaf collar stage. Subplots were four rows wide by 32 feet long. Yields were adjusted to 15% moisture. Data were analyzed at the 5% probability level.

Purpose of Study:

To evaluate corn response to plant population in west-central Minnesota, and determine whether it is influenced by hybrid maturity.

Table 1. ***Corn response to hybrid maturity at Morris in 2009, averaged across six plant populations.***

Hybrid	Hybrid Relative Maturity	Grain Yield at 15% Moisture (bu/ac)	Grain Moisture at Harvest (%)
DKC42-91	92-day	144	30.1
DKC46-60	96-day	142	32.0
DKC50-44	100-day	147	37.6
LSD (0.05)	---	NS*	1.7

*NS = not significant at the 0.05 probablility level.

Table 2. ***Response of corn yield and harvest moisture to plant population at Morris in 2009, averaged across three hybrids.***

Final Population (plants/ac)	Grain Yield at 15% Moisture (bu/ac)	Grain Moisture at harvest (%)
16500	125	32.6
22000	134	32.2
27500	156	33.6
33000	153	32.6
38500	146	35.1
44000	153	33.3
LSD (0.05)	15	NS

Thanks to the Minnesota Corn Growers Association/ Minnesota Corn Research and Promotion Council for funding this research, and to George Nelson, Joel Ekberg, Eric Ristau, and Ryan Van Roekel for their help.

For Additional Information:
Jeff Coulter, U of M Extension Corn Agronomist

Corn Response to Plant Population and Hybrid Maturity in West-Central Minnesota *(continued)*

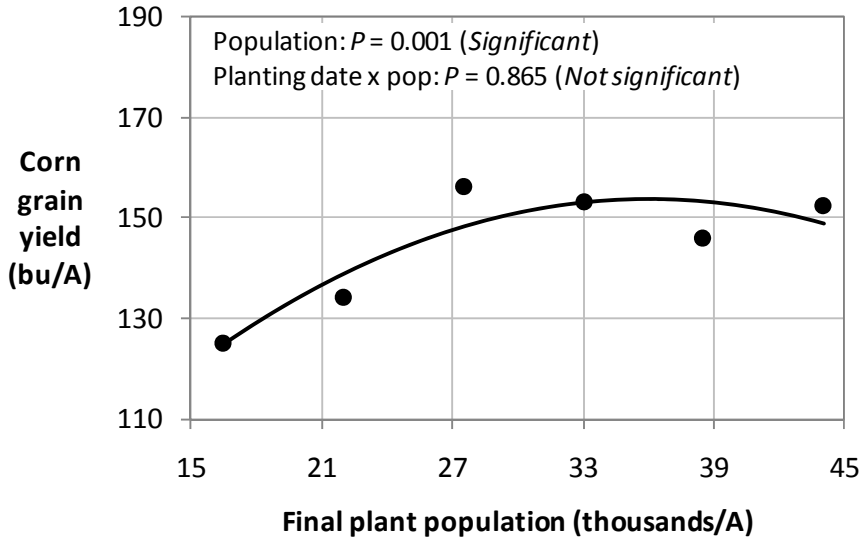
Results:

- The 2009 growing season at Morris, MN was unusually cool and dry, particularly in the first half of the growing season. 2,137 growing degree days (base 50^0F) were accumulated between planting and the first freeze on October 9. Total rainfall amounts were 0.48 inches in May, 2.12 inches in June, 1.01 inches in July, 3.78 inches in August, and 2.50 inches in September.
- Corn grain yield was not statistically different among hybrids, but grain moisture at harvest with the 100-day hybrid was 7.5 and 5.6 percentage points wetter than that with the 92- or 96-day hybrids, respectively (Table 1). Grain moisture at harvest was not affected by plant population (Table 2).
- The response of corn grain yield to plant population was consistent among hybrids. Averaged across hybrids, yield increased from 125 to 156 bu/ac as final plant population increased from 16,500 go 27,500 plants/ac (Table 2). However, yields were similar at plant populations ranging from 27,500 to 44,000 plants/ac. Corn yields at the various plant populations did not fit the typical yield response curve very well (Figure 1), so economically optimum seeding rates were not calculated.

Conclusion:

- Previous research from numerous small-plot experiments conducted in southern Minnesota by the University of Minnesota indicate that grain yield is typically maximized at 36,000 plants/ac, but that economically optimum final stands are between 32,000 and 34,000 plants/ac (www.extension.umn.edu/distribution/cropsystems/M1244.html).
- In this study, corn followed corn and rainfall was limited, resulting in low yields that were maximized at 27,500 plants/A. This supports previous research from across the Corn Belt, which has found lower optimum final plant populations in lower-yielding environments.

Figure 1. ***Response of corn grain yield to plant population at Morris, MN in 2009, averaged across three hybrids.***



Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Corn Response to Plant Population, Row Width, and Hybrid Maturity in Northwest Minnesota — Polk County

Cooperator: Elliot and Eric Solheim
Nearest Town: Beltrami
Soil: Clearwater loam, 7.4 pH, very high soil test P and K
Previous Crop: Soybean
Tillage: Field cultivator in fall and super-coulter in spring
Fertilizer: 100 lb N + 70 lb P + 3.6 lb Zn/ac
Planting Date: 14 May 2009
Hybrids: Pioneer 39V07, Pioneer 39N99, and Pioneer 38H08 (all HX1, LL, RR2)
Row Width: 22-inch vs. 30-inch

Purpose of Study:
To determine the optimum plant population for corn in northwest Minnesota, and whether it is influenced by row width or hybrid maturity.

Research Methods:
The experimental design was a split plot arrangement in a randomized complete block with four replications. Main lots were all possible combinations of two row widths and three hybrids. Subplots were six final plant populations, established by over-planting followed by hand-thinning at the five leaf collar stage. Subplots were four rows wide by 30 feet long. Yields were adjusted to 15% moisture. Data were analyzed at the 5% probability level.

Results:
- 1,958 growing degree days (base 50^0F) were accumulated between planting and the first freeze on September 28. Kernel stages at the time of the freeze are listed in Table 1.
- Corn grain yield was affected by row width, and this response was statistically consistent across hybrids and plant populations. When averaged across all hybrids and plant populations, corn grain yield was 6% higher with 22-inch rows than with 30-inch rows (Table 2).

Table 1. ***Kernel stage of hybrids when froze on September 28, 2009 near Beltrami, MN.***

Hybrid	Relative maturity	Kernel stage when froze
Pioneer 39V07	80-day	Mature
Pioneer 39N99	89-day	Milk line 80% down kernel
Pioneer 38H08	92-day	Milk line 67% down kernel

Table 2. ***Response of corn yield to row width near Beltrami, MN in 2009, averaged across three hybrids and six plant populations.***

Row width	Corn grain yield (bu/A)
22-inch	161 a[†]
30-inch	155 b

[†]Yields followed by different letters are statistically different at the 5% probability level.

Thank you to Jim Cameron, Phil Glogoza, Lynn Haake, Carlyle Holen, Randy Nelson, Eric Ristau and Ryan Van Roekel for their help.

For Additional Information:
Jeff Coulter, U of M Extension Corn Agronomist
Russ Severson, U of M Extension Educator

Project Funding Provided by:
Pioneer Hi-Bred International, Inc.

Corn Response to Plant Population, Row Width, and Hybrid Maturity in Northwest Minnesota *(continued)*

Results (continued):

- Corn grain yield was not statistically different among hybrids, and this was consistent for both row widths.
- The response of corn grain yield to plant population did not differ with row width or hybrid. Averaged across row widths and hybrids, grain yield was maximized at the highest plant population, which was 44,000 plants/acre (Figure 1). Grain yield increased by 25% as plant population increased from 16,500 to 33,000 plants/acre, and by 6% as plant population increased from 33,000 to 44,000 plants/acre.
- Based on the yield response curve in Figure 1, economically optimum seeding rates were calculated for various seed costs and corn prices (Table 3). Required seeding rates were assumed to be 5% higher than the desired final plant populations. These economically optimum seeding rates were much higher than expected. Multiple experiments recently conducted by the University in southern Minnesota indicate that the optimum final plant population for corn is between 32,000 and 34,000 plants/acre, or a seeding rate of 33,600 to 35,700 seeds/acre at 5% over-seeding (www.extension.umn.edu/distribution/cropsystems/M1244.html).

Summary:

- The results from this experiment indicate that: i) narrow rows increase grain yield; ii) the optimum plant population for corn is similar regardless of row width or hybrid maturity; and iii) very high seeding rates are needed to maximize economic return. Research is needed over additional years and locations in northwest Minnesota to validate these results and improve our recommendations.

Figure 1. ***Response of corn yield to final plant population, averaged across two row widths and three hybrids near Beltrami. 2009***

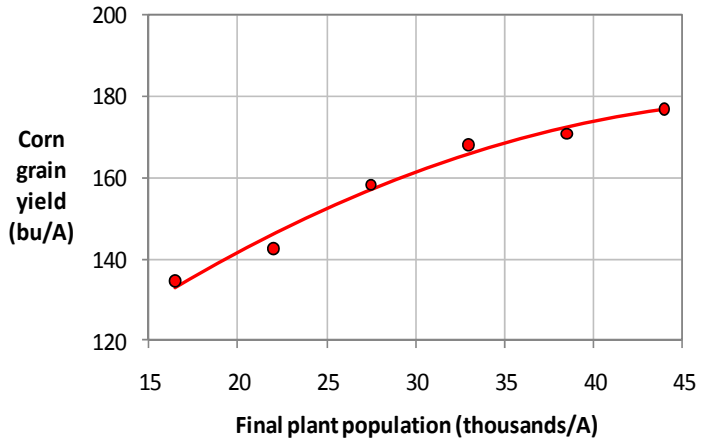


Table 3. ***Seeding rates (seeds/acre) to maximize economic return, averaged across two row widths and three hybrids near Beltrami, MN in 2009. The seeding rates listed below are 5% higher than the targeted final plant populations.***

Seed cost per	Corn price ($/bushel) 2.75	3.25	3.75	4.25	4.75
160	41,700	43,300	>44,000	>44,000	>44,000
185	40,000	41,900	43,300	>44,000	>44,000
210	38,400	40,500	42,100	43,300	>44,000
235	36,700	39,100	40,900	42,200	43,300
260	35,100	37,700	39,700	41,100	42,300
285	33,400	36,300	38,400	40,100	41,400

For Additional Information:
Jeff Coulter, U of M Extension Corn Agronomist
Russ Severson, U of M Extension Educator

Project Funding Provided by:
Pioneer Hi-Bred International, Inc.

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Evaluation of Phosphorus Fertilizer Enhancers For Corn

Location: Northwest and West-Central Minnesota
Row Width: 30 inches
Experimental Design: Randomized complete plot with 3-way factorial
Weed Management: Glyphosate post applied

Purpose of Study: To evaluate the use of fertilizer enhancers (Jumpstart® and Avail®) in combination with ammonium polyphosphate (10-34-0) for corn grown on calcareous soils, and to determine if application of jumpstart in combination with Avail has additive effects on nutrient uptake and yield of corn.

Table 1. Soil series and planting informaiton for 2008 trials.

				Planting Information		
County	City	Soil Type	Residue	Date	Hybrid	Final Population
						----plant/acre----
McLeod	Brownton	Canisteo	Corn	16-May	DK 50-44	35034
Polk	Crookston	Bearden	Wheat	7-May	DK 38-89	33246
Yellow Medicine	Clarkfield	Feldon	Soybeans	14-May	DK 50-44	34786

Table 2. Initial soil test information for 2008 trials.

		Soil Test†					
Location	County	P	K	Ca	pH	OM	CCE
		----------ppm----------				-------%--------	
Brownton	McLeod	8.3	156	5503	7.5	5.7	1.3
Crookston	Polk	7.3	397	5750	8.2	4.4	4.3
Clarkfield	Yellow Medicine	6.8	97	5812	8.2	4.3	18.4

† P, Olsen phosphorous; K, ammonium acetate potassium; Ca, ammonium acetate calcium; pH, soil pH; OM, soil organic matter; CCE, calcium carbonate equivalent.

Experimental Methods

Three locations were studied in 2008 (Table 2). Soils tested Medium to Low in P and pH values were 7.5 or higher (Table 2). Planting date and previous crop varied by location (Table 1).

Rates of 2.5 (10 lbs P_2O_5) and 5 (20 lbs P_20_5) gallons of 10-34-0 were applied 0.5 to 0.75 inches below the seed furrow.

10-34-0 was applied with and without Avail including 0 gal/ac 10-34-0 which consisted of avail and water applied at a similar vol/vol ratio as 10-34-0 and Avail. Nitrogen was applied to balance N rates applied with 10-34-0.

Commercial corn hybrids were inoculated with Jumpstart at recommended rates. Corn was planted within a week of inoculation. Identical hybrids and seed lots were used for treated and untreated plots.

Two rates of P (20 and 100 lbs P_2O_5 per ac.) were broadcast and incorporated (except for at Clarkfield where there was no incorporation) prior to planting as triple superphosphate (0-46-0).

Jumpstart® (Novozymes)

Active Ingredient: Naturally occurring soil fungus *Penicillium bilaii*
Mode of Action: Fungi grow along the roots of crops exuding organic acids that lower the pH in the surrounding area. Decreasing the pH increases P availability by making calcium bound forms more soluble.

Avail® (Specialty Fertilizer Products)

Active Ingredient: Maleate Copolymer
Mode of Action: Copolymer has a high CEC (cation exchange capacity) that has an affinity for exchangeable metal cations in the soil. This copolymer is intended to bind with the cations before they form insoluble compounds with P keeping fertilizer sources more available for crop uptake. Formulations are available for liquid and dry fertilizer sources

For Additional Information:
Daniel Kaiser

Project Funding Provided by:
Novozymes

Evaluation of Phosphorus Fertilizer Enhancers For Corn (*continued)*

Results

Early P uptake was consistently increased by starter fertilizer. At Brownton both rates increased P uptake similarly, all rates significantly differed at Crookston, and only the highest P rate increased uptake at Clarkfield. In general uptake was greater with starter than either broadcast P rate. Uptake increases were consistent with increased plant mass (not shown).

Jumpstart never increased early P uptake at any location. Avail treatments only differed at Crookston where measured P uptake was about 0.4 mg per plant less with Avail regardless of starter rate or Jumpstart use. There was no additive effect of using both products together at any location.

Corn grain yield was increased by one or more treatments at 2 locations (Table 4). At Crookston and Clarkfield yield was increased by starter P at the $P \leq 0.15$ probability level. Average yields were higher than the control only when 20 lbs of P_2O_5 (5 gals 10-34-0 per acre) was applied with the planter. Yield was not increased more with the highest broadcast fertilizer rate than the highest starter P rate. Yields were slightly lower with broadcast P at Clarkfield which is likely due to the broadcast treatments not being incorporated.

Avail did not significantly increase yield at any location. The effects of Jumpstart were only significant ($P \leq 0.05$) at Clarkfield where treatments averaged 4 bu. per acre greater. This effect was regardless of P rate or Avail use, but the overall effect appeared greater when no fertilizer P was applied as indicated by significant main treatment interactions. No specific soil factors could be used to determine this response although measured soil carbonates were the greatest at this location.

Table 3. Early plant (V5) P uptake from starter fertilizer, Jumpstart, and Avail. Singnificant responses are indicated by shaded cells.

		Starter P_2O_5 Rate with or without Avail						Broadcast P_2O_5 Rate		Jumpstart
		0		10		20				
Location	Jumpstart	Yes	No	Yes	No	Yes	No	20	100	Response†
		mg/plant								
Brownton	Yes	26.1	27.5	32.7	34.2	33.8	32.8			31.2
	No	26.1	25.6	26.1	28.4	28.5	28.6	24.9	25.0	27.2
	P response‖	**26.3b**		**30.4a**		**30.9a**		Yes	No	
	Response to Avail.§	26.1	26.6	29.4	31.3	31.2	30.7	28.9	29.5	
Crookston	Yes	6.5	8.1	7.4	7.9	8.9	7.4			7.7
	No	6.5	8.1	9.2	8.2	8.8	9.9	8.2	7.8	8.4
	P response‖	**7.3c**		**8.2b**		**8.8a**		Yes	No	
	Response to Avail.§	6.5	8.1	8.3	8.0	8.9	8.7	**7.9b**	**8.3a**	
Clarkfield	Yes	17.1	15.7	16.6	17.5	18.8	20.2			17.7
	No	15.6	16.2	18.6	16.7	18.6	17.5	15.1	14.9	17.2
	P response‖	**16.1b**		**17.4b**		**18.8a**		Yes	No	
	Response to Avail.§	16.4	15.9	17.6	17.1	18.7	18.9	17.6	17.3	

† Average yields from jumpstart across P rates and avail treatments
‖ Yield average from applied P rate across Jumpstart and Avail treatments.
§ Average yield for avail treatments across P application rates and Jumpstart treatment
**Different letters following numbers represent significant differences in main treatment effects at $P \leq 0.10$

Table 4. Corn grain yield response to starter fertilizer, Jumpstart, and Avail. Shaded cells indicate significant main treatment responses.

		Starter P_2O_5 Rate with or without Avail						Broadcast P_2O_5 Rate		Jumpstart
		0		10		20				
Location	Jumpstart	Yes	No	Yes	No	Yes	No	20	100	Response†
		bu/ac								
Brownton	Yes	230	226	227	226	235	225			228
	No	233	225	223	225	230	228	233	228	227
	P response‖	228		225		229		avg		
	Response to Avail.§	231	226	225	225	232	226	230	226	
Crookston	Yes	164	161	164	167	175	172			167
	No	163	168	167	168	169	172	171	171	168
	P response‖	**164b**		**166ab**		**172a**		avg		
	Response to Avail.§	163	164	165	167	172	172	167	168	
Clarkfield	Yes	165	167	168	165	169	177			**169a**
	No	154	164	170	161	174	168	155	164	**165b**
	P response‖	**163b**		**166ab**		**172a**		avg		
	Response to Avail.§	160	166	169	163	171	172	167	167	

† Average yields from jumpstart across P rates and avail treatments
‖ Yield average from applied P rate across Jumpstart and Avail treatments.
§ Average yield for avail treatments across P application rates and Jumpstart treatment
**Different letters following numbers represent significant differences in main treatment effects at $P \leq 0.10$. Yield responses to starter P are significant at $P \leq 0.15$.

Overall, the use of Jumpstart and Avail was not shown to increase uptake of P early in the growing season or late in the season as assessed by P removed in grain (not shown). In fact when responses for early P uptake or P removal in grain were significant both trended lower when either Jumpstart and Avail where used. Yield was increased by Jumpstart at one location which could not be explained by increased uptake of P. Starter fertilizer tended to increase yield more consistently with 5 gallons of 10-34-0 being adequate to maximize yields at the studied locations. A yield response to Jumpstart may be possible but it may more difficult to predict than response to applied P. Responses to Jumpstart and Avail would be more likely in high pH soils in Minnesota.

For Additional Information:
Daniel Kaiser

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

On-Farm Evaluation of Corn Plant Population and Hybrid Maturity in West-Central Minnesota

Location: Ashby (Grant County) - Jon Nelson's farm
Previous Crop: Sunflower
Tillage: Salford RTS in fall, followed by anhydrous applicator, field cultivator, and flex-coil packer in spring.
Fertilizer: 150 lb N/ac + 5 gal. 9-18-9-17S + zinc in furrow at planting
Planter: 16-row John Deere 1790 variable-rate planter
Row Width: 30 inches
Planting Date: 6 May 2009
Hybrids: Pioneer 39N96 (89-day) and P9494XR (94-day) - both HXX, LL, RR2

Purpose of Study:

To evaluate corn response to seeding rate in west-central Minnesota using field-scale equipment, and to determine whether this response differed between hybrids with differing maturity.

Research Methods:

The experimental design was a split plot arrangement in a randomized complete block with three replications. Main plots were two hybrids and subplots were six seeding rates planted with a variable-rate planter. Subplots were eight rows wide by 700 feet long. Corn was harvested on November 17, 2009. Grain was weighed in a calibrated weigh wagon, and grain moisture was determined from a grain analysis computer. Yields were adjusted to 15% moisture. Data were analyzed at the 5% probability level.

Table 1. ***Corn response to seeding rate at Ashby in 2009.***

	Pioneer 39N96 (89-day RM)			Pioneer 9494XR (94-day RM)		
Seeding rate (seeds/A)	**Final stand (plants/A)**	**Grain yield (bu/A)**	**Grain moisture at harvest (%)**	**Final stand (plants/A)**	**Grain yield (bu/A)**	**Grain moisture at harvest (%)**
20,500	18,700	152	24.2	20,000	156	25.9
25,500	23,600	159	24.5	24,600	161	26.5
30,500	27,000	156	23.4	29,200	158	26.4
35,500	30,900	166	23.5	33,500	167	25.3
40,500	36,500	170	23.6	37,000	165	26.7
45,500	41,200	180	24.5	42,300	172	25.9
LSD (0.05)	---	9	NS*	---	6	NS

*NS, not significant at the 0.05 probability level.

Thanks to Jon Nelson for planting, maintaining, and harvesting these plots, and to Steve Fitz of Red River Marketing for donating seed and helping with harvest.

For Additional Information:
Jeff Coulter, U of M Extension Corn Agronomist
Doug Holen, U of M Extension Educator

On-Farm Evaluation of Corn Plant Population and Hybrid Maturity in West-Central Minnesota *(continued)*

Results:

- Total rainfall amounts at this location in July, August, and September were 1.53, 1.28, and 1.40 inches, respectively.
- Barrenness (percentage of plants without harvestable ears) was rare, even with the high seeding rates. Barrenness averaged 0.33% across hybrids and seeding rates.
- Plants with two harvestable ears was rare. Averaged across hybrids, 2.6, 0.9, and 0.6% of the plants had two harvestable ears at the 20,500, 25,500, and 30,500 seeds/A seeding rates, respectively. At seeding rates above 30,500 seeds/A, the percentage of plants with two harvestable ears was essentially zero.
- Stalk lodging at the time of harvest was less than 0.5% for all seeding rates for both hybrids.
- Corn grain yield was not statistically different between hybrids, and averaged 164 bu/ac for 39N96 and 163 bu/ac for P9494XR.
- Grain yield increased as seeding rate increased, and this was consistent between hybrids (Table 1). Averaged across hybrids, grain yield increased linearly from 152 to 175 bu/ac as the final stand increased from 17,950 to 43,120 plants/ac (Figure 1). This is an averaged increase of 0.9 bu/ac for each additional 1,000 plants/ac. Assuming $225/bag of seed and 5% over-seeding, it costs $2.95/ac to increase the final stand by 1,000 plants/ac.

Conclusion:

The fact that corn grain yield increased linearly as final plant population increased was unexpected. Research from multiple small-plot experiments conducted in southern Minnesota by the University of Minnesota indicate that grain yield is typically maximized at 36,000 plants/ac, but that economically optimum final stands are between 32,000 and 34,000 plants/ac (www.extension.umn.edu/distribution/cropsystems/M1244.html). Additional on-farm research is needed.

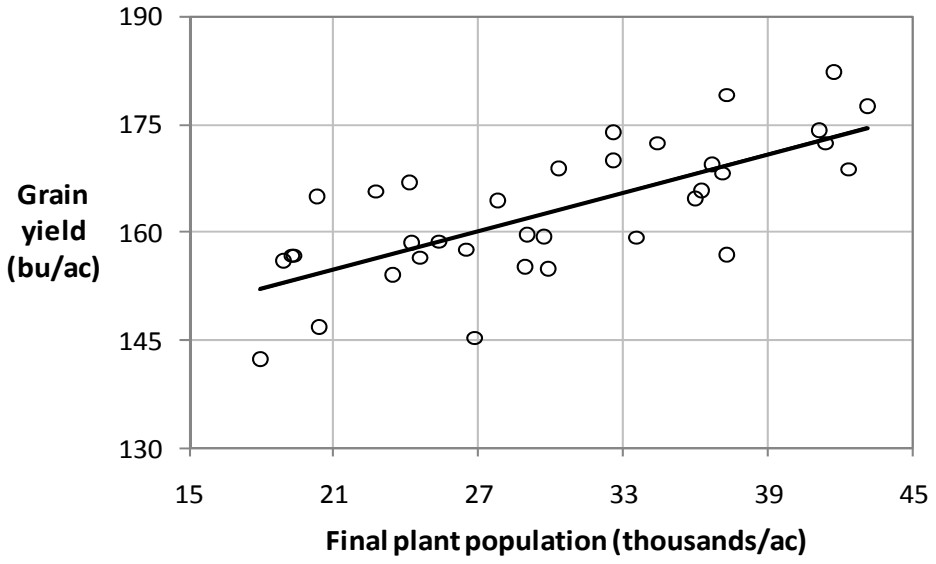


Figure 1. ***Response of corn grain yield to final plant population at Ashby in 2009 averaged across two hybrids.***

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Irrigated Corn Silage Hybrid Performance Evaluation — Otter Tail County

Cooperator: Dan Dreyer **Nearest Town:** Ottertail City
Soil Type: Sandy loam **Tillage:** Fall chisel + Spring field cultivator
Previous Crop: Silage corn **Planting Date:** 5 May 2009
Row Width: 30 inches
Fertilizer: 150 material pounds of 46-0-0
8,000 gallons of liquid dairy manure
Weed Management: Lumax at 2.5 quarts
Status at 2 ounces
Harvest Date: 30 September 2009 (a little on dry side)
Circular harvest pattern using 3 row pull behind chopper into dump box and transported with 2 grain trucks. Weights obtained on-farm with pad scale. Chopper has kernel processor. Cutting height was 12 inches.
Experimental Design: Randomized Complete Block (3 replications)

Purpose of Study:
Evaluate silage yield and quality performance of commercial corn hybrids in West Central Minnesota under irrigation.

Table 1. ***Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield and quality traits for corn hybrids planted at Ottertail, MN (Otter Tail County) in 2009.***

				Yield [2]			Quality (concentration) [3]					Milk Yield [4]	
Company	Hybrid	Traits [1]	RM	Moist	DM	silage	CP	NDF	IVD	NDFD	Starch	Ton	Acre
				%	- ton/ acre -		---------- % ----------					lb/ ton	lb/ acre
Pioneer Brand	35F44	Bt, CRW, GLY, LL	105	67.8	10.3	32.2	7.0	43	78	49	32	3,150	32,600
NuTech	3A-804 GT	Bt, GLY	104	61.4	10.3	26.6	5.6	42	78	50	34	3,150	32,400
Dekalb	DKC54-49 VT3	Bt, CRW, GLY	104	66.3	9.2	27.2	6.3	45	77	51	31	3,070	28,100
NuTech	3U-306	Bt, CRW, GLY, Lf	106	65.9	9.4	27.7	6.4	48	76	52	25	2,930	27,700
Dyna-Gro	V3593 VT3	Bt, CRW, GLY	95	57.1	9.3	21.8	6.2	45	77	50	32	2,880	26,900
Dyna-Gro	V4592VTNS	CRW, GLY	105	62.2	9.0	23.9	6.4	47	76	51	29	2,950	26,600
Dairyland	8208	Bt, CRW, LL	108	67.4	8.7	26.8	6.3	45	77	49	29	3,030	26,500
Hyland Seeds	HL CVR48 VT3	Bt, CRW, GLY	88	62.3	8.7	23.1	5.6	45	78	51	31	3,030	26,400
Dyna-Gro	55R10	Bt, CRW, GLY, LL	100	66.8	8.9	26.8	6.3	47	76	50	28	2,960	26,200
Pioneer Brand	37N16	Bt, CRW, GLY, LL	99	61.5	9.1	23.8	6.4	47	76	48	30	2,820	25,800
NuTech	3T-098 VT3	Bt, CRW, GLY	98	60.4	8.7	22.0	5.8	44	76	49	33	2,940	25,600
Dekalb	DKC45-79 VT3	Bt, CRW, GLY	95	61.1	8.5	21.8	6.0	47	76	50	30	2,870	24,400
Wensman	7107 VT3	Bt, CRW, GLY	90	58.7	7.8	18.8	6.4	40	80	51	37	3,140	24,300
Wensman	7273 VT3	Bt, CRW, GLY	98	62.1	8.1	21.3	6.2	46	75	48	31	2,870	23,200
Hyland Seeds	HL SR35	GLY, Lf	88	58.5	8.8	21.1	6.5	53	72	50	23	2,550	22,300
Dekalb	DKC50-44 VT3	Bt, CRW, GLY	100	62.3	6.9	18.4	5.7	49	75	51	28	2,860	19,800
Mean				**62.6**	**8.9**	**23.9**	**6.2**	**46**	**76**	**50**	**30**	**2,950**	**26,200**
LSD(0.10)				**2.0**	**ns**	**4.9**	**0.6**	**3**	**2**	**2**	**4**	**180**	**5,800**
CV				**2.3**	**14.4**	**14.9**	**7.2**	**5.9**	**2.3**	**2.5**	**9.4**	**4.5**	**16.0**

[1] Bt, CRW, GLY, LL, CL, Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate, Liberty Link and Clearfield herbicide resistance, and leafy trait, respectively.
[2] DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.
[3] Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to *Results Provided* text for additional information.
[4] Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to *Results Provided* text for additional information.

For Additional Information:
Doug Holen, Phil Glogoza

Project Funding Provided by:
Private Seed Companies

2009 Polk County Soybean Variety Plots

Cooperator: Tyler Ross
Nearest Town: Crookston
Previous Crop: Sugarbeets
Planting Date: 15 May 2006
Row Width: 6 inches
Weed Management: *See RM summary for additional information*
Population: 180,000 ppa
Harvest Date: 24 September, 30 September and 13 October
Experimental Design: RCB 3 replications

2009 Polk County Roundup Ready Early Relative Maturity Soybeans

Weed Management:

All Varieties - May 20
Valor 1.25 oz Pre-Emergence

Roundup Varieties - June 23 & July 13
Roundup PowerMax 1 qt/ac
Ammonium sulfate (39%) 1 qt/ac

Harvest Date: September 24

Company	Variety	RM	Oil %	Protein %	Yield (13%)
Dairyland Seed Co., Inc.	DSRC770RR	00.7	18.0	34.6	63.5
Legend Seed	0098RR	00.9	18.9	32.5	61.1
Thunder Seeds, Inc.	29008RR	00.8	17.8	33.6	56.6
Thunder Seeds, Inc.	30005RR	00.5	18.2	33.7	55.5
Wensman Seed	W20092RR	00.9	18.6	35.0	54.3
Gold Country Seed	9008RR	00.8	17.9	34.1	53.9
North Star Genetics, Ltd	NS0084RR	00.8	18.0	34.7	53.7
Asgrow	AG00901	00.9	17.7	34.4	53.5
Wensman Seed	W20074RR	00.8	18.6	33.1	47.2
Seeds 2000	0081RR	00.8	18.6	33.1	47.0
Legend Seed	0028RR	00.2	18.4	34.4	44.9
NK Brand	SOO-H7	00.7	18.3	33.4	44.4
Significance	LSD (.05)		0.4	0.6	4.3

2009 Polk County Roundup Ready Medium Relative Maturity Soybeans

Weed Management:

All Varieties - May 20
Valor 1.25 oz Pre-Emergence

Roundup Varieties - June 23 & July 13
Roundup PowerMax 1 qt/ac
Ammonium sulfate (39%) 1 qt/ac

Harvest Date: September 30

Company	Variety	RM	Oil %	Protein %	Yield (13%)
Croplan Genetics	RT0159RR	0.1	18.6	33.3	66.6
Peterson Farm Seeds	PFS1000RR	0.0	18.5	32.3	62.8
Integra Seed	79020R	0.2	17.5	33.8	59.2
North Star Genetics, Ltd	NS0214RR	0.1	17.5	33.6	59.2
Pioneer Hi-Bred Int'l	90Y20	0.2	17.7	34.5	58.9
Dairyland Seed Co., Inc.	DSR0101RR	0.1	18.6	32.7	58.7
Stine Seed Co.	0283-4	0.2	17.4	35.1	58.1
Wensman Seed	W2025RR	0.2	17.4	35.5	57.5
Hyland Seeds	HS02R28	0.2	16.5	34.6	55.3
Integra Seed	97014R	0.0	18.5	34.8	55.2
Croplan Genetics	RT0268RR	0.2	17.4	35.6	54.2
NK Brand	SO2-K3	0.2	18.7	33.8	53.3
NuTech Seed	NT 6022	0.2	18.1	33.6	52.1
Peterson Farm Seeds	PFS1002RR	0.2	17.9	33.6	50.5
NK Brand	SO1-C9	0.1	18.6	34.6	48.5
Hyland Seeds	RR RIDGEWAY	0.2	17.7	33.7	47.7
Significance	LSD (.05)		0.3	0.6	5.6

For Additional Information:
Russ Severson

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

2009 Polk County Soybean Variety Plots *(continued)*

2009 Polk County Roundup Ready Late Relative Maturity Soybeans

Weed Management:

All Varieties - May 20
Valor 1.25 oz Pre-Emergence

Roundup Varieties - June 23 & July 13
Roundup PowerMax 1 qt/ac
Ammonium sulfate (39%) 1 qt/ac

Harvest Date: October 13

Company	Variety	RM	Oil %	Protein %	Yield (13%)
Gold Country Seed	2806RR	0.6	18.4	33.0	70.6
NuTech Seed	NT 0636	0.6	18.5	32.9	68.2
Proseed, Inc	90-40	0.4	19.1	32.7	67.3
Pioneer Hi-Bred Int'l	90Y50	0.5	17.7	35.1	64.4
Dyna-Gro	SX09105	0.5	19.3	32.8	63.3
Asgrow	AG0409RR2-YIELD	0.4	17.6	33.6	62.5
Thunder Seeds, Inc.	2905RR	0.5	17.6	34.7	61.6
Gold Country Seed	2703RR	0.4	18.8	33.3	59.5
North Star Genetics, Ltd	NS0514RR	0.4	17.6	34.7	59.1
Peterson Farm Seeds	PFS0905RR	0.5	18.5	33.4	59.0
Proseed, Inc	80-50	0.5	17.8	34.5	59.0
Dyna-Gro	37P05	0.5	17.6	34.7	58.6
Dyna-Gro	32T03	0.3	18.6	33.4	57.7
Legend Seed	0539RR	0.4	17.6	34.7	57.7
Pioneer Hi-Bred Int'l	90Y42	0.4	17.7	34.3	57.3
Stine Seed Co.	0306-4	0.4	18.8	33.2	57.2
Croplan Genetics	RT0409RR	0.4	17.7	34.8	56.7
Integra Seed	2050R	0.5	17.4	34.5	56.5
Asgrow	AG0401	0.4	18.2	33.2	55.9
Proseed, Inc	P2 90-50 RR2Y	0.5	18.1	33.8	55.7
Dairyland Seed Co., Inc.	DSR0401RR	0.4	18.1	34.5	54.4
NuTech	NT6033	0.3	17.8	34.3	48.5
Hyland Seeds	RR RUGGED	0.3	19.0	33.6	45.8
Significance	LSD (.05)		0.4	0.4	5.9

2009 Polk County Food Grade Soybeans

Weed Management:

All Varieties - May 20
Valor 1.25 oz Pre-Emergence

Food Grade Varieties - June 24
Raptor 2 oz
Rezult 1.6 + 1.6 pt/ac
Crop Oil 1.5 pt/ac

Harvest Date: October 13

Company	Variety	RM	Oil %	Protein %	Yield (13%)
Legend	0668	0.5	18.9	32.1	68.7
NDSU	Sheyenne	0.8	17.6	33.7	62.3
U of M	MN0093SP	00.9	18.3	33.2	58.8
Integra	89009	00.9	17.8	33.5	57.6
U of M	MN0208CN	0.2	17.2	35.7	56.0
NDSU	Ashtabula	0.5	18.2	33.2	55.1
U of M	MN0095	00.9	18.0	34.2	54.9
Thunder	TA-10	0.5	16.0	35.4	54.6
U of M	MN0101	0.1	16.9	35.7	54.4
NDSU	Prosoy	0.8	17.2	37.5	54.2
U of M	MN0604	0.6	17.8	34.5	53.3
SunOpta	Bravado	0.2	17.7	33.9	52.5
SunOpta	Valor	0.2	16.3	35.4	50.4
NDSU	Walsh	0.3	17.4	33.8	49.7
Thunder	TA-8	0.4	14.9	35.6	49.6
NDSU	Traill	0.0	16.8	36.3	49.0
Thunder	07005	00.5	17.4	34.8	46.8
U of M	MN0105	0.1	16.6	36.7	45.7
U of M	MN0094SP	00.9	17.0	37.2	41.2
U of M	MN0096SP	00.9	15.7	40.0	38.3
U of M	MN0104SP	0.1	16.5	38.2	37.1
SunOpta	Hardnut	00.5	15.8	35.3	20.1
Significance	LSD (.05)		0.6	0.9	5.4

For Additional Information:
Russ Severson

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Soybean Relative Maturity and Planting Date Influence on Optimal Yield

Cooperator: Tyler Ross
Nearest Town: Crookston
Soil Type: Bearden silty clay loam
Harvest Populations: 140,000
Harvest Date: 24 September 2009, 30 September 2009 and 9 October 2009
Experimental Design: Split plot with varieties as main plot and planting date as subplot

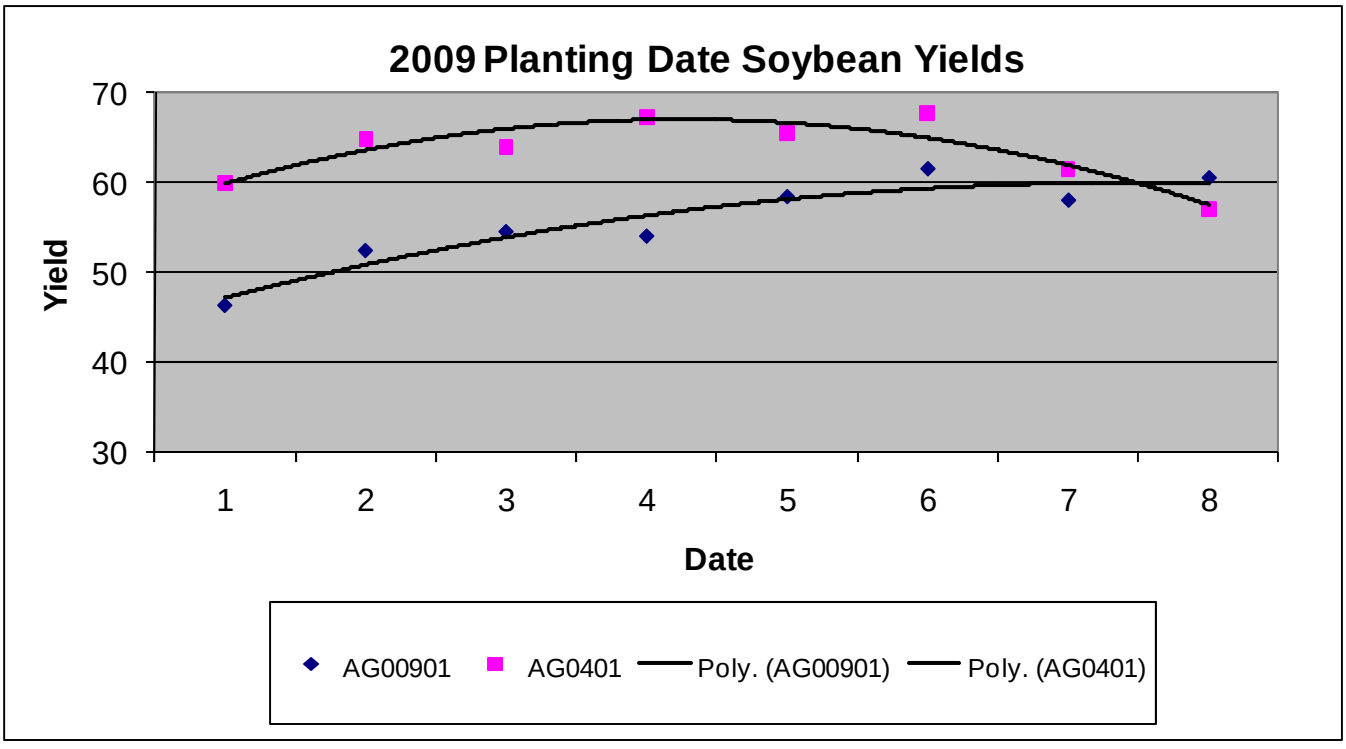
Purpose of Study:

To evaluate soybean relative maturity and planting date influence on optimal yield and soybean quality in northwest Minnesota.

Results:

The plots were established utilizing two Asgrow cultivars with 00.9, and 0.4 relative maturities planted at eight different dates commencing April 28 and concluding on June 16. Due to cool soil temperatures, it took 23 days for the first two planting dates to emerge. Optimum yield was achieved with planting date 4 for the AG0401 cultivar and date 7 for the AG00901 cultivar. Average soil temperatures at the 2'' depth reached 55 degrees May 11.

Figure 1. 2009 Planting Date Yields



For additional information:
Russ Severson

Partnership/Funding:
Minnesota Soybean Research and Promotion Council NW Research and Outreach Center

Soybean Relative Maturity and Planting Date Influence on Optimal Yield *(continued)*

***Results** continued . . .*

Protein percentage was not affected by planting date and oil percent significantly decreased with delayed planting for the early RM cultivar AG 00901 as is illustrated in Figure 2. The later maturing AG 0401 cultivar oil content decreased 0.8% and protein increased 1.5 % with delayed planting. These results differ from the 2006 and 2007 Planting Date Trials.

Soil temperature had a large effect on days from planting to emergence as can be seen in Figure 3, ranging from 14 days to 7 days from planting to emergence in 2007 to 38 days to 14 days in 2008 and 20 days to 9 days in 2009.

Figure 4 gives the average daily 2 inch soil temperatures for 2006 -2009 trials. Mean soil temperatures at the 2 depths had achieved 55 degrees as early as April 25 in 2007. This was well above normal. It was May 1 of 2006 before soil temperatures exceeded 55 degrees.

In 2008, it was May 25 before the average 2 inch soil temperature exceeded 55 degrees and May 11 in 2009.

To utilize this information to make planting date decisions, several years of different environments need to be considered to determine a risk assessment of early planting of soybean.

Figure 2. Percent oil by soybean variety and planting date. 2008

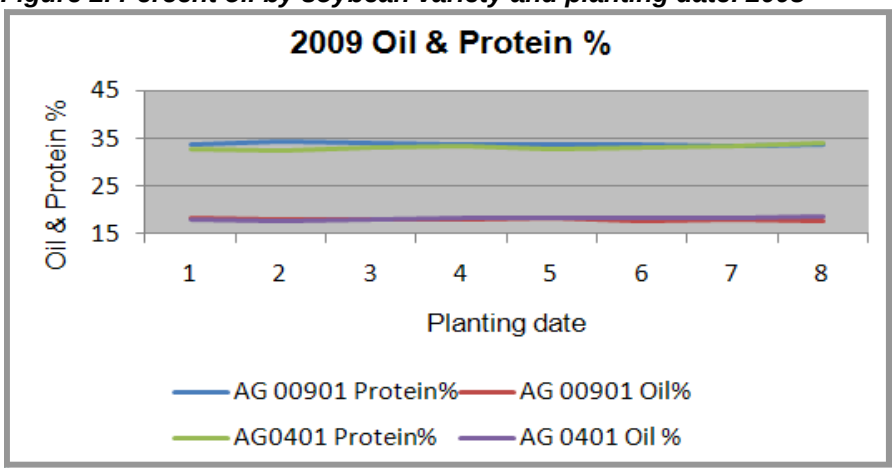


Figure 3. Days from planting to emergence by planting date. 2006-2009

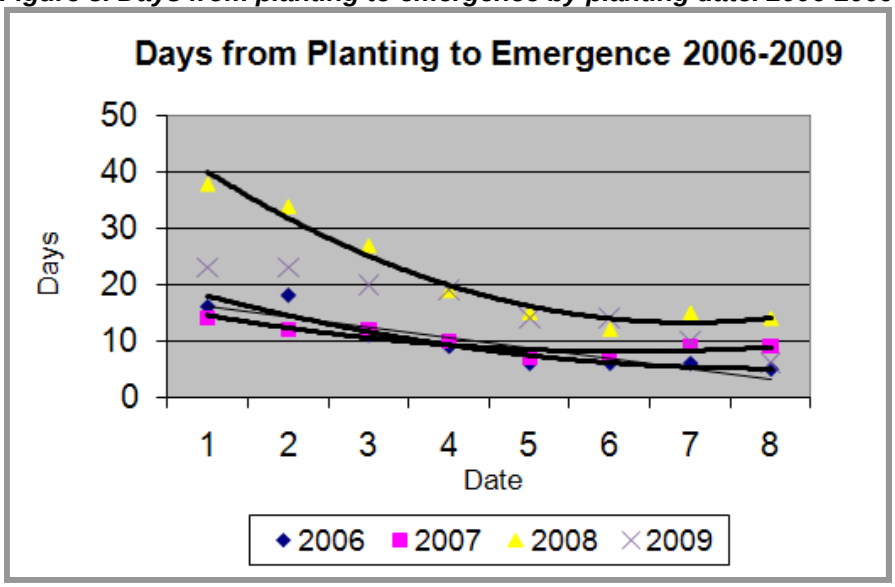
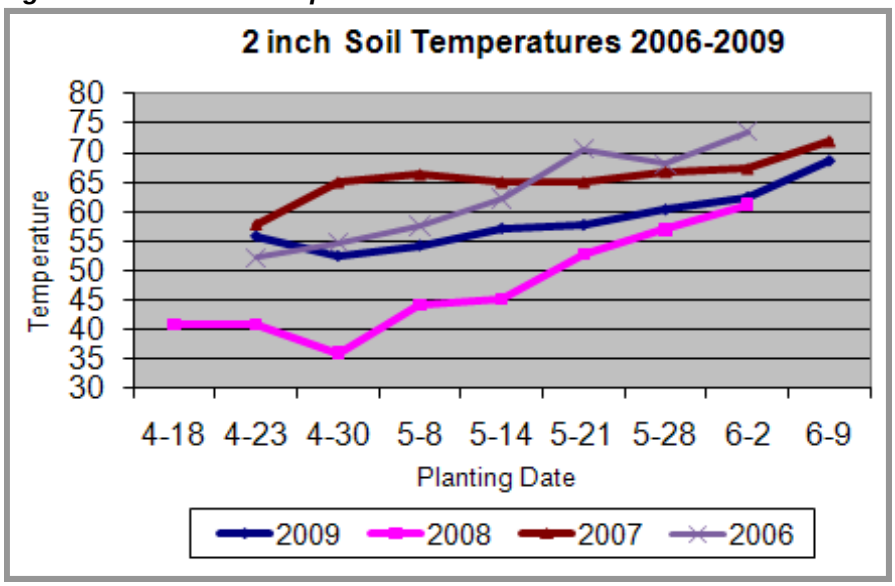


Figure 4. 2 inch soil temperatures. 2006-2009



Ground Rolling Timing Study — Grant County

Cooperator: Tony Endreson
Nearest Town: Wendell
Soil Type: Clay loam
Tillage: Fall ripped and spring digger with coil packer
Previous Crop: Corn
Planting Date: 18 May 2009
Variety: Pioneer 90Y80
Row Width: 15 inches
Weed Management: 10 June 2009 Bucaneer @ 32 oz/ac
26 June 2009 Bucaneer @ 32 oz/ac
Insecticide: 15 July 2009 Asana @ 9.6 oz/ac
Harvest Population: 151,000 to 177,000 plants/ac
Harvest Date: 25 September 2009
Experimental Design: Randomized complete block (3 replications)

Purpose of Study:
To determine the agronomic, economic and environmental impacts of ground rolling and timing on soybean production.

Results:
While there were trends in rolling timing and stand counts at the Wendell location, population was not statistically significant due to enormous field variability.

Residue measurements were taken to gather data regarding residue decomposition over time due to rolling (Table 1). Statistically, residue did not breakdown faster due to rolling. However, it is interesting to note the rapid decomposition rate of corn residue occurring naturally during June.

While there are trends in rolling timing and yields at some locations, they were not significantly different at 3 of the 4 sites (5% confidence level). Canby had a slight increase in yield when rolling occurred near planting versus rolling when the plants were at V1, V3, or not rolling at all (Table 2). Protein, oil and moisture content were not affected by rolling at all sites (data not shown).

Treatment	% Residue June 22, 2009	% Residue July 1, 2009
Pre-plant rolling	53.0	34.3
Post-plant rolling	51.3	35.0
50% Emergence	49.8	28.2
V1	54.8	34.0
V3	51.2	36.8
No rolling	53.0	38.5

Treatment	Population (plants/ac)	Yield (bu/ac)
Pre-plant rolling	177,200	46.2
Post-plant rolling	172,265	46.7
50% Emergence	164,310	46.9
V1	161,870	46.5
V3	151,475	46.2
No rolling	167,210	47.0

For Additional Information:
Jodi DeJong-Hughes, Doug Holen, Phil Glogoza, Russ S.

Project Funding Provided by:
Minnesota Soybean Research and Promotion Council

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Soybean Variety Trial 2009 — Norman County

Cooperators: Wayne and John Brandt, Ada; and Ken Pazdernik Agronomy Services
Previous Crop: Corn
Planting date: 15 June 2009 **Harvested:** 18 November 2009
Planting Pop: 180,000 **Seed Treatment:** 0=none, Cruiser Max=1, Trilex 6000 =2, Maxim+Apron=3,
Spring Tillage: Salford coutlers with crumbler baskets
Chemicals: 1st App. Generic Roundup at 1 qt/ac + AMS, 2nd App. Generic Roundup 26 oz/ac + Lorsban
Statistics: Two Replications, Statistical Analysis (Anova) Run by Carlyle Holen, NWROC, Crookston
Harvesting Help: Ray Bisek-Pioneer Weigh Wagon, Jeff Bates Weigh Wagon & Stine Weigh Wagon

Companies	Variety	RM	Height	Seed count #	Seed Trtmt	Moist %	Pro %	Oil %	Yield (bu/a) Adj. 13%M
Wensman Seed	W 20074RR	0.07	32	no	0	14.4	32.7	19.7	44.1
Seeds 2000	0081RR	0.08	32	2980	3	14.3	32.6	19.7	43.7
Integra Seed	79020RR	0.2	33	3230	3	13.9	33.7	18.6	43.4
Wensman Seed	W 20092RR	0.09	32	no	0	14.2	33.8	19.5	43.1
Proseed	80-00RR	0	33	no	1	13.9	32.7	19.2	42.2
Hyland Seeds	RidgewayRR	0.2	33	3430	0	13.6	33.4	18.9	42
Legend Seed	LS 0098	0.09	33	no	2	14.3	32.8	19.2	41.8
Peterson Seeds	1002RR	0.2	30	2425	0	14	34.1	18.9	41.6
Pioneer Hi-bred	90Y20RR	0.2	34	3250	0	14.3	34.1	18.7	39.7
Gold Country	2703RR	0.4	31	2855	2	14.1	33.9	19	39.7
Legend Seed	0528RR	0.4	26	no	2	14	35	18.4	39.6
Pioneer Hi-bred	90Y42RR	0.4	30	3100	1	13.6	34.2	18.8	39.5
Hyland Seeds	HS 02R28RR	0.2	33	2855	0	14.5	34.3	17.9	38.5
Wensman Seed	W2030RR	0.3	30	no	0	14.2	33.8	19.1	38.4
Asgrow	AG0401	0.4	26	3150	0	14	34.1	18.8	38.1
Proseed	60-40RR	0.4	30	no	1	13.9	34.1	19.2	37.7
Peterson Seeds	0905RR	0.5	29	no	0	13.7	33.9	19.1	37.5
Stine Seeds	0283RR	0.2	32	no	0	14.6	35.1	18.3	37.1
Thunder Seed	2703 RR	0.3	31	no	0	14.3	34.5	18.8	36.1
Stine Seeds	0306-4RR	0.4	27	3300	0	13.9	33.7	19.1	35.8
Dairyland Seed	0401RR	0.4	25	2898	3	13.6	35	18.6	34.8
Mustang Seed	M-036 RR	0.3	32	no	2	14.4	33.5	18.7	34.4
Stine Seeds	0634-4RR	0.6	27	2850	0	13.4	33.7	18.9	33.1
NuTech Seed	0636RR	0.6	15	no	0	14.3	33.8	18.5	32.7
Pioneer Hi-bred	90Y50RR	0.5	27	3600	1	14	34.4	18.7	31.7
Gold Country	2806 RR	0.6	22	3209	2	14.2	33.6	18.6	31.6
Thunder Seed	2905 RR	0.5	22	no	0	14	33.4	19	30.8
Asgrow	AG0808	0.8	27	2820	0	14.3	32.5	18.9	30.8
DairyLand Seed	0602RR	0.6	15	3139	1	13.9	33.3	19.3	30.7
Legend Seed	0758RRN	0.7	27	no	2	13.9	34.3	19.2	30
NuTech Seed	0686 RR	0.6	18	no	0	13.8	33.7	19.2	29.9
Mustang Seed	M-066 RR	0.6	22	3000	2	14.4	33.8	18.6	29.8
Proseed	80-50RR	0.5	23	no	1	13.9	34.2	18.7	29.7
Asgrow	AG0604	0.6	25	2850	0	14.1	33.5	19.6	27.7
NuTech Seed	0706 RR	0.7	23	no	0	14	33	19.1	27
Hyland Seeds	RockportRR	0.6	26	2800	0	14	34.1	19.5	27
Integra Seed	78070RR	0.9	21	2700	3	13.8	33.9	18.8	24.9
Thunder Seed	2908 RR	0.8	25	no	0	14.4	33	18.8	22.2
				LSD (0.05) =		*0.5*	*0.9*	*0.5*	*8.1*
				Means =		14	33.7	18.9	35.2

For Additional Information:
Ray Bisek: Bisek001@umn.edu
Pazdernik Agronomy Services: pazdernik@loretel.net or 218-206-4499

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Soybean Planting Date, Inoculation, Seed Treatment and Pre-Plant Nitrogen Effect on Nodulation and Yield in Northern Grown Soybeans

Cooperator: Richard Magnusson
Nearest Town: Roseau
Soil Type: Wabanica silt loam
Harvest Populations: 180,000 seeds/ac
Previous Crop: Ryegrass
Planting Date: 6 June 2009
Harvest Date: 22 October 2009
Experimental Design: 2x2x2 factorial design as a RCB

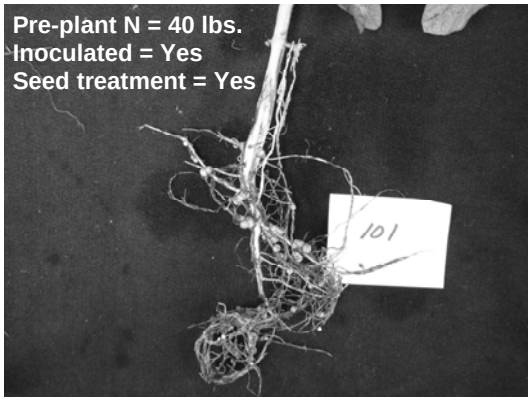
Purpose of Study:

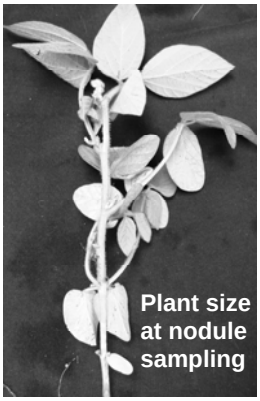
To evaluate the effect of planting date, pre-plant nitrogen, inoculation and seed treatment of soybean following ryegrass to the subsequent production of nodules and measured grain yield.

Results:

The plots were established utilizing an Asgrow cultivar with 00.9 relative maturities planted on June 6, 2009 at Roseau. Due to cool soil temperatures and wet soil conditions there was not an early planting date included. 40 pounds of nitrogen as urea was applied and incorporated prior to planting to the plots receiving pre-plant nitrogen. Soybean seed was obtained from Asgrow with and without seed treatment applied. A granular in-furrow inoculant was used and mixed with the seed at planting to the appropriate treatments. Individual plants were dug out of each plot on July 28 to evaluate nodule numbers. All plots had significant numbers of nodules per plant as can be seen in the photos below from treatments with all inputs versus no added inputs. There were no statistical differences among treatments as can be seen in Table 1. Any Pr>F greater than 0.05 indicates no statistical difference was observed.

Nodulation photos





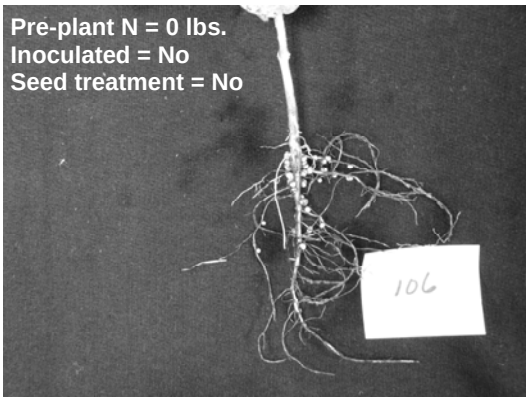


Table 1. Effect of N rate, Inoculation and Seed treatment on yield at Roseau

Effect	Pr > F
N rate	0.74
Inoculation	0.74
Seed treatment	0.20
N rate X Inoculation	0.86
Inoculation X Seed Treatment	0.62
N rate X Inoculation X Seed treatment	0.33

Depth	Soil test	Amount
0-6”	Nitrogen	6 lb/ac
6-24”	Nitrogen	12 lb/ac
0-6”	Phosphorus	5 ppm
0-6”	Potassium	129 ppm
0-24”	Sulfur	66 lb/ac
0-6”	Organic matter	3.30%
0-6”	pH	7.8

For additional information:
Russ Severson

Partnership/Funding:
Minnesota Soybean Research and Promotion Council with assistance from the NW Research and Outreach Center

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Optimum Nitrogen Management in Spring Wheat Production

Location: Northwest and West-Central Minnesota
Variety: Knudson
Fertilizer: 40 lb P_2O_5, 60 lb K_2O, and 15 lb S
Seeding Rate: 32 plants ft^2
Experimental Design: Randomized complete block with four replicates

Purpose of Study: To determine optimum nitrogen rates for maximizing grain yield and protein of spring wheat growth in northwest and west-central Minnesota.

Results:

Five locations were selected across MN. Soil test values and soil types varied by location (Table 1)

Yield and protein level varied by location (Table 2). Yields averaged around 100 bu/ac at all locations (not shown). The economic optimum nitrogen (N) rate (at the 0.05 price ratio) varied from between 108 to 127 lbs of N per acre except for at Site 3 in which there was no response to N due to high residual nitrate levels.

At individual locations yield responded differently (Figure 2). Yields where highly responsive to applied N up to the EONR value at Sites 1, 4, and 5. There was a small response to N at Site 2, but the relative increase per pound applied was small.

Protein levels averaged around 13.0 percent for all locations (Table 2). Nitrogen rates needed to maximize protein were higher than rates for yield at all locations (Figure 2).

Across locations the total N needed to maximize yield was 155 lbs of N per acre (Figure 1). Maximum yield was nearly 100 bu. per acre which equates to 1.5 lbs N per bu. to maximize yield. This level is nearly 1 lb lower than the recommended rate of 2.5 lbs of N per bu. Previous crop did not appear to be a factor in N response.

Table 1. Spring wheat field trial locations and soil analysis data.

					Soil Test (0-6")†				
Site	Year	Location	County	Soil Type	P	K	SOM	pH	Nitrate N‖
					-------ppm-------		---%---		-lb/ac-
1	2008	Hallock	Kittson	Northcote	54	472	6.6	7.9	22
2	2008	Perley	Norman	Whapeton	10	278	6.4	7.8	36
3	2008	Strathcona	Roseau	Percey	13	121	2.7	8.2	164
4	2009	Foxhome	Wilkin	Elmville	22	161	3.1	7.2	29
5	2009	Perley	Norman	Fargo	32	355	5.4	7.5	40

† P, Olsen phosphorus; K, ammonium acetate potassium; SOM, soil organic matter; pH, soil pH.
‖ 0 to 2 foot soil nitrate level.

Table 2. Individual optimum nitrogen rates and maximum protein rates at each location.

	Yield†		Protein‖		Previous	
Site	EONR	%YLDmax	MAX	Nrate	Crop	Nitrate N§
	-lbN/ac-	-----%-----	-----%-----	-lbN/ac-		---lb/ac---
1	127	99	12.9	nd	wheat	22
2	108	96	13.5	nd	soybean	36
3	0	na	13.4	96	soybean	164
4	125	100	13.1	nd	soybean	29
5	119	100	13.0	nd	soybean	40

† EONR, economic optimum N rate at the 0.05 price ratio (price per lb N/bu wheat price); %YLDmax, percent of maximum yield at EONR.

‖ MAX, maximum protein achieved at each location; Nrate, N rate at the maximum protein (nd, maximum N rate not detectable based on statitics).

§ 2' soil nitrate average taken in the spring at each location

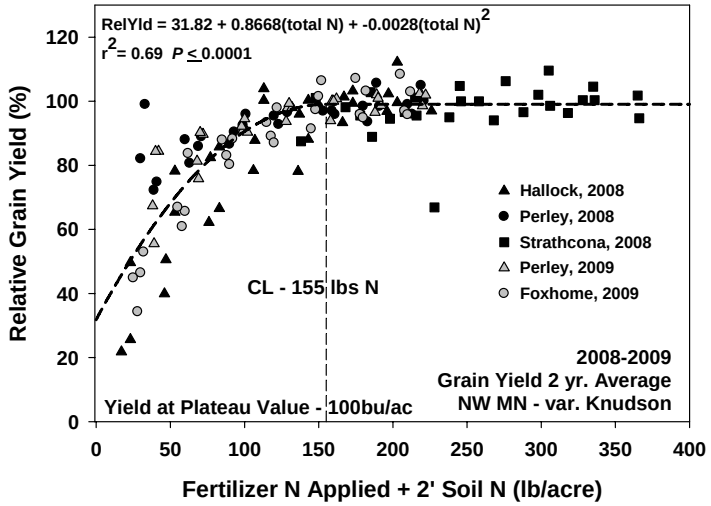


Figure 1. ***Total nitrogen applied (fert. + soil) versus relative grain yield across locations in 2008 and 2009.***

For Additional Information:
Daniel Kaiser, Jochum Wiersma

Project Funding Provided by:
Minnesota Ag. Fertilizer Research and Ed. Council

Optimum Nitrogen Management in Spring Wheat Production *(continued)*

Relative protein potential increased linearly up to 208 lbs of N per acre (Figure 3). The amount of protein produced by only soil N was around 20% of the maximum protein across locations. On average it took 50 lbs of additional N applied at seeding to maximize protein over yield.

The relative amount of protein produced per acre (Figure 4) increased in a curvilinear fashion until a maximum at 220 lbs of total N (N applied in fertilizer + N in the 2' soil nitrate test). Patterns of response were similar at all locations. At the maximum yield level (100 bu/ac) the amount of N needed to produce maximum protein yield was 2.2 lbs per bu. This amount in near the current recommended value for spring wheat.

** *All N was applied as Urea broadcast and incorporated prior to seeding at each location.*

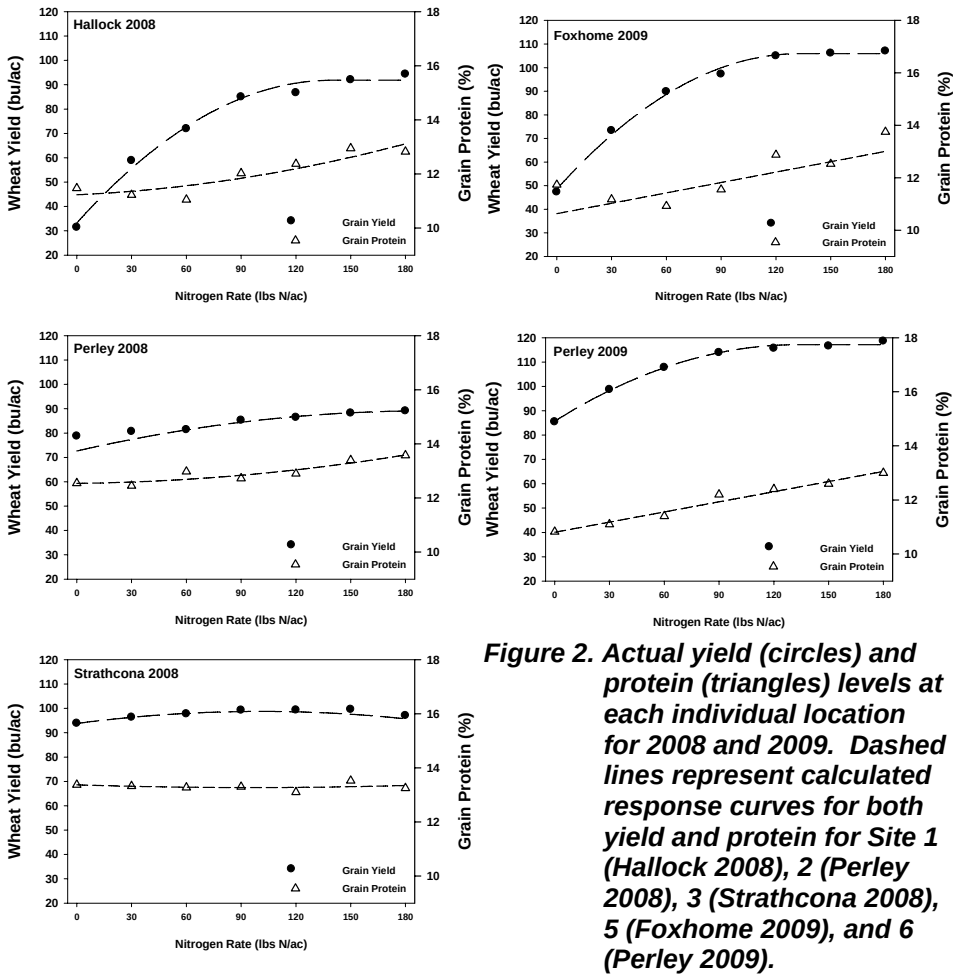


Figure 2. Actual yield (circles) and protein (triangles) levels at each individual location for 2008 and 2009. Dashed lines represent calculated response curves for both yield and protein for Site 1 (Hallock 2008), 2 (Perley 2008), 3 (Strathcona 2008), 5 (Foxhome 2009), and 6 (Perley 2009).

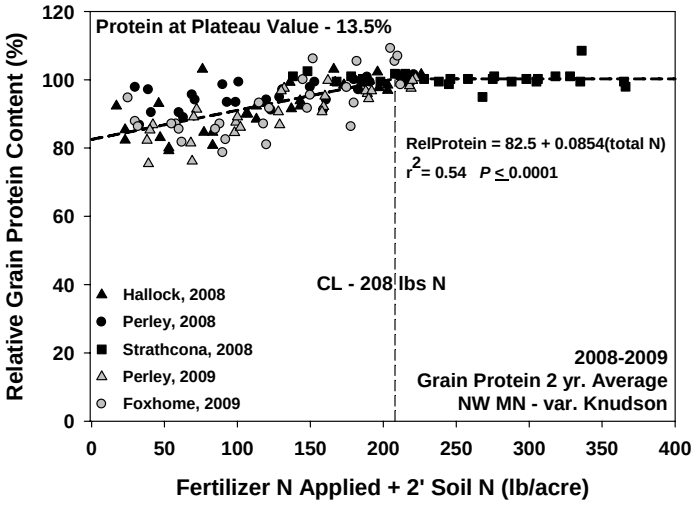


Figure 3. ***Total nitrogen applied (fert. + soil) versus relative grain protein content (%) across locations in 2008 and 2009.***

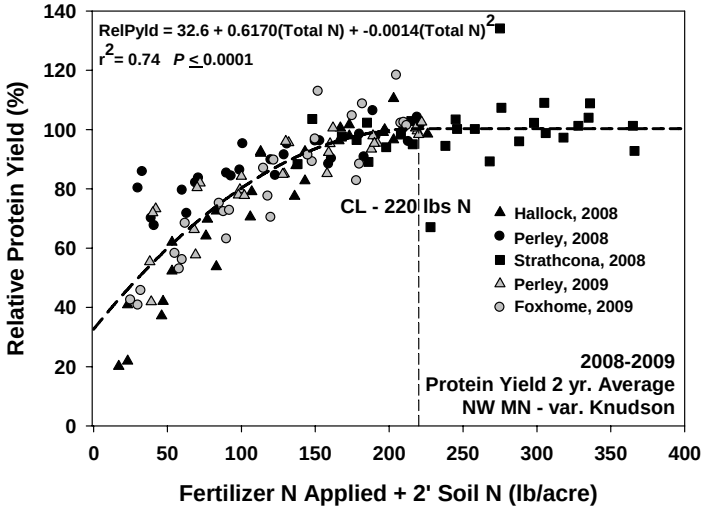


Figure 4. ***Total nitrogen applied (fert. + soil) versus relative protein produced per acre across locations in 2008 and 2009.***

For Additional Information:
Daniel Kaiser, Jochum Wiersma

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

2009 Spring Wheat On-Farm Yield Trials — Red River Valley

Following are the results of the 2009 Red River Valley On-Farm Yield Trials. These regional trials were located throughout Northwestern Minnesota.

About the Trials:

The 2009 Red River Valley On-Farm Yield Trials were grown in 5 locations throughout the regions. The locations, cooperators, and planting dates are summarized in Table 1. The northern two locations were lost due to excess precipitation immediately following emergence resulting in very poor stands. Growing conditions were, in general, very favorable for small grains despite the delayed planting. Consequently, yields were very high with Perley and Oklee averaging over 92 and 88 bu/ac across entries, respectively.

Table 1. Location of the 2009 Red River Valley On-Farm Yield Trials.

Location	Cooperator	Planting Date	Harvest Date
Fergus Falls	Dave Hasbargen	05/16/09	08/24/09
Perley	Brian Hest	05/19/09	08/27/09
Oklee	Ray Swenson	05/06/09	08/13/09
Strathcona	Jim Kukowski	05/19/09	
Humboldt	Gerald Olsonawski	05/20/09	

About the Entries:

The entries of the 2009 Red River On-Farm Yield Trials, including the breeder and the year of release, are listed in Table 2. New entries included Albany, Barlow, Brennan, Brogan, Brick, Jenna and Sabin. Many of these entries have been tested for two or more years as they were entered under number in the trials prior to their official release. Testing of Alsen was discontinued.

Table 2. Hard Red Spring Wheat entries in the Red River On-Farm Yield Trials (2007-2009).

Breeder	Cultivar	Year Released	2007	2008	2009
AgriPro Wheat	Knudson	2001	x	x	x
	Freyr	2005	x	x	x
	Kelby	2006	x	x	x
	Kuntz	2007	x	x	x
	Brennan	2009		x	x
	Jenna	2009		x	x
NDSU	Steele-ND	2004	x	x	x
	Glenn	2005	x	x	x
	Howard	2006		x	x
	Faller	2007	x	x	x
	Barlow	2009		x	x
SDSU	Briggs	2002	x	x	x
	Granger	2004	x	x	x
	Traverse	2006	x	x	x
	Brick	2009		x	x
Thunderbird Seeds	Cromwell	2007	x	x	x
Trigen Seed Services	Hat Trick	2007	x	x	x
	Albany	2009		x	x
Univ. of Minnesota	Oklee	2003	x	x	x
	Ada	2006	x	x	x
	RB07	2007	x	x	x
	Tom	2008	x	x	x
	Sabin	2009	x	x	x
WestBred	Bigg Red	2004	x	x	x
	Rush	2006	x	x	x
	Blade	2007	x	x	x
	Samson	2007	x	x	x
	Vantage	2007	x	x	x
	Breaker	2008		x	x
	Brogan	2009			x

Interpretation of the Data:

One-, two-, and three-year averages for grain yield are reported. Within the table, the varieties are listed alphabetically. No single location data is presented to avoid misinterpretation of data. Single environment data has to be interpreted with caution. Performance data across multiple environments, either single location/multiple year, or multiple location/ single year, and/or a combination of years and locations is more reliable. Performance data of individual locations is only available upon request. No data may be reproduced without written consent of the author.

In each table, the highest performer for each trait is printed in bold. The grain yield in each table is expressed as a percentage of the trial mean with the overall mean in bu/A listed below. Presenting the data this way allows for better comparisons over years. Secondly, variety selection is based on the relative ranking of the cultivars, rather than the absolute yield. Comparisons between varieties should only be made within each column and not between columns or between tables. In addition to the overall mean for the trial, the Fisher's Least Significant Difference (LSD) is printed at the bottom of each column. The LSD is calculated using an alpha level of 10%. This indicates that, if and when the observed difference between two varieties is larger than the LSD unit, with 90% confidence the observed difference is a real difference rather than experimental error.

For Additional Information:
Jochum Wiersma

2009 Spring Wheat On-Farm Yield Trials *(continued)*

Table 3. ***Grain yield expressed as a percentage of the trial mean across all locations in single year (2009) and multi-year (2007-2009) comparisons and agronomic characteristics of cultivars entered in the Red River Valley On-Farm Yield Trials.***

Across All Locations							
	Grain Yield			*2-Year data*			
Cultivar	*1 year*	*2 year*	*3 year*	*Plant Height (inches)*	*Lodging[1] (1-9)*	*Test Weight (lb/bu)*	*Protein (%)*
	----------	*(% of mean)*	---------				
Ada	96.1	97.7	98.2	31.5	2.2	61.5	13.3
Albany	111.5	**111.6**	-	32.2	1.7	61.2	12.2
Barlow	96.3	100.1	-	34	1.4	60.8	13.6
Bigg Red	98.9	97.1	93.4	34.7	2	62.4	13.1
Blade	101.8	99.7	101.4	33.2	1.3	61.9	13
Breaker	96.6	98.6	-	32.3	1.3	61.7	13.1
Brennan	96.3	98.7	-	31.2	1.4	61	13.2
Brick	99.6	103.2	-	34.2	2	62.1	13.4
Briggs	93.7	96.1	97.9	32.4	2.3	60.8	13.2
Brogan[2]	101.4	-	-	31.2	1	61.6	11.9
Cromwell	98.2	98.2	100.3	32.5	1.3	61.1	13.3
Faller	**114.7**	109.6	**111.5**	33.4	1.5	60.1	13.1
Freyr	100.5	99.3	101.3	34.2	1.3	60.9	13
Glenn	89.4	92.7	95.1	35.2	1.3	62.3	13.7
Granger	102.9	102.6	101.6	35.4	1.8	61.4	13.1
Hat Trick	102.6	100.8	101.9	33.1	1.4	61.4	13.1
Howard	104.8	100.8	99	32.9	2	61.7	13.3
Jenna	101.1	106.2	-	29.8	1.3	60.9	13.5
Kelby	89.9	93.2	93	29.2	1.4	61.4	13.7
Knudson	104.9	104.2	106.2	32	1.4	61.1	13.1
Kuntz	95	99.1	102.4	30.6	1.1	60.9	12.8
Marshall	91.3	85.4	78.6	30.8	1.9	58.7	12.9
Oklee	89.8	96.2	96.4	32.6	1.7	62.2	13.4
RB07	106.8	103.8	104.7	32	1.6	61.5	13.3
Sabin	104.5	104.3	103.8	32.6	1.6	61.2	13.6
Samson	99.5	102	104.7	29.9	1.4	60.4	13
Steele-ND	99.7	99	102	33.2	1.5	60.7	13.4
Tom	96.2	100.4	99.6	33	1.7	61.1	13.3
Traverse	114.5	108.1	110.7	34.8	1.7	60.4	12.7
Vantage	98.7	93.8	93.6	32.4	1	61.5	14.1
LSD (10%)	7	6.5	6.8	1.5	0.6	1	0.8
Mean (bu/A)	88.7	90.1	86.4	32.4	1.5	61.3	13.2

[1] 1=erect and 9 =flat

[2] 1 year data

For Additional Information:
Jochum Wiersma

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Effect of Foliar Applied GreenYields™ on Organically Grown Soybean and Corn — Clay County

Cooperator: Lynn Brakke Organic Farms
Nearest Town: Comstock
Soil Type: *Soybean:* Augsburg Silt Loam *Corn:* Fargo Silty Clay
Tillage: Spring: field cultivator with coil packer
Previous Crop: *Soybean:* blue corn *Corn:* soybeans
Planting Date: *Soybean:* 4 June 2009 *Corn:* 22 May 2009
Variety: *Soybean*: Prosoy *Corn:* Seeds 2000-2751
Row Width: 22 inches
Fertilizer: GreenYields™ was foliar applied at 20 g/ac to the middle four rows of six row plots (30' long) using a CO_2 pressurized plot sprayer. All plots, except for the untreated control, received GreenYields™ at 8 oz/ac applied once or twice during the growing season. An additional treatment was added to the soybean trial using GreenYields™ at 16 oz/ac applied at 40 g/ac.
Harvest Population: *Soybean:* 110,000 plants/ac *Corn:* 32,000 plants/ac
Harvest Date: *Soybean:* 14 October 2009 *Corn:* 11 November 2009
Experimental Design: *Soybean:* Latin Square with four replications.
Corn: Randomized complete block design (RCBD) with four replications.

Purpose of Study:
Evaluate the effect of foliar applied GreenYields™ on corn and soybean yield and quality in an organic production system.

Results:
Ten feet of row were harvested from the middle two rows of each plot and used to determine yield and quality.

There were no significant differences observed between treatment yields, protein, oil, and starch for both corn and soybean trials. Soybean seed quality was not statistically analyzed because individual plot yields were too low. A composite sample analysis is provided. The lower than expected yield was probably due to weed pressure from yellow foxtail that was present throughout the trial.

Table 1. ***Yield and seed quality from organically grown soybean and corn treated with GreenYields™. Comstock 2009***

Treatment	Spray date	Growth stage	Yield (*bu/a*)	Protein (%)	Oil (%)	Starch (%)
Soybean						
Untreated check	---	---	16.9	37.3	18.1	---
GreenYields™ 8 oz/a	7/2	VC	16.3	37.9	17.9	---
GreenYields™ 8 oz/a	7/2	VC	18.4	37.6	18.1	---
	7/22	V2				
GreenYield™ 16 oz/a	7/2	VC	18	37.1	18.2	---
LSD 0.05		---	*NS*	---	---	---
Corn						
Untreated check	---	---	47.8	8.8	2.1	71.7
GreenYields™ 8 oz/a	6/12	V2	66.8	9.1	3	71.1
GreenYields™ 8 oz/a	6/12	V2	66.6	8.4	1.4	72
	7/2	V6				
LSD 0.05		---	*NS*	*NS*	*NS*	*NS*

For Additional Information:
Randy Nelson and Phil Glogoza

Control of Glyphosate Resistant Common Ragweed — Red Lake

Cooperator: **Roy Quick**
Nearest Town: **Plummer**
Soil Type: **Sandy loam**
Previous Crop: **Soybeans 4 of last 5 years**
Planting Date: **2 June 2009**
Experimental Design: **Randomized complete block with 4 replications**

Purpose of Study:
To evaluate selected preemergence herbicides and glyphosate in RR soybean to control common ragweed that has low level resistance to glyphosate.

Table 1. ***Conditions at each application timing***

Date	6/3/2009	7/1/2009	7/22/2009
Timing	Preemergence	Post 1	Post 2
Ragweed height	Not emerged	1-4 inch	4 to 12 in
Soybean stage	Not emerged	1 trifoliate	Beginning to bloom

Results:
This site was identified in a survey conducted in 2008 as having common ragweed with a low level of resistance to glyphosate (survived 0.75 lbs ae of glyphosate but killed by 3 lbs ae) Weed management strategies with preemergence herbicides followed by a glyphosate application and total postemergence treatments were compared.

Common ragweed was moderately heavy (4 /sq ft) at this location however, the frequency of resistance was low. All of the preemergence herbicides provided high levels of ragweed control before the glyphosate applications were made (control rating on June 20 in Table 2). Gangster, FirstRate and Sonic provided excellent common ragweed control and all three treatments contain the active ingredient cloransulam. A split applications of Durango DMA provided very good common ragweed control, but there were between 3 and 10 plants in each plot that were stunted but not killed by the treatment (Figure 1). A split application of Ultra Blazer and Durango DMA decreased control of common ragweed compared to Durango MDA applied alone.

For Additional Information:
Carlyle Holen Bobby Holder Howard Person

Project Funding Provided by:
Minnesota Soybean Research and Promotion Council, Dow AgroSciences, Valent

Control of Glyphosate Resistant Common Ragweed — Red Lake *(continued)*

Table 2. ***Control of glyphosate resistant common ragweed with selected herbicides***

Treatment	Rate	Common Ragweed	
		June 20	October 8
PRE/POST		———— % control ———	
Gangster/Durango[1]	0.4+2 oz/ 22 fl oz	96	100
FirstRate/Durango	0.45oz/ 22 fl oz	96	100
Sonic/Durango	4.5 oz/ 22 fl oz	98	98
Valor/Durango	2 oz/ 22 fl oz	86	97
Sencor/Durango	4 oz/ 22 fl oz	67	92
POST/POST			
Ultra Blazer+Durango/Ultra Blazer+Durango/	0.75 pt+22 fl oz/ 0.75 pt + 22 fl oz	0	89
Durango/Durango	22 fl oz/22 fl oz	0	96
LSD (0.05)		6	3

[1]Durango DMA contains 4 lbs ae glyphosate

Figure 1. ***Common ragweed surviving two applications of glyphosate (1.36 lbs ae/ac)***

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Detecting Soybean Cyst Nematodes in the Red River Valley 2009

Cooperator: Hollingsworth, Chen, Severson, Person, D. Holen, Bisek, Glogoza, Nelson, Stordahl and Koch)

Purpose of Study:

Determine spread of SCN into counties in northern soybean production areas where the disease has either just recently been detected or remains undetected.

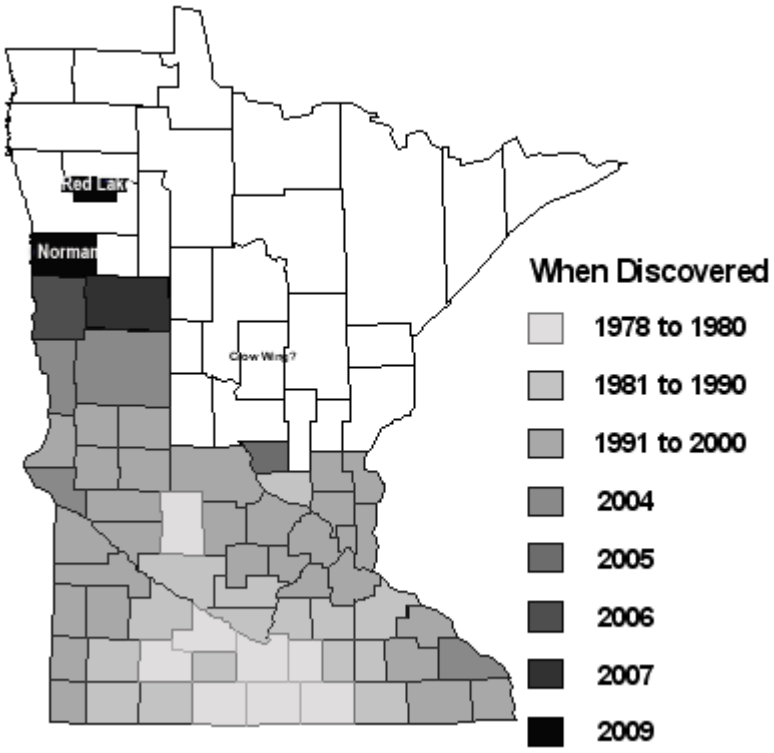
Results:

A total of 43 soil samples were collected from nine counties (Norman, Clay, Clearwater, Kittson, Mahnomen, Norman, Otter Tail, Polk, and Red Lake), and 36 samples have been processed for egg counts. Among the 36 samples, 19 samples were negative of SCN infestation, eight samples contained more than 1000 eggs/100 cm^3 soil, one sample contained low egg number (213 eggs/100 cm soil), and eight samples had only a few eggs (13-38 eggs/100 cm^3 soil). The low egg counts are likely contamination or the eggs of other nematodes.

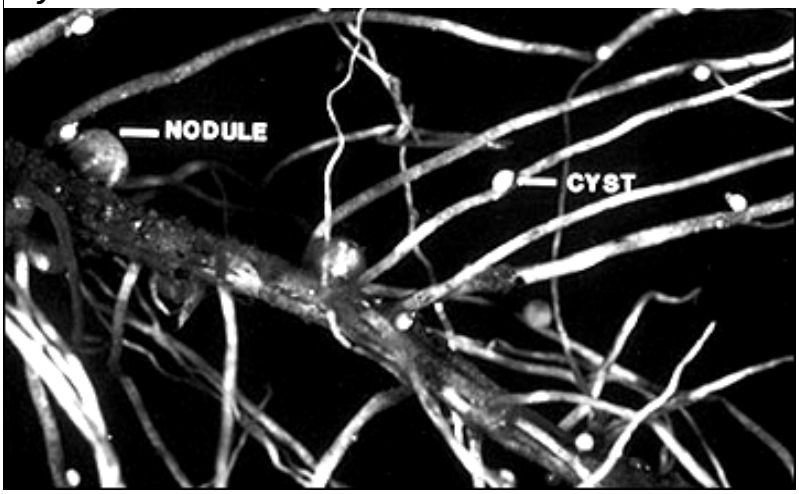
The soil samples will be processed for SCN juvenile counts to confirm the SCN infestation. In addition, greenhouse bioassay will be set up this month to confirm the SCN identity. The morphology of females and juveniles in one sample from Red Lake County, and two samples from Norman County were examined, and females (cysts) were observed on soybean roots in the fields.

Based on the morphology and parasitism of soybean by the nematodes, the nematodes were identified as the soybean cyst nematode. The two counties were new counties with confirmed SCN infestation in Minnesota (Fig. 1). A report of new SCN-infested counties has been submitted to MDA.

Red Lake and Norman Counties added as new SCN-infested counties in 2009 with MDA.



White cyst of SCN attached to soybean root adjacent to soybean nodule.



For Additional Information:
Russ Severson

Project Funding Provided by:
Minnesota Soybean Research & Promotion Council

Source: 2009 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension, published January 2010

Air Assist Sprayer and Organic Insecticide for Aphid — Clay County

Cooperator: Mark Askegaard and Lynn Brakke
Nearest Town: Comstock
Row Width: 30 inches
Experimental Design: Completely Randomized Design

Figure 1. ***PTO-driven, air-assist sprayer mounted on three-point hitch.***

Purpose of Study:
The study was established to assess the effectiveness of an air assist sprayer and interaction with organic insecticides for soybean aphid

Results:
An air-assist sprayer (Figure 1) was obtained through funding from the Northwest Minnesota Regional Sustainable Development Partnership.

The sprayer was quickly evaluated to assess the spray deposition pattern to provide effective coverage throughout the soybean plant canopy at a practical spray volume, tractor speed, swath width, and volute angle. Using water sensitive paper, it was determined that a volume of 10+ GPA, tractor speed of 5 MPH, swath of 25 feet, and a volute angle of 7 degrees below parallel to the ground was suitable for initial testing. The spray deposition pattern is depicted by cards in Figure 2.

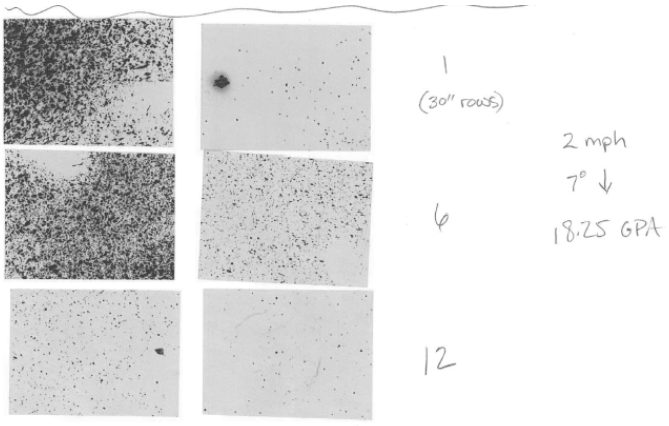


Figure 2. ***Spray deposition on water-sensitive paper at 1 row, 6 rows, and 12 rows distance from sprayer with water at 18.25 gallons/ac, 2 MPH, and a volute angel of 7 degrees below parallel.***

The primary OMRI approved insecticide that was evaluated was natural pyrethrum (Pyganic®). It was applied in water at rates of 16 and 24 fl oz of product per acre. Though the insecticide did not reduce the aphid infestation to the same levels as a synthetic insecticide customarily does, the pyrethrum did reduce populations to a level that appears to have been tolerable to the plants (Figure 3). Initial population reductions averaged about 40% and reached an upper average of about 60% (Figure 4). Yield, seed count, seed weight (Figure 7), seed per pod will be determined later to assess plant level impact of each infestation level.

In addition, neem (Dagger®) and some other plant essential oil formulations were quickly assessed for potential efficacy (Figure 5 and 6). No effects were immediately observed from those products.

For Additional Information:
Phillip Glogoza: glogo001@umn.edu or 218-236-2008

Partnership/Funding:
Northwest Minnesota Regional Sustainable Development Partnership

Air Assist Sprayer and Organic Insecticide for Aphid — *(continued)*

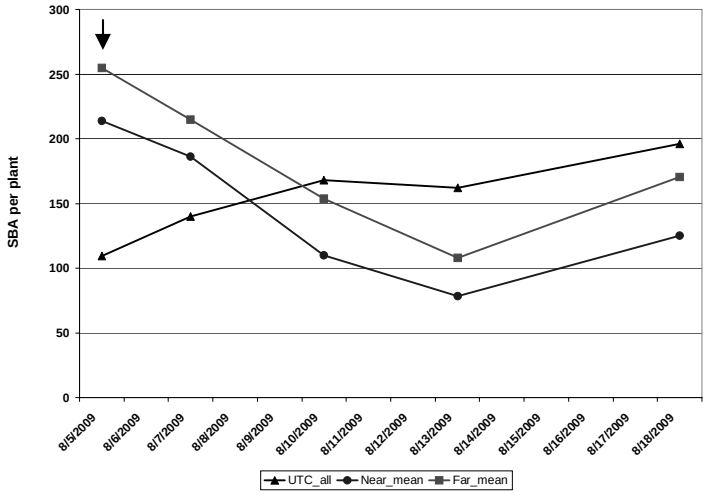


Figure 3. ***Soybean aphid populations on plants after treated with Pyganic® applied with an air-assist sprayer or untreated (UTC). Comstock, MN. 2009. The "near mean" is for plants in the 2nd row from the sprayer; "far mean" is for plants in the 10th row. ↓ = treatment***

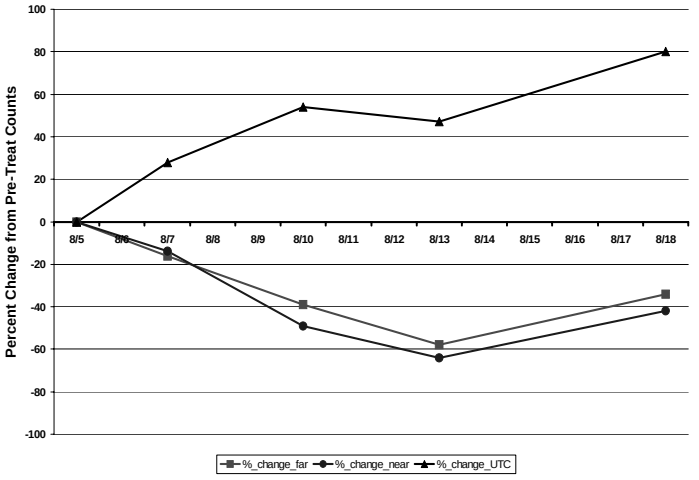


Figure 4. ***Percent change in aphids per plant compared to the pre-treatment counts on soybean plants that were untreated (UTC), or treated with Pyganic® from plants in the 2nd row from the sprayer, or the 10th row from the sprayer. Comstock 2009.***

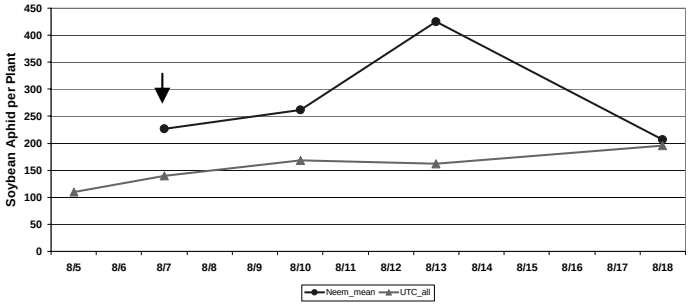


Figure 5. ***Soybean aphid populations on plants after treated with neem/azadirachtin (Dagger®) applied with an air-assist sprayer or untreated (UTC). Comstock 2009. ↓ = treatment***

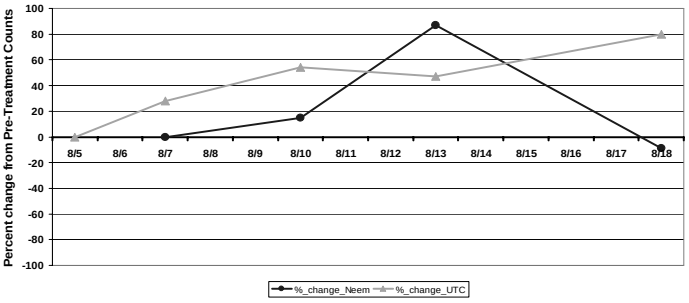


Figure 6. ***Percent change in aphids per plant compared to the pre-treatment counts on soybean plants that were untreated (UTC), or treated with Dagger®. Comstock 2009.***

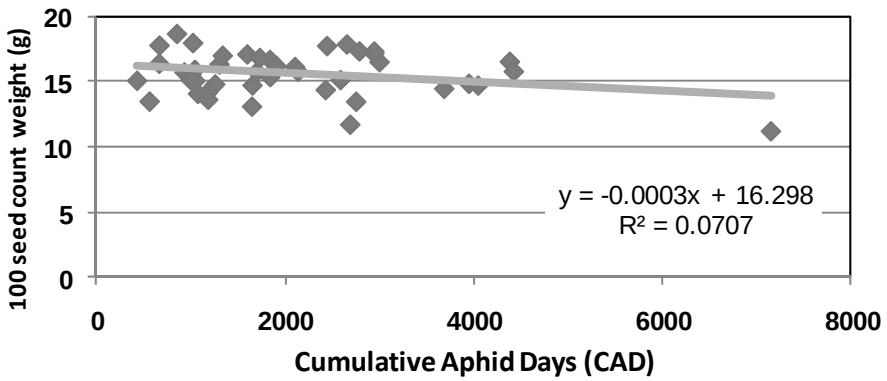


Figure 7. ***Relationship of Cumulative Aphid Days (CAD) with soybean seed* size.**

Minnesota Wheat Research & Promotion Council
2600 Wheat Drive • Red Lake Falls, MN 56750
Ph: 218-253-4311 or 800-242-6118 • Fax: 218-253-4320
www.smallgrains.org • mnwheat@gvtel.com

University of Minnesota Extension
240 Coffey Hall • 1420 Eckles Ave.
St. Paul, MN 55108-6068
Ph: 612-624-1222
http://www.extension.umn.edu