Langdon Research Extension Center

NORTH DAKOTA STATE UNIVERSITY

Annual Research Report No. 93

December 2018

NDSU NORTH DAKOTA STATE UNIVERSITY

NDSU Research and Extension Faculty and Staff Involved with the Langdon Research Extension Center

Randy Mehlhoff	Director
Bryan Hanson	Research Agronomist
Dr. Venkat Chapara	Assistant Research Professor/Plant Pathology
Naeem Kalwar	Extension Soil Health Specialist
Lesley Lubenow	Extension Cropping Systems Specialist
Sara Schuchard-McGregor	Administrative Assistant
Travis Hakanson	Research Specialist/Agronomy
Lawrence Henry	Research Specialist/Agronomy
James Chaput	Research Technician/Foundation Seed
Amanda Arens	Research Specialist/Plant Pathology
Carmen Ewert	Research Technician/Foundation Seed
Jeremiah Halley	Farm Business Management Instructor, LRSC
Dr. Anitha Chirumamilla	Cavalier County Extension Agent
Macine Lukach	Cavalier County Extension Agent

2018 Seasonal Employees

Kaylee Anderson	Wyatt Gage	Jordyn Ullyott	Jordan Braunberger	
Traci Murphy	Eyan Mehlhoff	Justina Klindt	Nancy Feil	Janet Hall

Langdon Research Extension Center Advisory Board

Dr. Anitha Chirumamilla	Cavalier County Extension Agent
Paul Berntson	Producer, Adams, ND
Tom Borgen	Producer, Langdon, ND
Shannon Duerr	Cavalier County JDA
Leon Hiltner	Producer, Wales, ND
Janet Jacobson	Producer, Wales, ND
Bruce Lewallen	Producer, Bisbee, ND
David Monson	Producer, Osnabrock, ND, ND District 10 Representative
Scott Nelson	Producer, Lakota, ND
Chuck Damschen	Producer, Hampden, ND, ND District 10 Representative
Kent Schluchter	Producer, Cavalier, ND
Aaron Johnson	Producer, Edmore, ND
JoAnn Rodenbiker	Northern Plains Electric Cooperative, SBARE Member
Janne Myrdal	Producer, Edinburg, ND, ND District 10 Senator
Cameron Mickelson	Producer, Rolla, ND

NDSU Langdon Research Extension Center
9280 107th Ave. N.E.
Langdon, ND 58249
phone: (701) 256-2582
fax: (701) 256-2580
Website: www.ag.ndsu.edu/langdonrec/
Email: NDSU.Langdon.REC@ndsu.edu

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

NDSU | EXTENSION

Table of Contents

Overview 4
2018 Crop Management - Langdon 5
2018 Crop Management - Off-Station 6
Weather Observations 7-10
Average Data by Crop and Year across Sites for Durum, Barley and HRSW 11-12
Langdon HRSW 13-14
Off-Station HRSW 15-17
Langdon Durum 18
Off-Station Durum and Rye 19
HRWW 20
HRWW Diseases 21
Corn 22
Barley 23-24
Oats 25-26
Flax 27
Canola - Conventional 28-29
Canola - Roundup Ready 30-31
Dry Bean 32
Field Pea 33
Faba Bean 34
Soybean - Conventional & Liberty Link 35
Soybean - Roundup Ready 36-43
Sunflower 44-46
Crop Production Research 47-51
Crop Disease Research 52-66
Soil Health & Fertility Research 67-82
Foundation Seed Increase 83

The 2018 annual research report is intended to provide producers information to aid in selecting varieties and/or hybrids. Variety information and research reports on crop disease and production can also be found on our website www.ag.ndsu.edu/langdonrec/. Variety trial results from all NDSU Research Extension Centers and the Main Station at Fargo, along with crop extension bulletins, can be accessed on the web at www.ag.ndsu.edu/varietytrials/.

Choosing a variety is one of the most important decisions a producer makes in successful crop production. Characteristics to consider in selecting a variety may include yield potential, disease resistance, protein content, straw strength, plant height, test weight, yield stability across years and locations, quality and economic profitability. A variety's performance may differ from year to year and from location to location within a year due to varying environmental conditions. When selecting a variety to grow, it is best to consider a variety's performance over several years and locations.

The agronomic data presented in this publication are from replicated research plots using experimental designs that enable the use of statistical analysis. The trials are designed so that "real" yield and agronomic differences can be statistically separated from differences that occur by chance. The least significant difference (LSD) values given in the report are used for this purpose. For example, if the LSD 10% is five bushels, then if the difference between any two varieties is greater than five bushels they are said to be significantly different from one another 90 times out of 100 under those growing conditions. If the difference between two varieties is less than five bushels, they are not significantly different from one another. If there is a "NS" for the LSD 10% value it means there was no real difference between any varieties or the trial was too variable to detect a real difference. The CV stands for coefficient of variation and is expressed as a percentage. The CV is a measure of variability in the trial. Large CVs mean that a large amount of variation could not be attributed to differences in the varieties or agronomic characteristic.

The NDSU Langdon Research Extension Center, in addition to its on-station research program, conducted variety research trials at several locations in 2018. Trial locations were at Cavalier, Park River, Pekin, and Cando. These locations are in cooperation with a local farmer, the NDSU Extension Service and the County Crop Improvement Association.

2018 Weather Summary

The 2018 growing season precipitation averaged 78 percent of normal across NE North Dakota. In 2017, the average was 75 percent. Stored subsoil moisture in 2017 was very good because of the excessive soil moisture in 2016 whereas this year spring subsoil moisture was below average. This resulted in crops relying more on rainfall for adequate moisture in 2018. Fall recharge at Langdon for September through October 2017 was 2.91 inches, 0.38 inches below normal. Precipitation from November 2017 through March 2018 was 2.98 inches, 0.27 inches below normal. Snowfall for 2017-2018 was 37.9 inches, 0.35 inches below normal. Winter temperatures were 2.3^{o} F below normal. Precipitation in April and May was 57 percent of normal at Langdon and higher as you moved south and east in the region. Accumulated growing degree days averaged 197 and 71 above normal for corn and small grains, respectively, across NDAWN locations across the region. Disease levels were generally lower this year with the drier conditions. Timely rainfalls resulted in average to above average yield for small grains and canola. Soybean yields were lower in some areas because of lack of rainfall during August. Cool damp weather later in September and two snowfall events in early October delayed the completion of soybean and corn harvest.

2018 Crop Management - Langdon						
Field Trial	**Previous Crop**	**Seeding Rate Unit/Acre**	**Yield Goal**	**Planting Date**	**Harvest Date**	**Row Spacing**
Barley	soybean	1.25 million pls	100 bu	May 9	Aug. 14	6
Canola - LL, CL, SU	soybean	610,000 pls	2500 lb	May 21	Aug. 23	6
Canola - RR	soybean	610,000 pls	2500 lb	May 21	Aug. 23	6
Corn	soybean	28,000 thinned	150 bu	May 10	Oct. 17	30
Durum	soybean	1.50 million pls	60 bu	May 9	Aug. 21	6
Dry Bean	soybean	70,000-90,000 pls	2000 lb	May 16	Aug. 31	30
Faba Bean	soybean	192,000 pls	60 bu	May 8	Aug. 30	6
Field Pea	soybean	300,000 pls	60 bu	May 8	Aug. 15	6
Flax	soybean	2.8 million pls	40 bu	May 14	Sept. 4	6
HRSW	soybean	1.50 million pls	60 bu	May 9	Aug. 20	6
HRWW	soybean	1.25 million pls	60 bu	Sept. 21, 2017	*	6
Industrial Hemp	soybean	522,000 pls	1200 lb	June 6	Sept. 6	12
Oats	soybean	1.0 million pls	120 bu	May 9	Aug. 21	6
Rye	canola	1.0 million pls	70 bu	Sept. 21, 2017	Aug. 10	6
Soybean – Conv./LL	wheat	200,000 pls	60 bu	May 15	Oct. 2	6
Soybean – RR, Xtend	wheat	200,000 pls	60 bu	May 15	Oct. 1	6
Sunflower - Confection	wheat	17,000 thinned	2500 lb	May 21	Oct. 16	30
Sunflower - Oil	wheat	20,000 thinned	2500 lb	May 21	Oct. 16	30
Soil Type - Svea-Barnes loam						

pls = pure live seed
*Trial was not harvested due to winter kill.

Special thanks to our local cooperators and Extension Agents for their efforts in our off-station variety testing.

Darin Weisz - Cando
Lindy Berg - Towner County Extension Agent
Dave Hankey - Park River
Brad Brummond - Walsh County Extension Agent
Kent Schluchter - Cavalier
Samantha Lahman - Pembina County Extension Agent
Doug Stein - McVille
Katelyn Hain - Nelson County Extension Agent
Lesley Lubenow - LREC Extension Cropping Systems Specialist

2018 Crop Management – Off-Station						
Location (County/Field Trial)	**Previous Crop**	**Seeding Rate Unit/Acre**	**Yield Goal**	**Planting Date**	**Harvest Date**	**Row Spacing**
Cavalier (Pembina)						
HRSW	wheat	1.50 million pls	60 bu	May 3	Aug. 16*	6
Soybean	wheat	200,000 pls	60 bu	May 23	Oct. 18	6
Park River (Walsh)						
HRSW	cover crop	1.50 million pls	65 bu	May 3	Aug. 16	6
Soybean	wheat	200,000 pls	60 bu	May 23	Oct. 23	6
Pekin (Nelson)						
HRSW	soybean	1.50 million pls	60 bu	May 4	Aug. 17	6
Soybean	wheat	200,000 pls	60 bu	May 22	Oct. 22	6
Cando (Towner)						
HRSW	soybean	1.50 million pls	60 bu	April 30	Aug. 18	6
Durum	soybean	1.50 million pls	60 bu	April 30	Aug. 18	6

Location	**Soil Type**
Cavalier	Fargo silty clay
Park River	Glyndon silt loam, soybean – Gardena silt loam
Pekin	Svea-Cresbard loam
Cando	Egeland-Embden fine sandy loam

pls = pure live seeds
*Trial results were too unreliable to report.

Record of Climatological Observation
Langdon, ND

	Precipitation		Dep. from		Temperature		Dep. from
	Normal*	2018	Normal		Normal*	2018	Normal
April	1.23	0.30	-0.93	April	38.1	31.4	-6.7
May	2.28	1.70	-0.58	May	51.6	58.4	+6.8
June	3.26	3.74	+0.48	June	60.9	66.7	+5.8
July	2.9	2.81	-0.09	July	66.2	66.9	+0.7
August	2.58	1.26	-1.32	August	64.5	66.1	+1.6
September	2.06	1.82	-0.24	September	54.5	51.6	-2.9
Total	14.31	11.63	-2.68	Total	56.0	56.9	+0.9

*115 year average

Monthly Growing Degree Days and Normals-Langdon

	Wheat Growing Degree Days			Corn Growing Degree Days			Sunflower Growing Degree Days		
	2018	Normal	Deviation	2018	Normal	Deviation	2018	Normal	Deviation
April	197	274	-77	--	--	--	--	--	--
May	797	613	+184	375	219	+156	502	314	+188
June	969	875	+94	471	356	+115	645	519	+126
July	1006	1018	-12	504	499	+5	688	685	+3
August	943	962	-19	482	457	+25	659	642	+17
September	540	671	-131	188	255	-67	283	358	-75
Total	4452	4413	+39	2020	1786	+234	2777	2518	+259

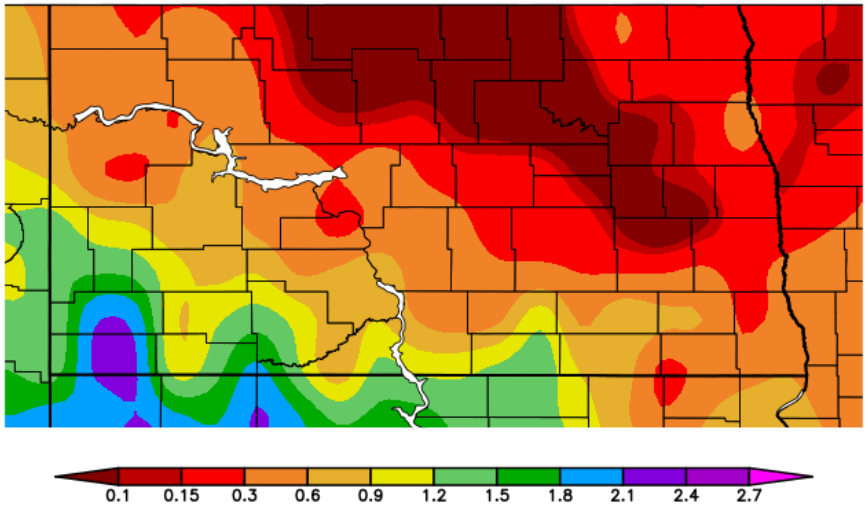
Frost Dates-Langdon and Selected Cities

	Last Spring Frost		First Fall Frost		Frost Free Days	
Langdon	32°F	28°F	32°F	28°F	32°F	28°F
Normal	20-May	9-May	19-Sep	29-Sep	122	143
2018	11-May	11-May	23-Sep	28-Sep	135	140
Cavalier						
Normal	16-May	5-May	24-Sep	5-Oct	131	153
2018	11-May	11-May	28-Sep	28-Sep	140	140
Park River						
Normal	8-May	30-Apr	30-Sep	10-Oct	145	163
2018	11-May	10-May	28-Sep	28-Sep	140	141
Pekin						
Normal	18-May	3-May	22-Sep	30-Sep	127	150
2018	11-May	10-May	18-Sep	28-Sep	130	141

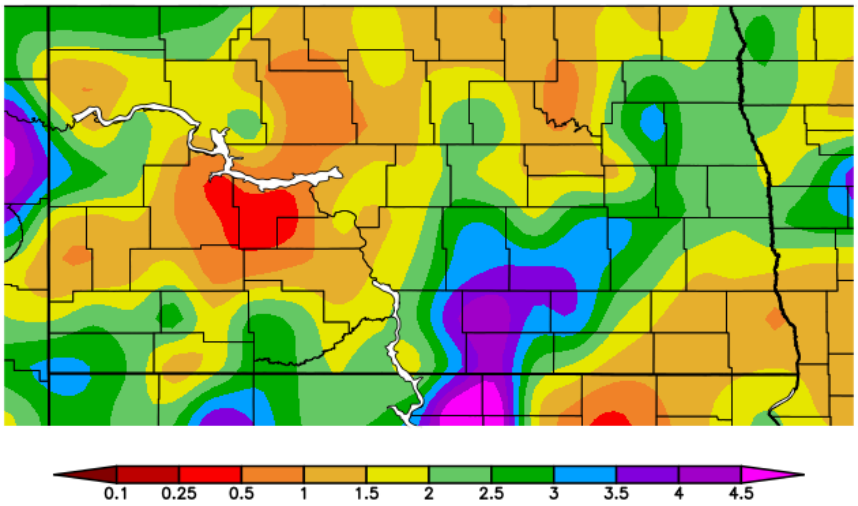
Normals are from the NWS. The 2018 frost dates are from the nearest reporting NDAWN station.

North Dakota 2018 Precipitation (inches) Maps

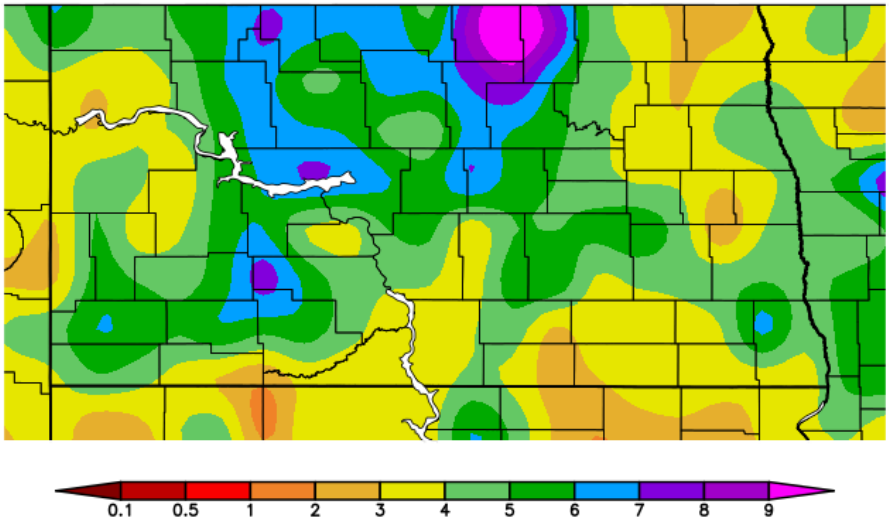
4/1/18 – 4/30/18



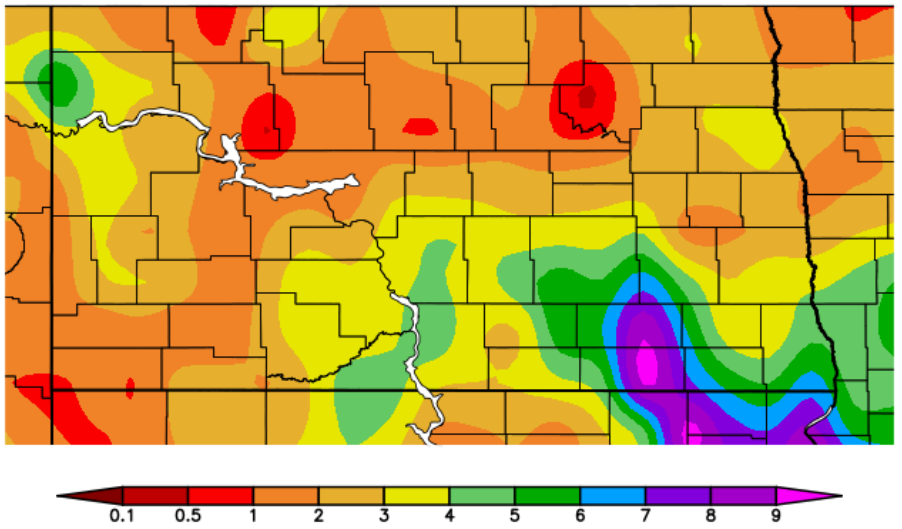
5/1/18 – 5/31/18



6/1/18 – 6/30/18

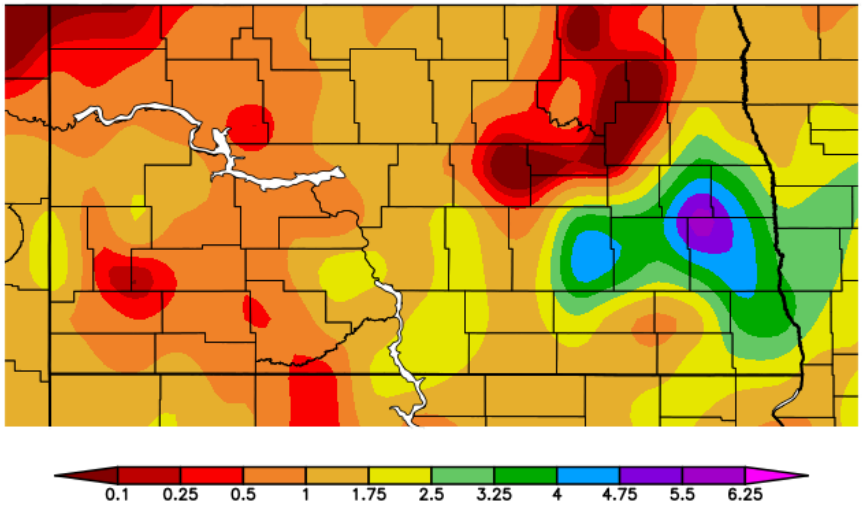


7/1/18 – 7/31/18

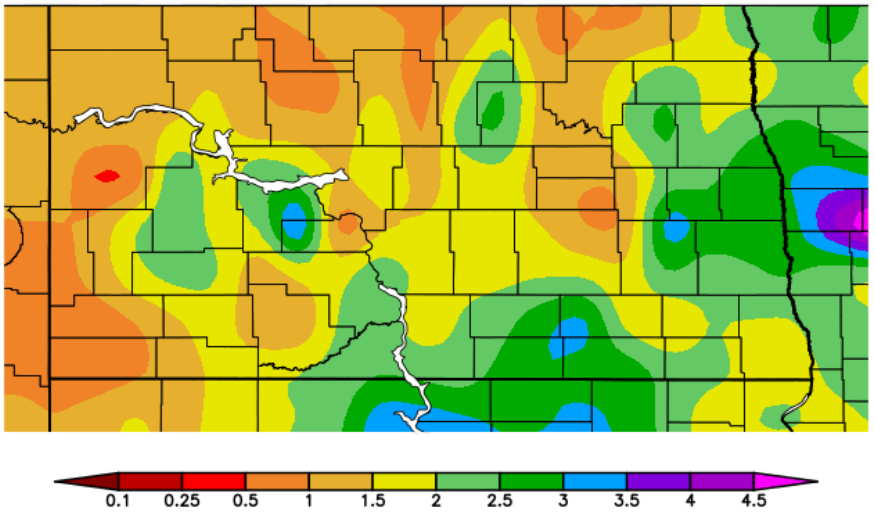


North Dakota 2018 Precipitation (inches) Maps Continued

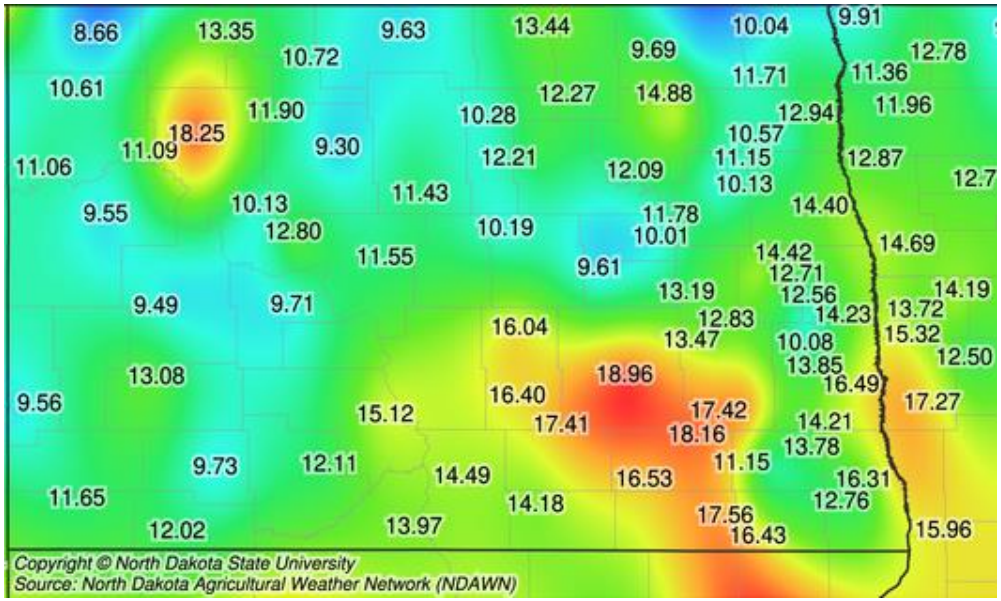
8/1/18 – 8/31/18



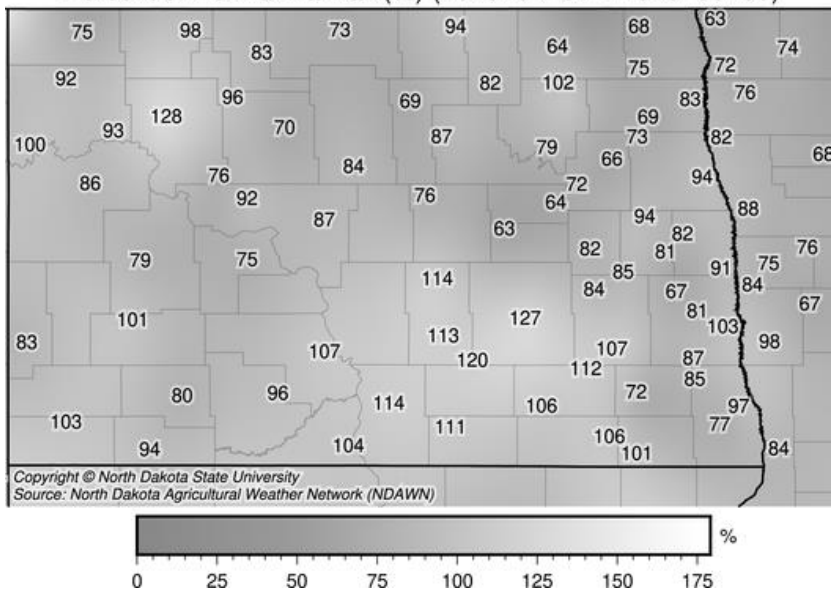
9/1/18 – 9/30/18



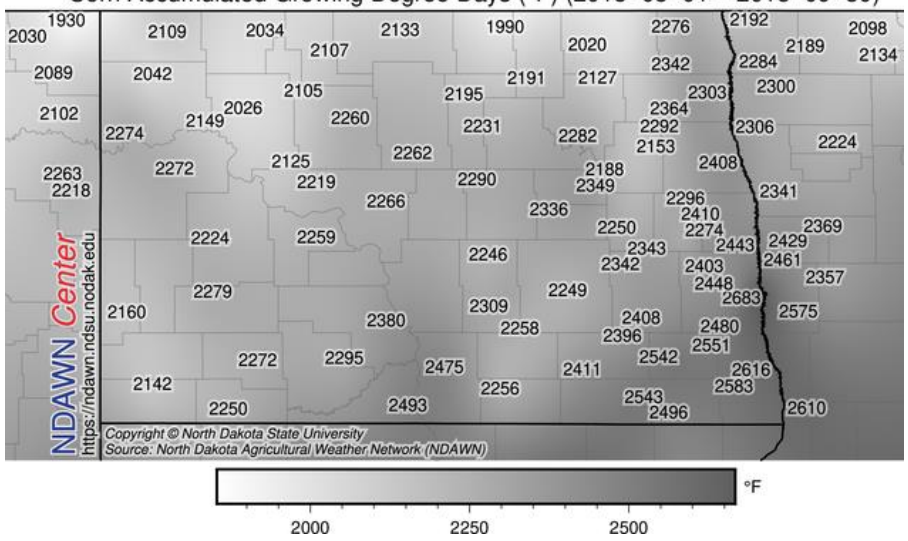
Growing Season 4/1/18 – 9/30/18



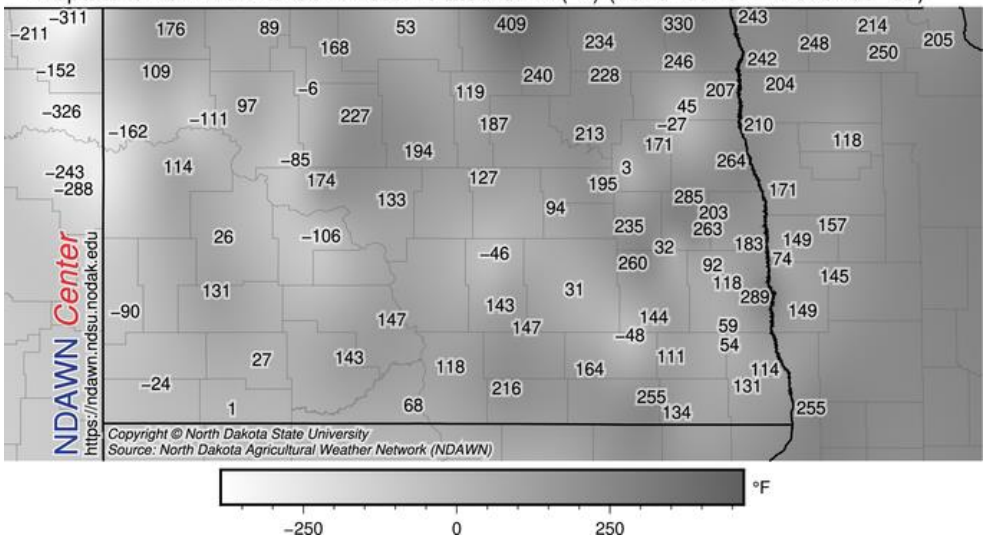
Percent of Normal Rainfall (%) (2018–04–01 – 2018–09–30)



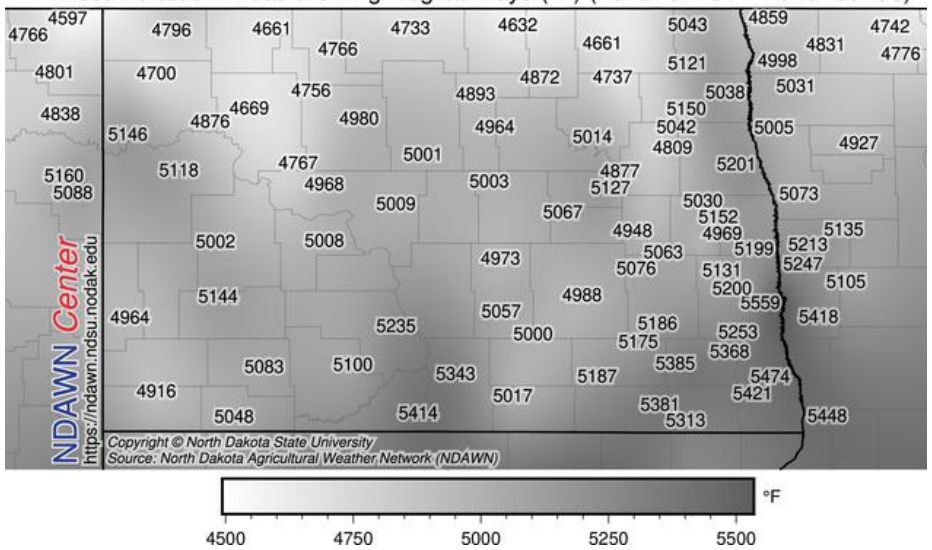
Corn Accumulated Growing Degree Days (°F) (2018–05–01 – 2018–09–30)



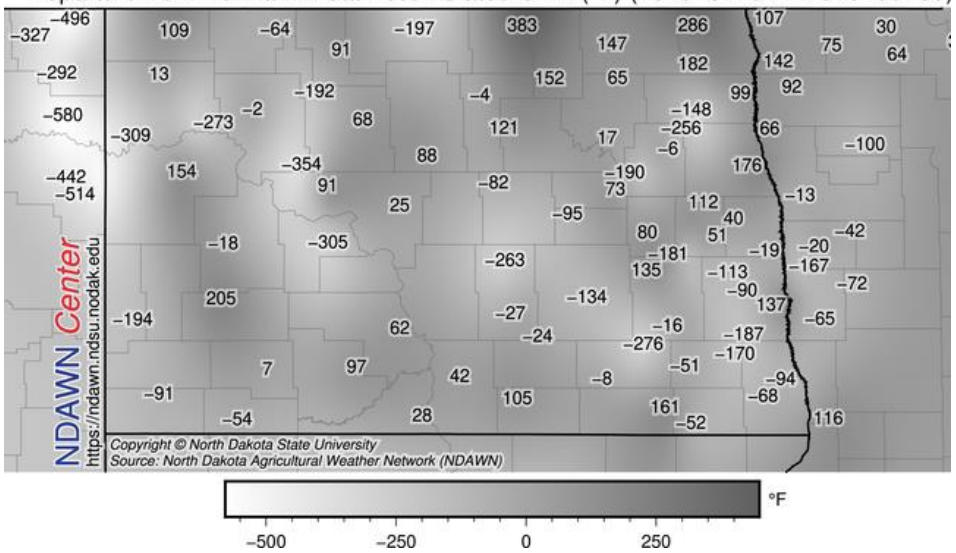
Departure from Normal Corn Accumulated GDD (°F) (2018–05–01 – 2018–09–30)



Accumulated Wheat Growing Degree Days (°F) (2018–04–01 – 2018–09–30)



Departure from Normal Wheat Accumulated GDD (°F) (2018–04–01 – 2018–09–30)



Average Data by Crop and Year Across Sites

Durum	Yield (bu/a)						Test Weight (lbs/bu)						Height (in)						Days to Head					
No. Sites	2	2	2	1	2	5	2	2	2	1	2	5	2	2	2	1	2	5	2	2	2	1	2	5
Variety	14	15	16	17	18	3yr	14	15	16	17	18	3yr	14	15	16	17	18	3yr	14	15	16	17	18	3yr
Alkabo	69	61	62	71	73	69	59.2	60.7	57.6	61.0	61.6	60.1	40	36	39	43	36	39	57	64	62	61	57	60
Tioga	67	67	50	70	79	66	58.5	60.3	54.0	60.3	61.9	58.7	43	39	41	48	37	42	58	65	62	61	56	60
Divide	68	70	50	78	76	68	58.5	60.4	54.9	60.7	61.6	59.1	42	38	40	47	37	41	59	65	63	61	56	60
Carpio	67	74	57	79	78	71	58.4	61.0	57.3	61.7	62.3	60.4	41	38	40	45	36	40	59	66	63	62	56	60
Joppa	71	71	58	75	80	71	58.7	60.6	56.1	60.5	62.2	59.6	41	38	39	44	35	39	59	64	63	61	55	60
ND Grano	--	--	--	78	76	--	--	--	--	61.0	62.4	--	--	--	--	45	35	--	--	--	--	62	55	--
ND Riveland	--	--	--	88	82	--	--	--	--	61.5	61.7	--	--	--	--	46	36	--	--	--	--	61	55	--
Lebsock	69	67	--	--	--	--	59.6	62.2	--	--	--	--	39	37	--	--	--	--	55	63	--	--	--	--
Grenora	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Barley	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Plump (%)						Days to Head				
No. Sites	3	3	3	3	1	7	3	3	3	3	1	7	3	3	3	3	1	7	3	3	3	3	1	7	3	2	1	1	4
Variety	14	15	16	17	18	3yr	14	15	16	17	18	3yr	14	15	16	17	18	3yr	14	15	16	17	18	3yr	15	16	17	18	3yr
Lacey	123	110	113	129	133	125	50.0	49.2	47.1	48.4	50.4	48.6	13.1	13.2	13.4	12.5	14.3	13.4	95	93	92	88	98	93	63	55	55	50	53
Tradition	124	109	104	115	131	117	49.5	48.4	46.1	47.6	49.8	47.8	12.7	13.0	13.2	12.6	14.3	13.4	94	92	89	88	96	91	61	57	56	50	54
Innovation	130	109	111	124	118	118	49.8	48.5	45.9	47.7	49.9	47.8	13.3	13.2	13.2	12.8	14.7	13.6	97	92	90	89	98	92	61	56	56	51	54
Pinnacle*	--	114	103	118	130	117	--	49.6	47.1	49.4	52.0	49.5	--	11.8	12.4	12.1	12.8	12.4	--	95	96	96	99	97	63	56	57	51	55
ND Genesis*	--	105	90	115	139	115	--	48.1	46.4	48.0	50.4	48.3	--	10.8	11.4	10.8	11.9	11.4	--	94	96	94	97	96	64	58	57	51	55
AAC Synergy*	--	--	--	118	147	--	--	--	--	48.0	51.2	--	--	--	--	12.1	13.1	--	--	--	--	90	97	--	--	--	58	52	--
Quest	123	107	98	--	126	--	48.1	47.8	45.1	--	49.6	--	12.9	12.9	12.9	--	14.1	--	92	87	87	--	94	--	63	56	--	50	--
Celebration	125	--	--	--	128	--	49.2	--	--	--	49.5	--	13.6	--	--	--	15.2	--	94	--	--	--	98	--	--	--	--	50	--
Stellar-ND	126	--	--	--	135	--	48.6	--	--	--	48.8	--	12.7	--	--	--	13.2	--	97	--	--	--	98	--	--	--	--	50	--

*2-row barley

No off-station barley trials in 2018.

Average Data by Crop and Year Across Sites

HRSW	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Height (in)					Days to Head				Lodging			
No. Sites	5	5	5	5	4	14	5	5	5	5	4	14	5	5	5	5	4	14	5	5	4	4	13	5	4	4	4	12	4	5	3	12
Variety	14	15	16	17	18	3yr	14	15	16	17	18	3yr	14	15	16	17	18	3yr	15	16	17	18	3yr	15	16	17	18	3yr	15	16	17	3yr
Faller	93	60	76	84	86	82	60.9	58.2	59.4	60.7	61.8	60.6	13.2	13.9	13.6	12.9	13.6	13.4	33	36	36	33	35	64	55	55	51	54	3.7	2.7	1.3	2.0
Prosper	90	57	74	82	84	80	60.9	58.2	59.4	60.5	62.1	60.7	13.3	13.9	13.7	13.1	13.8	13.5	34	36	36	33	35	64	57	55	52	55	4.3	3.4	2.4	2.9
Rollag	79	63	68	73	69	70	61.8	60.1	59.9	61.4	61.9	61.1	14.5	15.2	14.8	14.7	15.1	14.9	31	33	33	30	32	63	55	54	51	53	0.7	1.2	0.1	0.7
Linkert	75	63	66	67	68	67	60.6	59.4	58.7	60.1	61.4	60.1	14.6	15.0	14.6	14.8	14.9	14.8	30	31	31	28	30	63	56	53	52	54	0.1	0.2	0.1	0.2
SY Ingmar	79	62	70	71	74	72	61.5	60.1	59.6	60.0	62.3	60.6	14.4	14.7	14.8	14.5	14.8	14.7	32	33	34	29	32	63	57	54	51	54	0.4	1.4	0.1	0.8
HRS 3419	87	67	79	84	87	83	59.3	58.2	58.4	59.8	61.1	59.8	12.6	12.8	13.4	12.9	12.8	13.0	33	34	35	32	34	66	60	57	55	57	0.7	0.3	0.0	0.2
Bolles	--	55	64	73	70	69	--	58.3	58.5	60.2	61.1	59.9	--	15.8	15.7	15.4	15.5	15.5	32	34	35	32	34	65	58	56	53	56	2.8	1.8	0.0	0.9
SY Valda	--	62	75	81	86	81	--	58.8	59.4	60.1	61.6	60.4	--	14.0	13.9	13.5	13.6	13.7	31	34	34	29	32	64	57	53	51	54	2.2	1.8	0.6	1.2
HRS 3530	--	65	77	81	83	80	--	59.0	59.8	60.4	61.5	60.6	--	14.1	14.2	13.9	14.1	14.1	36	37	37	34	36	65	57	55	53	55	3.1	2.4	0.1	1.3
HRS 3504	--	65	69	72	80	74	--	56.9	57.3	57.9	60.6	58.6	--	13.3	13.5	13.5	13.1	13.4	31	32	32	29	31	65	57	55	52	55	1.5	0.5	0.0	0.3
Shelly	--	--	73	82	80	78	--	--	58.7	61.5	62.1	60.8	--	--	13.9	13.5	13.6	13.7	--	33	34	30	32	--	58	54	52	55	--	1.3	0.1	--
HRS 3616	--	--	67	75	75	72	--	--	58.2	59.7	61.1	59.7	--	--	15.2	14.9	14.9	15.0	--	34	35	31	33	--	56	53	51	53	--	2.2	0.3	--
ND VitPro	--	--	64	69	71	68	--	--	61.2	62.1	63.0	62.1	--	--	14.8	14.6	14.7	14.7	--	35	36	32	34	--	55	52	50	52	--	1.4	0.3	--
Lang-MN	--	--	--	74	74	--	--	--	--	62.4	61.9	--	--	--	--	14.9	14.8	--	--	--	39	34	--	--	--	56	53	--	--	--	0.1	--
WB9590	--	--	--	73	80	--	--	--	--	59.6	62.0	--	--	--	--	14.2	14.4	--	--	--	30	27	--	--	--	52	50	--	--	--	0.1	--
WB9479	--	--	--	76	74	--	--	--	--	60.4	62.4	--	--	--	--	14.6	15.3	--	--	--	32	28	--	--	--	53	51	--	--	--	0.0	--
LCS Rebel	--	--	--	79	78	--	--	--	--	62.0	62.6	--	--	--	--	13.8	14.1	--	--	--	38	33	--	--	--	52	49	--	--	--	1.3	--
MS Camaro	--	--	--	70	70	--	--	--	--	60.4	61.6	--	--	--	--	13.8	14.1	--	--	--	32	28	--	--	--	53	50	--	--	--	0.6	--
HRS 3888	--	--	--	--	77	--	--	--	--	--	60.9	--	--	--	--	--	13.9	--	--	--	--	30	--	--	--	--	51	--	--	--	--	--
LCS Trigger	--	--	--	--	88	--	--	--	--	--	62.0	--	--	--	--	--	11.8	--	--	--	--	34	--	--	--	--	55	--	--	--	--	--
MS Barracuda	--	--	--	--	79	--	--	--	--	--	61.9	--	--	--	--	--	14.4	--	--	--	--	29	--	--	--	--	48	--	--	--	--	--
TCG-Climax	--	--	--	--	70	--	--	--	--	--	63.2	--	--	--	--	--	15.3	--	--	--	--	31	--	--	--	--	54	--	--	--	--	--
TCG-Spitfire	--	--	--	--	79	--	--	--	--	--	61.3	--	--	--	--	--	13.9	--	--	--	--	30	--	--	--	--	53	--	--	--	--	--
WB9719	--	--	--	--	77	--	--	--	--	--	64.0	--	--	--	--	--	13.9	--	--	--	--	29	--	--	--	--	52	--	--	--	--	--
SY Soren	77	54	71	71	--	--	61.1	58.8	59.4	60.0	--	--	14.2	14.8	14.3	14.3	--	--	29	32	33	--	--	63	55	53	--	--	1.1	1.6	0.1	0.9
WB Mayville	75	55	60	66	--	--	60.6	58.1	57.5	58.9	--	--	14.1	14.7	14.6	14.4	--	--	29	31	32	--	--	62	55	52	--	--	0.3	0.5	0.0	0.3
LCS Breakaway	78	57	69	72	--	--	62.3	56.8	60.4	61.1	--	--	14.4	14.6	14.3	14.0	--	--	31	32	34	--	--	62	55	52	--	--	2.7	1.4	0.4	0.9
Elgin-ND	82	59	67	78	--	--	60.7	58.2	58.8	60.6	--	--	14.0	14.4	14.5	14.0	--	--	36	38	41	--	--	64	56	52	--	--	3.3	2.1	1.0	1.6
SY Rowyn	82	61	72	79	--	--	61.1	59.3	59.5	60.4	--	--	13.5	14.0	13.9	13.4	--	--	30	33	33	--	--	63	55	53	--	--	2.7	2.3	2.0	2.2
Boost	--	--	63	76	--	--	--	--	58.6	60.3	--	--	--	--	14.9	14.1	--	--	--	35	37	--	--	--	59	56	--	--	--	3.1	1.3	--
Surpass	--	--	67	77	--	--	--	--	58.8	60.5	--	--	--	--	13.9	13.7	--	--	--	34	37	--	--	--	51	50	--	--	--	3.7	1.7	--
LCS Prime	--	--	69	82	--	--	--	--	59.7	61.3	--	--	--	--	13.2	12.5	--	--	--	35	37	--	--	--	54	52	--	--	--	2.8	0.8	--
HRS 3100	--	--	71	75	--	--	--	--	57.5	58.1	--	--	--	--	13.6	13.4	--	--	--	34	36	--	--	--	58	55	--	--	--	0.8	0.0	--
MS Chevelle	--	--	--	83	--	--	--	--	--	60.2	--	--	--	--	--	12.8	--	--	--	--	34	--	--	--	--	52	--	--	--	--	1.2	--
HRS 3361	82	71	72	--	--	--	60.1	57.5	57.6	--	--	--	13.6	13.0	13.6	--	--	--	32	34	--	--	--	63	57	--	--	--	1.2	0.8	--	--
WB9507	91	55	76	--	--	--	60.0	55.8	57.8	--	--	--	13.8	13.8	13.6	--	--	--	33	35	--	--	--	62	55	--	--	--	3.5	2.5	--	--
Prevail	81	62	71	--	--	--	60.6	58.9	58.6	--	--	--	13.8	13.8	13.7	--	--	--	34	35	--	--	--	62	54	--	--	--	2.8	1.3	--	--
Focus	--	63	63	--	--	--	--	60.6	60.6	--	--	--	--	14.0	13.9	--	--	--	37	37	--	--	--	58	50	--	--	--	4.2	2.6	--	--
WB9653	--	60	71	--	--	--	--	56.2	56.9	--	--	--	--	13.4	13.4	--	--	--	31	32	--	--	--	64	57	--	--	--	2.1	1.5	--	--
LCS Anchor	--	--	62	--	--	--	--	--	58.6	--	--	--	--	--	14.6	--	--	--	--	31	--	--	--	--	55	--	--	--	--	1.3	--	--
TCG-Cornerstone	--	--	57	--	--	--	--	--	58.1	--	--	--	--	--	14.4	--	--	--	--	32	--	--	--	--	57	--	--	--	--	0.6	--	--
Barlow	81	57	--	--	--	--	61.6	59.5	--	--	--	--	14.2	14.7	--	--	--	--	34	--	--	--	--	63	--	--	--	--	3.5	--	--	--
LCS Iguacu	85	63	--	--	--	--	61.0	60.2	--	--	--	--	11.5	12.1	--	--	--	--	32	--	--	--	--	65	--	--	--	--	1.2	--	--	--
LCS Nitro	87	62	--	--	--	--	59.8	57.9	--	--	--	--	12.0	12.8	--	--	--	--	31	--	--	--	--	65	--	--	--	--	2.4	--	--	--

HRSW Summary, Langdon 2014-2018

	Days to Head						Height (in)						2018 Fusarium Head Blight			2018 Bacterial Leaf Streak
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**Inc (%)**	**Sev (%)**	**Index**	**(0-9)**
Barlow	53	61	55	56	46	52	37	36	35	41	34	37	31	12	3.5	4.4
Elgin-ND	53	61	57	58	48	54	39	38	39	43	36	39	24	10	2.4	4.5
Faller	54	62	57	59	50	55	35	36	38	39	33	37	14	2	0.0	1.5
Glenn	52	60	53	55	46	51	37	38	37	42	35	38	19	3	0.4	6.1
LCS Breakaway	53	60	55	56	46	52	33	33	33	35	30	33	20	5	1.2	4.8
Prosper	53	63	57	58	50	55	36	36	36	38	33	36	21	7	1.4	2.0
Rollag	53	61	56	58	49	54	33	32	35	35	29	33	25	4	1.2	5.1
SY Soren	53	61	56	58	48	54	31	32	33	34	28	32	30	5	1.7	5.5
Bolles	55	64	59	61	50	57	35	35	35	37	33	35	20	3	1.0	3.0
SY Ingmar	54	62	58	59	49	55	32	32	34	34	29	32	16	5	0.9	3.8
Linkert	54	62	57	58	50	55	29	31	32	31	29	31	52	13	6.6	3.5
HRS 3419	58	64	61	61	53	58	33	35	34	37	33	35	8	1	0.1	4.0
MS Chevelle	51	60	54	57	46	52	33	34	34	37	31	34	17	7	1.4	5.9
Boost	55	63	59	60	51	57	35	36	35	38	33	35	21	6	1.1	2.3
WB9653	--	62	58	59	49	55	--	32	31	34	29	31	33	8	2.6	5.1
SY Valda	--	62	57	58	49	55	--	33	35	35	30	33	19	3	0.7	3.3
HRS 3530	--	64	58	60	50	56	--	39	39	39	34	37	37	12	4.5	2.8
HRS 3504	--	62	58	60	50	56	--	33	32	34	30	32	37	18	7.2	5.9
Shelly	--	63	59	59	51	56	--	33	34	36	30	33	30	6	1.9	7.0
HRS 3100	--	--	58	58	50	55	--	--	35	38	30	34	21	6	1.2	2.9
HRS 3616	--	--	57	58	49	55	--	--	34	35	31	33	46	11	4.9	8.2
TCG-Spitfire	--	--	61	60	51	57	--	--	33	34	31	33	29	8	2.5	6.8
Surpass	--	--	52	54	45	50	--	--	34	40	32	35	25	4	1.0	3.7
ND VitPro	--	--	56	57	48	54	--	--	35	37	33	35	36	12	5.3	6.0
Lang-MN	--	--	--	60	51	--	--	--	--	41	35	--	30	5	1.4	2.6
MS Camaro	--	--	--	58	48	--	--	--	--	33	28	--	26	4	1.6	7.5
LCS Rebel	--	--	--	57	46	--	--	--	--	41	34	--	17	5	0.8	2.1
LCS Trigger	--	--	--	62	53	--	--	--	--	39	35	--	10	1	0.1	0.6
TCG-Climax	--	--	--	63	52	--	--	--	--	38	31	--	20	6	1.2	7.2
WB9479	--	--	--	57	49	--	--	--	--	33	28	--	31	10	3.9	5.8
WB9590	--	--	--	56	49	--	--	--	--	30	28	--	32	14	4.6	7.6
WB9719	--	--	--	59	51	--	--	--	--	34	30	--	37	15	5.6	4.2
DynaGro Caliber	--	--	--	60	50	--	--	--	--	30	26	--	67	17	11.5	5.4
AAC Brandon	--	--	--	--	49	--	--	--	--	--	32	--	31	4	1.5	5.3
AAC Penhold	--	--	--	--	51	--	--	--	--	--	29	--	13	2	0.4	2.5
AC Goodwin	--	--	--	--	49	--	--	--	--	--	32	--	39	9	3.8	3.8
MS Barracuda	--	--	--	--	45	--	--	--	--	--	29	--	18	3	0.6	2.6
DynaGro Ambush	--	--	--	--	47	--	--	--	--	--	31	--	25	10	2.5	4.9
HRS 3888	--	--	--	--	49	--	--	--	--	--	31	--	23	6	1.4	6.3
LCS Cannon	--	--	--	--	44	--	--	--	--	--	30	--	23	4	1.1	4.1
TCG-Glenville	--	--	--	--	47	--	--	--	--	--	28	--	51	14	7.3	6.7
Prevail	54	60	56	56	--	--	36	35	37	39	--	--	--	--	--	--
WB Mayville	51	60	55	57	--	--	33	31	33	32	--	--	--	--	--	--
SY Rowyn	53	61	55	58	--	--	33	34	34	34	--	--	--	--	--	--
LCS Nitro	56	63	59	60	--	--	34	34	34	36	--	--	--	--	--	--
LCS Prime	--	60	55	56	--	--	--	36	35	38	--	--	--	--	--	--
LCS Anchor	--	--	57	57	--	--	--	--	32	34	--	--	--	--	--	--
TCG-Cornerstone	--	--	58	59	--	--	--	--	33	35	--	--	--	--	--	--
Ambush	--	--	--	56	--	--	--	--	--	36	--	--	--	--	--	--
AKF-Astro	--	--	--	60	--	--	--	--	--	37	--	--	--	--	--	--
MS Stingray	56	65	64	--	--	--	36	37	38	--	--	--	--	--	--	--
LCS Iguacu	55	63	59	--	--	--	35	34	36	--	--	--	--	--	--	--
HRS 3361	54	62	58	--	--	--	34	33	35	--	--	--	--	--	--	--
WB9507	52	60	55	--	--	--	34	35	34	--	--	--	--	--	--	--
Focus	50	56	51	--	--	--	36	39	38	--	--	--	--	--	--	--
LCS Pro	--	61	55	--	--	--	--	38	40	--	--	--	--	--	--	--
Redstone	--	66	63	--	--	--	--	35	37	--	--	--	--	--	--	--
Prestige	--	59	54	--	--	--	--	35	35	--	--	--	--	--	--	--
Velva	55	--	58	--	--	--	36	--	37	--	--	--	--	--	--	--
TCG-Wildfire	--	--	58	--	--	--	--	--	37	--	--	--	--	--	--	--
Trial Mean	53	61	57	58	49		35	35	36	37	31		28	7	2.4	4.4
C.V. %	1.8	0.8	1.2	1.7	1.7		4.0	3.1	4.4	3.7	3.3		27.7	54.4	76.9	31.5
LSD 5%	1.3	0.7	0.9	1.3	1.1		1.9	1.5	2.2	1.9	1.5		12.4	6.1	3.0	2.2
LSD 10%	1.1	0.6	0.8	1.1	1.0		1.6	1.3	1.8	1.6	1.2		10.4	5.1	2.5	1.9

HRSW Summary, Langdon 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Lodging (0-9)		
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**16**	**17**	**2yr**
Barlow	86	74	60	74	85	73	62.9	62.1	60.0	61.5	62.6	61.4	13.9	14.1	14.8	13.8	14.2	14.3	3.9	1.8	2.9
Elgin-ND	90	73	65	81	89	78	62.3	60.8	59.2	61.1	61.7	60.7	13.7	13.6	14.9	13.5	13.6	14.0	2.6	0.0	1.3
Faller	96	74	79	82	98	86	62.2	60.5	60.8	61.5	62.3	61.5	12.3	12.3	13.6	11.7	12.7	12.7	3.7	0.0	1.9
Glenn	76	75	64	71	76	70	64.0	64.5	63.0	63.8	62.9	63.2	14.4	14.3	14.7	14.3	14.4	14.5	1.7	0.5	1.1
LCS Breakaway	77	74	71	75	85	77	62.9	62.2	61.7	61.8	63.0	62.2	13.7	13.7	14.1	13.2	14.0	13.8	1.8	0.0	0.9
Prosper	93	71	78	83	98	86	62.4	60.4	60.9	60.8	62.7	61.5	12.4	12.6	13.8	11.9	13.2	13.0	4.6	0.3	2.5
Rollag	85	75	71	76	78	75	63.0	61.5	61.3	62.4	62.0	61.9	14.1	14.0	14.8	14.4	14.2	14.5	1.8	0.0	0.9
SY Soren	85	74	69	76	80	75	63.2	61.8	60.6	61.3	61.5	61.1	13.4	13.8	14.5	13.6	13.4	13.8	1.9	0.0	1.0
Bolles	86	73	63	74	82	73	61.6	60.9	60.2	61.2	61.3	60.9	13.8	15.1	15.9	15.0	14.9	15.3	2.6	0.0	1.3
SY Ingmar	87	74	70	74	91	78	62.9	61.5	60.9	61.1	62.9	61.6	13.7	13.9	15.1	14.1	14.2	14.5	2.5	0.0	1.3
Linkert	82	76	63	64	75	67	62.2	61.1	59.7	60.8	61.0	60.5	13.6	14.5	15.1	14.7	14.3	14.7	0.6	0.0	0.3
HRS 3419	89	83	79	92	101	91	60.0	60.6	59.1	61.6	62.2	61.0	12.3	12.5	13.3	12.3	11.6	12.4	0.4	0.0	0.2
MS Chevelle	91	80	68	86	94	83	62.1	60.5	58.5	61.3	62.3	60.7	12.5	12.5	13.4	12.2	12.6	12.7	2.8	0.0	1.4
Boost	85	72	61	79	88	76	61.4	60.6	58.5	60.7	61.9	60.4	13.1	13.5	15.0	13.3	13.7	14.0	3.5	0.0	1.8
WB9653	--	74	76	83	93	84	--	58.1	58.5	58.8	61.7	59.7	--	12.5	13.4	12.6	13.0	13.0	1.8	0.0	0.9
SY Valda	--	79	78	85	100	88	--	60.7	60.5	60.3	62.3	61.0	--	13.0	13.9	12.8	13.1	13.3	0.8	0.0	0.4
HRS 3530	--	77	78	79	99	85	--	60.3	60.8	61.3	62.2	61.4	--	12.8	14.3	12.7	13.0	13.3	2.1	0.0	1.1
HRS 3504	--	85	73	77	92	81	--	58.2	58.2	59.0	61.4	59.5	--	12.7	13.4	12.8	12.9	13.0	0.8	0.0	0.4
Shelly	--	80	71	81	88	80	--	62.0	59.7	61.9	62.2	61.3	--	13.0	14.0	13.0	13.1	13.4	2.6	0.0	1.3
HRS 3100	--	--	70	75	87	77	--	--	58.1	60.1	61.3	59.8	--	--	13.7	13.0	13.4	13.4	1.4	0.0	0.7
HRS 3616	--	--	66	76	81	74	--	--	59.4	61.5	61.2	60.7	--	--	15.3	14.3	14.4	14.7	2.6	0.0	1.3
TCG-Spitfire	--	--	58	76	92	75	--	--	59.0	59.8	61.7	60.2	--	--	14.2	13.2	12.9	13.4	1.2	0.0	0.6
Surpass	--	--	59	80	91	77	--	--	59.4	60.9	62.2	60.8	--	--	14.2	12.9	13.6	13.6	4.2	3.0	3.6
ND VitPro	--	--	63	72	78	71	--	--	62.1	62.7	63.2	62.7	--	--	15.1	14.2	14.1	14.5	2.0	0.0	1.0
Lang-MN	--	--	60	78	79	72	--	--	61.0	63.3	61.9	62.1	--	--	15.5	14.7	14.3	14.8	--	0.0	--
MS Camaro	--	--	--	67	77	--	--	--	--	61.6	62.0	--	--	--	--	13.6	13.7	--	--	0.0	--
LCS Rebel	--	--	--	84	93	--	--	--	--	62.4	63.1	--	--	--	--	13.2	13.6	--	--	0.0	--
LCS Trigger	--	--	--	98	110	--	--	--	--	62.3	62.6	--	--	--	--	11.0	11.1	--	--	0.0	--
TCG-Climax	--	--	--	72	82	--	--	--	--	62.8	63.8	--	--	--	--	15.1	14.6	--	--	0.0	--
WB9479	--	--	--	75	89	--	--	--	--	61.0	63.0	--	--	--	--	13.9	14.5	--	--	0.0	--
WB9590	--	--	--	72	92	--	--	--	--	60.4	62.5	--	--	--	--	13.3	13.7	--	--	0.0	--
WB9719	--	--	--	70	89	--	--	--	--	61.9	63.8	--	--	--	--	13.1	13.1	--	--	0.0	--
DynaGro Caliber	--	--	--	63	76	--	--	--	--	59.8	60.8	--	--	--	--	14.7	14.5	--	--	0.0	--
AAC Brandon	--	--	--	--	86	--	--	--	--	--	62.5	--	--	--	--	--	13.7	--	--	--	--
AAC Penhold	--	--	--	--	88	--	--	--	--	--	62.7	--	--	--	--	--	13.3	--	--	--	--
AC Goodwin	--	--	--	--	89	--	--	--	--	--	63.1	--	--	--	--	--	14.1	--	--	--	--
MS Barracuda	--	--	--	--	93	--	--	--	--	--	62.9	--	--	--	--	--	14.2	--	--	--	--
DynaGro Ambush	--	--	--	--	88	--	--	--	--	--	63.2	--	--	--	--	--	14.2	--	--	--	--
HRS 3888	--	--	--	--	87	--	--	--	--	--	61.6	--	--	--	--	--	13.8	--	--	--	--
LCS Cannon	--	--	--	--	90	--	--	--	--	--	63.5	--	--	--	--	--	13.7	--	--	--	--
TCG-Glenville	--	--	--	--	71	--	--	--	--	--	61.9	--	--	--	--	--	14.2	--	--	--	--
Prevail	85	74	66	76	--	--	61.9	61.7	59.3	61.4	--	--	13.3	13.0	14.3	13.5	--	--	1.3	0.0	0.7
WB Mayville	81	66	57	58	--	--	61.4	60.3	58.9	58.5	--	--	13.6	13.9	14.7	13.9	--	--	0.9	0.0	0.5
SY Rowyn	87	78	67	86	--	--	62.2	61.8	60.1	62.0	--	--	12.9	12.7	14.1	12.3	--	--	3.6	0.0	1.8
LCS Nitro	91	75	78	92	--	--	61.5	60.5	60.0	62.2	--	--	11.8	12.0	13.3	11.2	--	--	3.0	0.0	1.5
LCS Prime	--	78	69	88	--	--	--	61.6	60.9	61.4	--	--	--	11.9	13.5	11.8	--	--	2.4	0.0	1.2
LCS Anchor	--	--	60	69	--	--	--	--	59.3	61.8	--	--	--	--	14.7	13.7	--	--	2.7	0.0	1.4
TCG-Cornerstone	--	--	58	64	--	--	--	--	59.5	58.9	--	--	--	--	14.5	13.6	--	--	1.3	0.0	0.7
Ambush	--	--	--	72	--	--	--	--	--	61.5	--	--	--	--	--	13.8	--	--	--	0.0	--
AKF-Astro	--	--	--	56	--	--	--	--	--	54.3	--	--	--	--	--	12.3	--	--	--	0.0	--
MS Stingray	93	62	76	--	--	--	60.1	56.6	58.8	--	--	--	10.7	10.9	11.6	--	--	--	0.7	--	--
LCS Iguacu	91	73	76	--	--	--	62.0	61.9	60.7	--	--	--	11.6	11.3	12.4	--	--	--	1.6	--	--
HRS 3361	85	66	71	--	--	--	61.3	58.6	58.7	--	--	--	13.5	12.5	13.8	--	--	--	1.2	--	--
WB9507	87	61	77	--	--	--	60.4	57.7	59.2	--	--	--	13.1	11.9	13.7	--	--	--	3.1	--	--
Focus	73	73	53	--	--	--	62.3	62.4	61.2	--	--	--	13.9	13.2	14.3	--	--	--	3.5	--	--
LCS Pro	--	76	68	--	--	--	--	62.0	61.1	--	--	--	--	13.5	14.4	--	--	--	2.4	--	--
Redstone	--	79	76	--	--	--	--	61.2	60.1	--	--	--	--	12.7	13.4	--	--	--	0.4	--	--
Prestige	--	78	68	--	--	--	--	61.2	59.4	--	--	--	--	12.9	14.5	--	--	--	2.7	--	--
Velva	93	--	53	--	--	--	61.2	--	57.7	--	--	--	12.5	--	14.8	--	--	--	2.1	--	--
TCG-Wildfire	--	--	64	--	--	--	--	--	59.4	--	--	--	--	--	14.2	--	--	--	2.4	--	--
Trial Mean	84	73	67	76	87		62.1	61.2	60.2	61.3	62.2		13.3	13.3	14.4	13.4	13.7		2.6	0.1	
C.V. %	5.6	5.8	8.7	5.9	4.1		0.7	0.9	1.1	0.9	0.7		4.2	2.4	2.8	2.9	2.8		41.7	350	
LSD 5%	6.6	5.9	8.1	6.3	4.9		0.7	0.8	1.0	0.8	0.6		0.8	0.4	0.6	0.5	0.5		1.5	0.7	
LSD 10%	5.5	5.0	6.8	5.3	4.1		0.5	0.6	0.8	0.7	0.5		0.7	0.4	0.5	0.5	0.4		1.3	0.6	

HRSW Summary, Nelson County 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Lodging (0-9)		
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**17**	**18**	**2yr**
Faller	102	60	71	94	93	86	60.7	57.6	57.2	62.1	61.5	60.3	14.1	13.0	14.0	13.1	13.9	13.7	2.2	0.8	1.5
Prosper	100	59	75	86	92	84	60.5	58.0	58.0	61.9	61.5	60.5	13.9	13.0	13.9	13.1	14.0	13.7	3.2	1.3	2.3
Rollag	85	74	63	78	74	72	61.7	60.9	57.9	62.6	61.0	60.5	14.8	15.0	15.0	14.6	15.1	14.9	0.3	0.0	0.2
Linkert	83	70	66	73	72	70	60.6	60.2	56.8	61.5	60.6	59.6	15.0	15.0	14.3	14.7	14.9	14.6	0.1	0.0	0.1
SY Ingmar	86	62	74	79	82	78	61.5	60.2	59.0	61.8	61.7	60.8	14.9	14.2	14.4	14.1	14.8	14.4	0.2	0.0	0.1
HRS 3419	91	71	71	86	88	81	59.3	57.6	56.3	61.8	60.0	59.4	13.4	12.6	14.4	12.9	13.1	13.5	0.1	0.0	0.1
Bolles	--	54	64	81	74	73	--	58.1	56.2	61.8	60.7	59.6	--	15.2	15.9	15.3	15.5	15.6	0.0	0.0	0.0
HRS 3530	--	63	80	92	93	88	--	58.4	58.6	62.2	61.0	60.6	--	13.2	14.2	14.4	13.6	14.1	0.2	0.0	0.1
HRS 3504	--	58	72	81	86	80	--	54.7	56.1	60.7	59.7	58.8	--	12.8	13.9	13.4	13.0	13.4	0.0	0.0	0.0
SY Valda	--	64	79	91	96	89	--	58.1	59.1	61.6	61.2	60.6	--	13.2	14.0	13.1	13.8	13.6	0.5	0.0	0.3
Shelly	--	--	72	90	91	84	--	--	56.6	62.4	61.2	60.1	--	--	14.4	13.3	13.5	13.7	0.0	0.0	0.0
HRS 3616	--	--	69	78	85	77	--	--	56.9	60.6	60.7	59.4	--	--	14.7	15.0	14.5	14.7	0.7	0.0	0.4
ND VitPro	--	--	66	71	80	72	--	--	60.4	62.9	62.9	62.1	--	--	14.5	14.5	14.9	14.6	0.7	0.0	0.4
Lang-MN	--	--	--	71	73	--	--	--	--	62.5	60.9	--	--	--	--	14.9	15.3	--	0.1	2.0	1.1
WB9590	--	--	--	90	95	--	--	--	--	62.0	61.5	--	--	--	--	14.2	14.0	--	0.2	0.0	0.1
WB9479	--	--	--	88	88	--	--	--	--	62.8	62.0	--	--	--	--	14.8	14.6	--	0.0	0.0	0.0
LCS Rebel	--	--	--	85	85	--	--	--	--	63.4	62.4	--	--	--	--	14.1	14.1	--	0.6	0.0	0.3
MS Camaro	--	--	--	76	77	--	--	--	--	61.5	61.0	--	--	--	--	14.3	13.9	--	0.5	0.0	0.3
HRS 3888	--	--	--	--	82	--	--	--	--	--	60.3	--	--	--	--	--	13.8	--	--	0.8	--
LCS Trigger	--	--	--	--	91	--	--	--	--	--	61.4	--	--	--	--	--	11.7	--	--	0.5	--
MS Barracuda	--	--	--	--	90	--	--	--	--	--	61.0	--	--	--	--	--	14.6	--	--	0.0	--
TCG-Climax	--	--	--	--	72	--	--	--	--	--	62.4	--	--	--	--	--	15.6	--	--	0.0	--
TCG-Spitfire	--	--	--	--	86	--	--	--	--	--	60.6	--	--	--	--	--	13.7	--	--	0.0	--
WB9719	--	--	--	--	87	--	--	--	--	--	63.8	--	--	--	--	--	13.6	--	--	0.0	--
SY Soren	81	50	72	78	--	--	60.9	57.4	58.0	61.4	--	--	14.3	14.1	13.6	14.0	--	--	0.0	--	--
WB Mayville	86	59	66	79	--	--	61.0	58.9	57.0	61.6	--	--	14.4	14.1	14.3	14.6	--	--	0.0	--	--
LCS Breakaway	94	59	73	79	--	--	62.7	59.5	58.8	63.0	--	--	14.8	13.6	14.4	13.8	--	--	1.2	--	--
Elgin-ND	91	63	64	76	--	--	60.5	58.7	57.0	61.5	--	--	14.5	13.6	14.7	13.9	--	--	0.2	--	--
SY Rowyn	93	63	78	85	--	--	61.3	58.8	59.2	61.7	--	--	13.8	13.1	13.7	13.2	--	--	2.9	--	--
HRS 3100	--	--	73	85	--	--	--	--	56.9	60.6	--	--	--	--	13.6	13.5	--	--	0.0	--	--
Boost	--	--	72	78	--	--	--	--	58.8	61.1	--	--	--	--	15.0	14.2	--	--	1.1	--	--
Surpass	--	--	75	81	--	--	--	--	57.8	61.4	--	--	--	--	14.0	13.4	--	--	2.0	--	--
LCS Prime	--	--	75	89	--	--	--	--	58.9	62.1	--	--	--	--	13.1	12.6	--	--	1.8	--	--
MS Chevelle	--	--	--	88	--	--	--	--	--	61.8	--	--	--	--	--	12.7	--	--	2.2	--	--
Prevail	83	70	70	--	--	--	60.5	60.7	57.8	--	--	--	14.5	13.2	13.5	--	--	--	--	--	--
WB9507	104	56	81	--	--	--	60.0	56.1	56.9	--	--	--	14.6	12.8	14.0	--	--	--	--	--	--
HRS 3361	86	52	72	--	--	--	60.0	56.4	56.6	--	--	--	13.9	12.2	13.3	--	--	--	--	--	--
Focus	--	70	63	--	--	--	--	61.4	59.5	--	--	--	--	13.0	14.1	--	--	--	--	--	--
WB9653	--	54	73	--	--	--	--	53.5	56.2	--	--	--	--	12.4	13.9	--	--	--	--	--	--
LCS Anchor	--	--	67	--	--	--	--	--	57.5	--	--	--	--	--	14.1	--	--	--	--	--	--
TCG-Cornerstone	--	--	59	--	--	--	--	--	57.1	--	--	--	--	--	14.2	--	--	--	--	--	--
Barlow	88	63	--	--	--	--	61.4	59.5	--	--	--	--	14.7	14.0	--	--	--	--	--	--	--
LCS Iguacu	95	62	--	--	--	--	61.1	60.2	--	--	--	--	11.4	11.7	--	--	--	--	--	--	--
LCS Nitro	99	66	--	--	--	--	59.8	58.1	--	--	--	--	12.4	11.9	--	--	--	--	--	--	--
Trial Mean	89	62	71	82	84		60.9	58.6	57.8	61.9	61.3		14.2	13.5	14.2	14.0	14.2		0.7	0.2	
C.V. %	4.0	5.0	5.7	5.7	5.8		0.5	1.4	1.0	0.5	0.8		1.9	2.9	1.7	1.5	4.4		126	349	
LSD 5%	5.0	4.4	5.7	6.6	6.9		0.5	1.1	0.8	0.5	0.7		0.4	0.6	0.3	0.4	0.9		1.3	1.0	
LSD 10%	4.2	3.7	4.8	5.5	5.7		0.4	0.9	0.6	0.4	0.6		0.3	0.5	0.3	0.3	0.7		1.1	0.8	

HRSW Summary, Towner County 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Lodging (0-9)		
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**15**	**16**	**2yr**
Faller	84	56	88	59	66	71	58.6	59.6	60.2	57.1	61.0	59.4	14.1	14.1	13.7	14.3	15.0	14.3	1.3	2.9	2.1
Prosper	79	55	83	58	67	69	58.3	60.4	59.8	57.2	61.4	59.5	14.3	13.9	14.0	14.3	14.8	14.4	0.6	2.7	1.7
Rollag	70	54	73	49	58	60	59.9	61.3	60.2	57.6	61.8	59.9	15.4	15.0	15.3	15.7	15.8	15.6	0.0	1.0	0.5
SY Ingmar	74	51	76	43	63	61	59.1	60.9	59.2	54.4	61.8	58.5	15.0	15.0	15.3	15.4	15.3	15.3	0.2	1.2	0.7
HRS 3419	77	53	93	48	70	70	57.7	58.9	59.8	54.5	60.1	58.1	13.7	12.3	13.5	14.3	14.2	14.0	0.3	0.3	0.3
Linkert	64	50	75	48	58	60	57.9	59.9	59.4	55.7	61.9	59.0	15.1	14.9	14.9	15.5	15.3	15.2	0.0	0.0	0.0
Bolles	--	46	77	50	60	62	--	59.0	59.9	55.6	60.7	58.7	--	16.4	16.0	16.3	16.9	16.4	0.7	2.5	1.6
SY Valda	--	56	83	54	66	68	--	60.8	59.7	56.3	60.8	58.9	--	13.9	14.6	14.7	14.4	14.6	0.9	1.4	1.2
HRS 3530	--	57	92	51	62	68	--	60.3	60.5	55.5	60.4	58.8	--	14.8	14.5	15.0	15.6	15.0	0.2	2.5	1.4
HRS 3504	--	62	75	43	66	61	--	59.3	57.1	51.8	60.0	56.3	--	13.3	13.8	14.7	14.1	14.2	0.2	0.6	0.4
Shelly	--	--	87	63	67	72	--	--	59.8	59.4	62.1	60.4	--	--	14.1	14.3	14.7	14.4	--	1.4	--
ND VitPro	--	--	73	49	58	60	--	--	61.1	59.0	62.1	60.7	--	--	15.0	15.0	15.6	15.2	--	2.2	--
HRS 3616	--	--	77	58	64	67	--	--	58.8	56.1	60.2	58.4	--	--	15.9	15.4	16.2	15.8	--	3.0	--
Lang-MN	--	--	--	58	68	--	--	--	--	60.4	61.8	--	--	--	--	15.4	15.1	--	--	--	--
WB9590	--	--	--	42	63	--	--	--	--	54.1	61.2	--	--	--	--	15.9	15.3	--	--	--	--
WB9479	--	--	--	57	60	--	--	--	--	55.9	61.6	--	--	--	--	15.7	16.0	--	--	--	--
LCS Rebel	--	--	--	60	64	--	--	--	--	59.5	61.5	--	--	--	--	14.0	15.4	--	--	--	--
MS Camaro	--	--	--	48	61	--	--	--	--	57.5	61.3	--	--	--	--	14.7	15.1	--	--	--	--
HRS 3888	--	--	--	--	64	--	--	--	--	--	60.1	--	--	--	--	--	15.0	--	--	--	--
LCS Trigger	--	--	--	--	66	--	--	--	--	--	61.4	--	--	--	--	--	13.6	--	--	--	--
MS Barracuda	--	--	--	--	62	--	--	--	--	--	60.9	--	--	--	--	--	15.3	--	--	--	--
TCG-Climax	--	--	--	--	60	--	--	--	--	--	63.1	--	--	--	--	--	15.8	--	--	--	--
TCG-Spitfire	--	--	--	--	63	--	--	--	--	--	61.6	--	--	--	--	--	14.7	--	--	--	--
WB9719	--	--	--	--	65	--	--	--	--	--	64.1	--	--	--	--	--	14.7	--	--	--	--
SY Soren	67	45	82	42	--	--	58.8	59.8	60.0	54.8	--	--	14.5	15.0	14.8	15.5	--	--	0.4	2.1	1.3
WB Mayville	66	47	69	43	--	--	58.0	59.5	57.6	53.8	--	--	14.8	15.2	14.7	15.3	--	--	0.1	0.4	0.3
LCS Breakaway	72	49	78	49	--	--	60.4	48.9	61.5	56.8	--	--	14.9	14.9	14.5	15.2	--	--	0.3	1.5	0.9
Elgin-ND	71	59	76	61	--	--	58.0	60.2	60.1	57.3	--	--	14.9	14.4	14.9	14.3	--	--	0.4	2.3	1.4
SY Rowyn	78	50	81	47	--	--	59.2	60.3	60.1	55.8	--	--	14.3	14.4	14.3	15.0	--	--	1.1	2.2	1.7
Boost	--	--	68	60	--	--	--	--	59.1	58.4	--	--	--	--	15.7	14.8	--	--	--	4.1	--
Surpass	--	--	82	57	--	--	--	--	60.0	58.6	--	--	--	--	14.1	13.9	--	--	--	3.1	--
LCS Prime	--	--	80	55	--	--	--	--	60.3	58.3	--	--	--	--	13.6	13.2	--	--	--	3.9	--
HRS 3100	--	--	79	51	--	--	--	--	57.3	53.8	--	--	--	--	14.1	14.6	--	--	--	0.8	--
MS Chevelle	--	--	--	68	--	--	--	--	--	57.3	--	--	--	--	--	13.5	--	--	--	--	--
Prevail	74	55	83	--	--	--	58.5	59.7	59.6	--	--	--	14.0	13.6	13.8	--	--	--	0.5	1.2	0.9
HRS 3361	73	50	80	--	--	--	58.1	58.6	57.6	--	--	--	13.9	13.7	14.2	--	--	--	0.4	0.5	0.5
WB9507	93	54	84	--	--	--	58.5	58.2	58.1	--	--	--	14.6	14.2	13.5	--	--	--	0.6	2.7	1.7
Focus	--	58	86	--	--	--	--	61.8	61.5	--	--	--	--	13.8	13.9	--	--	--	1.3	1.2	1.3
WB9653	--	61	74	--	--	--	--	58.5	56.6	--	--	--	--	13.5	13.9	--	--	--	0.5	2.2	1.4
LCS Anchor	--	--	78	--	--	--	--	--	59.8	--	--	--	--	--	15.0	--	--	--	--	1.2	--
TCG-Cornerstone	--	--	62	--	--	--	--	--	58.5	--	--	--	--	--	14.6	--	--	--	--	0.3	--
Barlow	75	47	--	--	--	--	59.9	60.8	--	--	--	--	15.1	14.6	--	--	--	--	0.9	--	--
LCS Iguacu	74	45	--	--	--	--	58.7	60.4	--	--	--	--	11.7	12.7	--	--	--	--	0.3	--	--
LCS Nitro	76	53	--	--	--	--	57.0	58.9	--	--	--	--	12.9	12.7	--	--	--	--	0.7	--	--
Trial Mean	73	53	79	53	63		58.6	60.1	59.6	56.7	61.4		14.5	14.3	14.5	14.9	15.1		0.5	1.8	
C.V. %	5.4	8.8	6.1	10.3	6.2		0.9	0.9	1.1	2.3	0.7		1.5	2.4	2.3	2.0	1.9		161	59.7	
LSD 5%	5.5	6.6	6.9	11.3	5.5		0.7	0.8	0.9	2.8	0.6		0.3	0.5	0.5	0.6	0.4		NS	1.5	
LSD 10%	4.6	5.5	5.7	9.4	4.6		0.6	0.7	0.8	2.3	0.5		0.3	0.4	0.4	0.5	0.3		NS	1.3	

HRSW Summary, Walsh County 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Protein (%)						Lodging (0-9)					
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**13**	**14**	**15**	**16**	**17**	**3yr**
Faller	93	62	81	89	85	85	61.4	57.3	58.9	60.3	62.5	60.6	11.8	15.2	13.0	12.5	12.8	12.8	3.1	0.0	6.5	2.2	1.1	3.3
Prosper	96	53	79	91	80	83	61.5	56.6	59.1	60.7	62.8	60.9	12.1	15.0	13.1	12.7	13.0	12.9	4.0	0.3	7.4	1.7	2.5	3.9
Rollag	82	62	74	81	67	74	62.3	59.3	59.9	62.2	62.7	61.6	13.4	16.5	14.3	14.4	15.1	14.6	0.2	0.0	2.1	0.4	0.0	0.8
Linkert	79	65	71	82	67	73	61.4	58.7	58.3	61.3	62.2	60.6	13.9	15.9	14.2	14.7	14.9	14.6	0.0	0.0	0.0	0.0	0.0	0.0
SY Ingmar	81	68	74	80	61	72	61.9	60.0	59.2	61.6	62.6	61.1	13.2	15.4	14.1	14.6	14.8	14.5	--	0.0	0.9	1.2	0.1	0.7
HRS 3419	93	68	83	98	87	89	59.9	57.8	58.1	60.6	61.9	60.2	11.3	13.2	12.5	12.5	12.2	12.4	--	0.0	0.6	0.0	0.0	0.2
Bolles	--	59	69	86	64	73	--	57.3	58.3	60.9	61.5	60.2	--	16.6	14.9	14.9	14.6	14.8	--	--	5.7	0.4	0.0	2.0
SY Valda	--	66	78	90	81	83	--	58.9	58.4	61.7	62.1	60.7	--	14.9	13.3	13.5	12.9	13.2	--	--	3.8	2.0	0.0	1.9
HRS 3530	--	67	80	94	77	83	--	58.3	59.8	61.7	62.3	61.3	--	15.6	13.5	13.4	14.0	13.6	--	--	7.2	2.7	0.1	3.3
HRS 3504	--	70	69	82	76	76	--	57.1	55.6	58.3	61.2	58.4	--	14.2	13.2	13.3	12.4	13.0	--	--	2.6	0.5	0.0	1.0
Shelly	--	--	82	87	73	81	--	--	58.7	61.1	62.9	60.9	--	--	13.1	13.4	13.1	13.2	--	--	--	0.3	0.1	--
ND VitPro	--	--	69	80	66	72	--	--	61.1	62.8	63.8	62.6	--	--	14.3	14.9	14.0	14.4	--	--	--	0.8	0.0	--
HRS 3616	--	--	73	86	69	76	--	--	57.8	59.7	62.4	60.0	--	--	14.8	15.1	14.5	14.8	--	--	--	2.2	0.1	--
Lang-MN	--	--	--	82	74	--	--	--	--	62.9	62.8	--	--	--	--	15.0	14.4	--	--	--	--	--	0.0	--
WB9590	--	--	--	84	70	--	--	--	--	60.9	62.6	--	--	--	--	13.9	14.4	--	--	--	--	--	0.1	--
WB9479	--	--	--	83	60	--	--	--	--	61.5	62.9	--	--	--	--	14.4	16.0	--	--	--	--	--	0.1	--
LCS Rebel	--	--	--	84	71	--	--	--	--	62.5	63.3	--	--	--	--	13.7	13.2	--	--	--	--	--	1.7	--
MS Camaro	--	--	--	86	64	--	--	--	--	59.9	62.2	--	--	--	--	12.7	13.8	--	--	--	--	--	1.1	--
WB9719	--	--	--	--	68	--	--	--	--	--	64.3	--	--	--	--	--	14.0	--	--	--	--	--	--	--
LCS Trigger	--	--	--	--	83	--	--	--	--	--	62.4	--	--	--	--	--	10.9	--	--	--	--	--	--	--
MS Barracuda	--	--	--	--	70	--	--	--	--	--	62.7	--	--	--	--	--	13.6	--	--	--	--	--	--	--
TCG-Climax	--	--	--	--	67	--	--	--	--	--	63.5	--	--	--	--	--	15.0	--	--	--	--	--	--	--
TCG-Spitfire	--	--	--	--	74	--	--	--	--	--	61.4	--	--	--	--	--	14.1	--	--	--	--	--	--	--
HRS 3888	--	--	--	--	73	--	--	--	--	--	61.6	--	--	--	--	--	13.1	--	--	--	--	--	--	--
SY Rowyn	85	63	76	89	--	--	61.5	58.0	58.3	60.9	--	--	12.0	15.4	13.3	13.6	--	--	3.6	0.3	5.0	2.3	2.1	3.1
SY Soren	84	55	76	82	--	--	61.5	58.1	58.9	61.4	--	--	13.6	15.9	13.9	14.5	--	--	0.0	0.2	1.1	1.8	0.2	1.0
WB Mayville	77	56	65	83	--	--	61.4	57.0	57.1	61.3	--	--	13.3	15.0	14.2	14.4	--	--	0.1	0.0	0.4	0.2	0.0	0.2
Elgin-ND	83	56	77	90	--	--	61.4	56.4	59.1	61.9	--	--	12.2	15.5	13.6	14.3	--	--	4.1	0.5	6.5	0.4	2.3	3.1
LCS Breakaway	85	57	75	83	--	--	62.9	58.0	60.0	62.2	--	--	13.1	15.6	13.6	13.9	--	--	2.4	0.0	4.3	1.0	0.1	1.8
Boost	--	--	69	86	--	--	--	--	58.2	61.2	--	--	--	--	14.2	14.1	--	--	--	--	--	2.5	0.0	--
Surpass	--	--	73	89	--	--	--	--	57.8	60.1	--	--	--	--	13.0	14.5	--	--	--	--	--	4.6	0.7	--
LCS Prime	--	--	76	94	--	--	--	--	59.1	62.0	--	--	--	--	12.6	12.5	--	--	--	--	--	2.6	0.5	--
HRS 3100	--	--	71	83	--	--	--	--	56.4	59.9	--	--	--	--	13.0	13.2	--	--	--	--	--	0.9	0.0	--
MS Chevelle	--	--	--	88	--	--	--	--	--	59.4	--	--	--	--	--	12.9	--	--	--	--	--	--	0.8	--
Prevail	84	65	79	--	--	--	60.8	57.5	57.9	--	--	--	13.2	14.7	13.3	--	--	--	--	2.7	6.3	2.5	--	--
HRS 3361	85	66	72	--	--	--	60.6	57.1	57.0	--	--	--	12.2	13.8	12.9	--	--	--	--	0.0	2.1	1.3	--	--
WB9507	92	59	80	--	--	--	60.6	54.2	57.1	--	--	--	11.7	15.5	12.5	--	--	--	--	0.0	7.1	2.1	--	--
Focus	--	62	69	--	--	--	--	59.2	59.8	--	--	--	--	15.4	13.2	--	--	--	--	--	5.8	3.5	--	--
WB9653	--	69	70	--	--	--	--	57.0	55.7	--	--	--	--	14.0	12.7	--	--	--	--	--	2.3	0.4	--	--
LCS Anchor	--	--	61	--	--	--	--	--	57.3	--	--	--	--	--	14.3	--	--	--	--	--	--	0.8	--	--
TCG-Cornerstone	--	--	60	--	--	--	--	--	57.9	--	--	--	--	--	14.2	--	--	--	--	--	--	0.4	--	--
Barlow	81	59	--	--	--	--	62.2	59.0	--	--	--	--	13.1	15.6	--	--	--	--	2.2	1.8	5.7	--	--	--
LCS Iguacu	91	71	--	--	--	--	61.6	59.6	--	--	--	--	10.9	12.7	--	--	--	--	--	0.1	4.0	--	--	--
LCS Nitro	94	65	--	--	--	--	60.9	56.7	--	--	--	--	10.9	13.8	--	--	--	--	--	0.3	3.7	--	--	--
Trial Mean	86	62	74	86	72		61.6	57.9	58.4	61.2	62.5		12.5	15.2	13.5	13.9	13.8		2.2	0.5	4.4	1.5	0.5	
C.V. %	4.2	9.6	4.9	4.8	8.5		0.5	1.4	0.9	0.9	0.7		4.2	2.6	2.3	2.6	5.4		91.5	110	28.3	87.9	190	
LSD 5%	5.0	8.4	5.1	5.8	8.6		0.4	1.1	0.8	0.8	0.6		0.7	0.6	0.5	0.5	1.1		2.8	0.8	1.7	1.9	1.2	
LSD 10%	4.2	7.0	4.3	4.8	7.2		0.4	0.9	0.7	0.7	0.5		0.6	0.5	0.4	0.4	0.9		2.3	0.7	1.5	1.5	1.0	

Durum Summary, Langdon 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Lodging (0-9)					Height (in)					Days to Head				
Variety	**14**	**15**	**16**	**17**	**18**	**5yr**	**14**	**15**	**16**	**17**	**18**	**5yr**	**11**	**15**	**16**	**17**	**4yr**	**15**	**16**	**17**	**18**	**4yr**	**15**	**16**	**17**	**18**	**4yr**
AC Commander	88	59	45	70	75	67	60.7	57.7	52.5	57.8	61.0	57.9	0.0	1.0	3.8	1.8	1.7	30	35	37	28	33	64	62	61	53	60
Alkabo	85	70	51	71	81	72	62.2	61.6	56.6	61.0	61.4	60.6	0.7	0.5	5.8	1.3	2.1	39	39	43	35	39	64	62	61	56	61
Ben	80	72	45	66	76	68	62.8	61.7	55.3	60.3	62.3	60.5	0.4	2.3	6.2	4.0	3.2	40	41	46	36	41	64	62	60	52	60
Grenora	86	77	41	69	87	72	62.1	61.3	54.2	59.7	62.1	59.9	1.1	0.8	6.7	5.8	3.6	37	39	43	33	38	63	62	60	52	59
Lebsock	79	72	53	78	77	72	62.6	61.7	57.2	61.3	63.0	61.2	0.3	3.8	5.7	3.8	3.4	38	40	45	33	39	63	61	60	52	59
Maier	83	74	37	77	80	70	62.0	61.5	53.7	60.5	61.5	59.8	0.2	0.5	5.0	4.8	2.6	37	38	44	33	38	63	62	61	52	60
Mountrail	87	80	38	81	87	75	61.8	60.7	54.4	60.0	62.3	59.8	0.1	2.0	7.2	5.0	3.6	39	41	44	34	40	64	63	60	52	60
Pierce	82	73	41	76	91	73	62.3	61.9	56.7	61.5	62.7	61.0	0.4	3.0	6.6	5.3	3.8	39	43	46	35	41	63	62	60	52	59
Strongfield	85	65	33	63	77	65	60.6	59.6	53.2	58.9	61.5	58.8	0.2	3.8	6.4	4.5	3.7	39	39	43	33	39	64	62	61	52	60
Tioga	84	76	37	70	89	71	61.9	61.5	53.2	60.3	62.2	59.8	1.2	0.3	6.4	6.0	3.5	41	41	48	37	42	64	63	61	54	61
Carpio	79	85	43	79	93	76	60.6	61.3	55.6	61.7	62.6	60.4	0.0	1.0	7.6	6.5	3.8	39	40	45	36	40	66	63	62	54	61
Alzada	80	61	37	47	55	56	57.7	57.6	51.4	55.3	59.9	56.4	0.3	0.0	3.0	0.3	0.9	30	34	36	28	32	61	57	56	52	57
Joppa	86	82	43	75	90	75	61.9	61.3	55.4	60.5	62.3	60.3	0.7	0.5	6.9	6.8	3.7	40	40	44	35	40	64	64	61	52	60
Divide	84	78	35	78	89	73	61.4	61.0	53.6	60.7	61.6	59.7	0.3	1.8	6.9	6.3	3.8	40	41	47	37	41	64	64	61	54	61
CDC Verona	76	70	36	72	80	67	60.7	59.8	55.5	60.8	61.7	59.7	0.4	0.8	5.7	6.0	3.2	37	41	45	34	39	64	64	62	53	61
Rugby	74	66	32	61	76	62	62.1	61.4	54.3	60.2	61.8	60.0	0.3	4.0	7.0	8.0	4.8	42	42	48	38	43	62	61	60	53	59
VT Peak	81	75	55	85	82	75	62.6	62.5	58.6	62.4	62.4	61.7	--	0.5	4.3	4.3	--	38	40	45	34	39	64	62	60	52	60
ND Grano	84	80	41	78	84	73	61.7	61.4	55.6	61.0	62.1	60.4	--	0.8	6.4	5.0	--	40	40	45	34	40	65	64	62	54	61
ND Riveland	86	78	53	88	89	79	61.6	61.3	56.4	61.5	62.0	60.6	--	1.8	5.9	3.3	--	40	43	46	36	41	64	63	61	53	60
TCG Webster	--	--	--	--	69	--	--	--	--	--	62.0	--	--	--	--	--	--	--	--	--	27	--	--	--	--	50	--
AC Navigator	84	52	35	69	--	--	61.3	58.0	52.9	59.9	--	--	0.5	0.8	4.1	2.8	2.1	29	35	41	--	--	63	60	61	--	--
Trial Mean	83	73	40	74	84		61.7	61.2	55.1	60.7	62.2		0.6	1.7	6.1	5.9		38	40	45	35		64	63	62	53	
C.V. %	4.2	7.5	11.1	7.0	8.4		1.2	1.0	1.5	1.1	0.8		168	114	14.9	31.8		5.1	4.1	4.0	5.1		1.4	1.1	1.6	2.9	
LSD 5%	4.9	7.6	6.3	7.2	9.8		1.0	0.9	1.2	0.9	0.7		1.4	NS	1.3	2.6		2.7	2.3	2.5	2.5		1.2	0.9	1.4	2.2	
LSD 10%	4.1	6.4	5.3	6.0	8.2		0.9	0.7	1.0	0.8	0.6		--	2.2	1.1	2.2		2.3	1.9	2.1	2.1		1.0	0.8	1.2	1.8	

2016 trial was severely damaged by Fusarium head blight.

Durum Summary, Towner County 2013-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Height (in)					Days to Head				
Variety	**13**	**14**	**15**	**16**	**18**	**3yr**	**13**	**14**	**15**	**16**	**18**	**3yr**	**14**	**15**	**16**	**18**	**3yr**	**14**	**15**	**16**	**18**	**3yr**
Alkabo	74	52	52	73	65	63	61.0	56.2	59.8	58.6	61.8	60.1	40	33	38	37	36	58	64	61	57	61
Tioga	79	50	57	63	68	63	60.5	55.1	59.1	54.8	61.6	58.5	42	37	41	37	38	59	66	61	57	61
Divide	73	51	61	64	62	62	59.8	55.6	59.7	56.2	61.5	59.1	42	36	39	37	37	59	65	62	58	62
Carpio	75	55	62	70	62	65	61.2	56.1	60.7	58.9	61.9	60.5	41	37	39	36	37	60	66	63	57	62
Joppa	85	56	60	73	69	67	60.7	55.4	59.9	56.8	62.0	59.6	40	35	37	35	36	60	64	61	57	61
ND Grano	--	--	--	71	67	--	--	--	--	58.2	62.6	--	--	--	39	35	--	--	--	63	56	--
ND Riveland	--	--	--	79	74	--	--	--	--	58.5	61.4	--	--	--	40	36	--	--	--	62	56	--
Lebsock	68	58	61	--	--	--	61.0	56.5	62.7	--	--	--	39	35	--	--	--	55	63	--	--	--
Grenora	80	--	--	--	--	--	59.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trial Mean	76	54	59	72	67		60.5	55.8	60.3	57.7	61.8		41	35	39	36		59	64	62	57	
C.V. %	6.0	9.4	9.2	4.5	7.9		0.6	1.4	3.2	1.9	0.8		3.1	4.5	2.8	4.6		1.5	2.3	1.4	1.2	
LSD 5%	6.7	NS	NS	4.7	7.8		0.5	NS	NS	1.6	0.7		1.9	2.4	1.6	NS		1.3	2.3	NS	1.0	
LSD 10%	5.5	NS	NS	3.9	6.5		0.4	NS	NS	1.3	0.6		1.5	2.0	1.3	NS		1.1	1.9	1.1	0.8	

Rye, Langdon 2018

Variety	Winter Survival	Julian Days to Head	Plant Height (in)	Lodging (0-9)	Test Weight (lbs/bu)	Yield (bu/a)	2 yr Avg Yield (bu/a)	3 yr Avg Yield (bu/a)
Aroostok	96	147	45	1.8	54.6	49.7	54.1	54.6
Dacold	99	157	43	1.8	53.9	65.0	70.1	72.3
Hancock	91	153	41	0.5	55.2	56.4	67.3	70.2
ND Dylan	100	153	44	1.8	55.5	70.7	82.7	83.2
Rymin	99	154	42	0.8	56.8	72.8	81.3	76.1
Spooner	81	153	41	1.0	55.1	54.4	62.3	64.0
Brasetto	99	154	45	1.3	54.7	88.7	113.6	--
Hazlet	98	155	45	0.8	56.7	65.7	81.1	--
Wheeler	99	157	37	0.5	52.3	39.8	45.7	--
Trial Mean	96	153	42	1.1	54.9	61.9		
C.V. %	5.1	0.7	8.2	76.3	0.9	7.8		
LSD 5%	7.0	1.5	5.0	NS	0.7	7.0		
LSD 10%	5.8	1.3	4.2	NS	0.6	5.8		

HRWW Summary, Langdon 2014-2017*

	Yield (bu/a)					Test Weight (lbs/bu)					Winter Survival	Julian Days to Head	Height (in)	Lodging (0-9)	Protein (%)				
Variety	**14**	**15**	**16**	**17**	**3yr**	**14**	**15**	**16**	**17**	**3yr**	**17**	**17**	**17**	**17**	**14**	**15**	**16**	**17**	**3yr**
AC Broadview	78	76	87	25	63	59.6	58.9	56.8	43.9	53.2	97	163	39	0.0	12.4	11.3	10.1	11.6	11.0
AC Emerson	76	85	86	90	87	59.9	62.0	59.3	60.2	60.5	99	164	40	0.0	12.3	11.8	10.9	11.9	11.5
Accipiter	74	73	75	43	64	59.8	59.7	56.3	51.8	55.9	97	166	40	0.0	10.7	11.8	10.5	11.2	11.2
Decade	73	84	74	28	62	60.9	61.3	54.2	45.5	53.7	100	163	37	0.0	13.8	12.0	10.6	12.2	11.6
Flourish	69	75	90	75	80	60.5	59.1	57.4	54.9	57.1	98	163	38	0.0	12.2	11.9	11.3	11.5	11.6
Ideal	68	80	74	16	57	60.7	60.9	56.2	44.3	53.8	100	164	39	0.3	11.1	11.3	10.4	12.4	11.4
Jerry	72	76	65	17	52	60.2	59.7	56.0	46.7	54.1	97	165	42	0.0	13.3	12.0	10.7	12.9	11.9
Lyman	72	84	81	35	67	59.9	61.2	58.1	47.3	55.5	89	162	40	0.0	13.7	11.6	11.6	12.7	12.0
Moats	75	77	83	96	85	59.6	59.7	59.8	60.6	60.0	99	164	43	0.0	12.9	11.7	11.8	12.3	11.9
Overland	69	90	88	44	74	60.8	61.2	58.1	51.1	56.8	100	163	43	0.0	13.1	10.9	10.8	11.5	11.1
Peregrine	76	78	81	80	80	60.3	60.7	58.8	57.0	58.8	100	165	45	0.0	12.0	11.0	10.8	10.8	10.9
SY Wolf	72	84	92	67	81	61.1	61.6	58.7	53.3	57.9	95	163	39	0.0	12.8	11.4	11.3	12.5	11.7
WB Matlock	76	70	73	20	54	60.6	60.6	57.1	47.3	55.0	99	166	40	0.0	12.2	12.2	10.9	12.9	12.0
AC Gateway	71	79	88	59	75	59.2	61.3	56.5	53.6	57.1	99	164	39	0.0	13.5	12.3	11.3	12.3	12.0
CDC Chase	--	85	90	96	90	--	61.6	59.9	60.3	60.6	99	164	44	0.0	--	11.2	11.6	12.1	11.6
Northern	--	84	93	83	86	--	59.8	54.0	55.0	56.3	100	164	40	0.0	--	11.7	11.3	11.6	11.5
Redfield	--	79	82	53	71	--	60.5	58.0	50.7	56.4	98	162	38	0.8	--	11.5	11.1	12.2	11.6
Loma	--	--	76	72	--	--	--	52.9	53.7	--	91	166	37	0.0	--	--	10.9	11.9	--
Ruth	--	--	81	85	--	--	--	56.9	56.1	--	99	162	40	0.0	--	--	10.7	11.2	--
SY Monument	--	--	98	81	--	--	--	56.5	54.4	--	94	163	38	0.0	--	--	11.1	12.1	--
SY Sunrise	--	--	100	86	--	--	--	57.3	56.6	--	93	163	34	0.0	--	--	11.2	11.6	--
WB4614	--	--	88	57	--	--	--	52.6	54.7	--	99	164	38	0.0	--	--	11.5	12.5	--
Oahe	--	--	--	105	--	--	--	--	60.7	--	99	162	42	0.3	--	--	--	11.3	--
Keldin	--	--	--	84	--	--	--	--	56.8	--	98	163	40	0.0	--	--	--	11.2	--
Trial Mean	--	80	80	63		--	59.8	56.8	53.3		97	164	40	0.0	--	11.7	11.2	11.9	
C.V. %	--	7.2	8.6	9.8		--	1.0	1.9	2.7		6.3	0.5	3.9	672.4	--	2.8	3.0	3.2	
LSD 5%	5.3	8.1	11.3	8.7		1.1	0.8	1.8	2.0		NS	1.3	2.2	NS	0.9	0.5	0.5	0.5	
LSD 10%	--	6.7	9.5	7.2		--	0.7	1.5	1.7		NS	1.1	1.8	NS	--	0.4	0.5	0.4	

Fungicides were used in 2014-2015 but not in 2016-2017.

Severe stripe rust infections resulted in reduced yields in susceptible varieties in 2017.

*** The 2018 trial was lost due to winter kill.**

HRWW Disease Summary, Langdon 2017*

Variety	Stripe Rust % Incidence	Stripe Rust % Severity	Powdery Mildew % Incidence	Powdery Mildew % Severity	DON (ppm)	Yield (bu/a)	Test Weight (lbs/bu)
Jerry	86	36	1	2	0.2	16.6	46.7
Decade	78	13	3	8	0.0	27.9	45.5
Lyman	89	29	0	0	0.3	35.0	47.3
Ideal	100	58	1	3	0.0	16.3	44.3
Overland	75	7	4	7	0.0	44.1	51.1
SY Wolf	34	8	2	3	0.2	66.9	53.3
WB Matlock	99	55	1	2	0.1	19.7	47.3
Peregrine	23	3	3	13	0.0	79.5	57.0
Accipiter	69	12	1	2	0.2	42.7	51.8
Moats	7	1	0	0	0.0	96.3	60.6
Flourish	30	5	3	3	0.0	74.5	54.9
AC Broadview	100	42	4	22	0.0	25.2	43.9
AC Emerson	7	1	3	8	0.0	89.8	60.2
AC Gateway	48	8	5	15	0.0	59.1	53.6
CDC Chase	10	2	3	3	0.0	96.1	60.3
Redfield	79	11	3	10	0.0	53.1	50.7
Ruth	27	5	3	9	0.2	85.4	56.1
WB4614	53	8	2	2	0.5	57.4	54.7
SY Monument	5	1	1	2	0.4	80.7	54.4
SY Sunrise	12	2	2	3	0.5	86.2	56.6
Northern	60	6	4	10	0.5	83.0	55.0
Loma	50	3	2	2	0.6	72.3	53.7
Oahe	8	1	4	3	0.0	105.1	60.7
Keldin	39	3	3	5	0.4	83.9	56.8
Trial Mean	50	13	2	6	0.2	62.6	53.3
C.V. %	26	73	130	181	90.4	9.8	2.7
LSD 5%	21	15	NS	NS	0.3	8.7	2.0

Severe stripe rust infections resulted in reduced yields and low test weight in susceptible varieties.

*** The 2018 trial was lost due to winter kill.**

Corn Grain, Langdon 2018

Brand	Hybrid	RM[1]	Hybrid Traits[1]	Days to Silk	Harvest Moisture	Test Weight	Yield	
							2018	2yr
					(%)	(lbs/bu)	------bu/a------	
Allegiant	7404 VT2P	74	RR2, VT2P	71	28.1	56.1	96.0	125.1
Allegiant	7868 VT2P	78	RR2, VT2P	75	29.8	52.4	109.0	144.3
Allegiant	7914 VT2P	79	RR2, VT2P	73	29.8	54.9	130.2	--
Channel	176-02VT2PRIB	76	RR2, VT2P	71	30.0	54.0	115.3	--
Channel	182-09VT2PRIB	81	RR2, VT2P	73	30.4	52.9	126.7	--
Hefty	H2802VT2P	78	RR2, VT2P, B	73	30.9	52.6	113.7	--
Hefty	H2922VT2P	79	RR2, VT2P, B	69	30.3	54.0	127.6	--
Hefty	H3022VT2P	80	RR2, VT2P, B	73	31.4	53.3	140.8	--
Integra	2508R	75	RR2	71	30.1	55.8	78.0	115.6
Integra	2601 VT2PRIB	76	RR2, VT2P	70	30.4	54.3	107.0	141.3
Integra	2803 VT2PRIB	78	RR2, VT2P	73	31.1	52.0	105.4	131.8
Integra	CX801079	80	RR2	70	31.6	53.6	119.8	--
Legacy	L-1713 RR2	77	RR2, VT2P	73	29.2	53.6	108.6	148.7
Legacy	L-1746 VT2P	75	RR2, VT2P	74	30.9	53.4	117.3	143.7
Legacy	L-1814 VT2P	78	RR2, VT2P	73	29.3	55.1	124.0	154.5
Legacy	L-2213 VT2PRO	80	RR2, VT2P	71	31.1	54.0	125.6	146.8
NuTech/G2	5F-379	79	RR2, LL, AM	71	29.6	51.9	124.3	154.2
NuTech/G2	5F-775	75	RR2, LL, AM	70	30.1	51.5	119.7	154.6
NuTech/G2	E5BN-A978	78	GT, LL, 3010	72	33.0	51.3	132.2	--
NuTech/G2	E5GN-A278	78	RR2, LL, AM	74	34.9	51.8	131.0	--
Peterson	71D83	81	RR2	71	34.5	52.6	126.0	150.3
Pioneer	P7227R	72	RR2	69	25.2	53.3	123.9	154.7
Pioneer	P7332R	73	RR2	68	26.4	53.3	112.8	145.8
Proseed	1378	78	RR2, VT2P	73	30.9	53.0	119.9	147.6
Proseed	1480	80	RR2, VT2P	73	31.0	54.3	128.7	158.7
Proseed	1879	79	RR2	72	32.1	53.3	135.9	--
REA	1B720	72	RR2, VT2Pro	69	24.8	57.0	109.3	--
REA	1B780	79	RR2, VT2Pro	72	30.9	52.8	134.5	--
REA	1B811	81	RR2, VT2Pro	74	30.4	53.5	116.3	--
Thunder	4578 RR	78	RR2, VT2P	72	29.2	53.9	105.8	143.3
Thunder	6782 VT2P	81	RR2	73	32.1	53.2	128.1	--
Thunder	6874 VT2P	74	RR2, VT2P	70	29.1	56.6	105.0	128.0
Thunder	6880 VT2P	80	RR2, VT2P	73	29.5	55.0	125.2	--
Trial Mean				72	30.2	53.7	118.6	
C.V. %				1.7	4.3	1.5	8.6	
LSD 5%				2.0	2.1	1.3	16.6	
LSD 10%				1.7	1.8	1.1	13.9	

[1]Relative maturity and hybrid traits as submitted by the company.

Yield reported at 15.5% moisture.

Barley Summary, Langdon 2014-2018

	Height (in)						Protein (%)						Days to Head					
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**
Lacey	33	37	32	41	28	34	12.2	13.5	13.9	12.7	14.3	13.6	52	61	54	55	50	53
Stellar-ND	33	37	34	40	25	33	12.3	12.7	13.3	12.5	13.2	13.0	52	61	54	56	50	53
Tradition	33	39	34	38	27	33	12.0	12.8	13.9	12.9	14.3	13.7	52	60	55	56	50	54
Celebration	33	37	32	39	28	33	12.9	14.3	13.9	13.7	15.2	14.3	53	61	55	56	50	54
Quest	34	37	33	39	27	33	12.2	12.8	13.0	13.5	14.1	13.5	52	61	55	57	50	54
Innovation	32	36	32	40	25	32	13.0	13.6	13.5	13.5	14.7	13.9	50	60	55	56	51	54
Pinnacle*	33	37	34	39	27	33	11.5	12.1	12.5	12.0	12.8	12.4	53	61	55	57	51	54
ND Genesis*	32	36	30	38	29	32	11.8	11.0	10.9	11.3	11.9	11.4	54	61	57	57	51	55
AAC Synergy*	--	--	31	37	29	32	--	--	11.9	11.9	13.1	12.3	--	--	58	58	52	56
Sirish*	--	--	30	33	26	30	--	--	13.0	11.9	13.4	12.8	--	--	60	60	53	58
ABI Balster*	--	--	31	35	28	31	--	--	12.8	12.4	13.4	12.9	--	--	59	59	51	56
ABI Growler*	--	--	32	36	26	31	--	--	12.4	13.1	13.4	13.0	--	--	60	59	54	58
LCS Genie*	--	--	29	32	25	29	--	--	12.4	11.0	12.9	12.1	--	--	62	61	54	59
Explorer*	--	--	--	32	24	--	--	--	--	11.5	13.4	--	--	--	--	58	50	--
Conlon	30	37	--	--	27	--	12.4	12.8	--	--	13.8	--	48	56	--	--	47	--
CDC Meredith*	--	36	31	36	--	--	--	12.9	12.2	12.3	--	--	--	65	59	60	--	--
LCS Odyssey*	--	--	31	33	--	--	--	--	12.0	10.7	--	--	--	--	61	61	--	--
Rawson*	32	37	33	--	--	--	11.7	12.1	12.2	--	--	--	50	58	54	--	--	--
AC Metcalfe*	29	37	--	--	--	--	12.6	13.2	--	--	--	--	54	62	--	--	--	--
CDC Copeland*	32	40	--	--	--	--	12.2	12.3	--	--	--	--	56	66	--	--	--	--
Conrad*	27	34	--	--	--	--	12.7	13.3	--	--	--	--	55	64	--	--	--	--
Trial Mean	32	37	32	37	26		12.1	12.3	12.5	12.3	13.4		52	61	56	57	51	
C.V. %	4.1	3.9	6.4	5.8	6.3		4.6	2.6	5.3	4.6	3.4		1.7	1.2	1.3	1.4	2.1	
LSD 5%	1.9	2.1	2.9	3.0	2.3		0.8	0.4	0.9	0.8	0.6		1.3	1.1	1.0	1.1	1.5	
LSD 10%	1.6	1.7	2.4	2.5	2.0		0.7	0.4	0.8	0.7	0.5		1.1	0.9	0.8	0.9	1.3	

*2-row

Conlon suffered damage from rodents in 2016 and 2017. Data is not presented.

Barley Summary, Langdon 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Lodging (0-9)			Plump (%)					
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**16**	**17**	**2yr**	**14**	**15**	**16**	**17**	**18**	**3yr**
Lacey	134	128	116	135	133	128	52.1	51.1	46.9	49.4	50.4	48.9	0.6	0.3	0.5	99	97	91	94	98	94
Stellar-ND	142	129	104	131	135	123	50.9	49.6	48.8	48.8	48.8	48.8	0.0	0.0	0.0	99	97	95	97	98	97
Tradition	133	131	108	122	131	121	51.9	49.8	46.8	48.8	49.8	48.5	1.1	2.3	1.7	98	96	89	94	96	93
Celebration	144	130	111	128	128	122	51.9	49.6	47.1	47.7	49.5	48.1	2.5	4.5	3.5	98	97	92	91	98	94
Quest	130	124	107	115	126	116	50.3	49.4	45.9	47.2	49.6	47.6	0.6	5.5	3.1	96	92	85	82	94	87
Innovation	138	128	113	121	118	117	51.8	50.2	46.3	48.6	49.9	48.3	0.0	2.5	1.3	99	97	91	93	98	94
Pinnacle*	138	132	106	133	130	123	53.9	51.9	47.9	50.8	52.0	50.2	0.9	0.0	0.5	98	97	96	98	99	98
ND Genesis*	128	125	105	129	139	124	52.6	50.5	47.3	49.1	50.4	48.9	3.1	0.0	1.6	98	96	96	96	97	96
AAC Synergy*	--	--	113	131	147	130	--	--	48.0	49.5	51.2	49.6	2.9	3.5	3.2	--	--	94	94	97	95
Sirish*	--	--	88	126	126	113	--	--	44.1	48.7	48.9	47.2	3.5	0.3	1.9	--	--	85	95	97	92
ABI Balster*	--	--	92	117	142	117	--	--	43.7	46.4	50.5	46.9	6.6	3.3	5.0	--	--	84	85	93	87
ABI Growler*	--	--	94	118	133	115	--	--	45.4	45.7	50.6	47.2	5.4	3.8	4.6	--	--	84	82	97	88
LCS Genie*	--	--	77	116	128	107	--	--	43.5	47.9	51.0	47.5	3.2	0.3	1.8	--	--	83	93	95	90
Explorer*	--	--	--	131	125	--	--	--	--	47.7	51.0	--	--	0.0	--	--	--	--	91	96	--
Conlon	126	111	--	--	111	--	52.4	51.9	--	--	51.7	--	--	--	--	99	96	--	--	98	--
CDC Meredith*	--	116	90	114	--	--	--	48.6	44.7	46.9	--	--	8.0	4.3	6.2	--	92	86	89	--	--
LCS Odyssey*	--	--	71	129	--	--	--	--	39.9	47.3	--	--	5.5	0.8	3.2	--	--	82	95	--	--
Rawson*	122	124	107	--	--	--	52.1	49.0	46.8	--	--	--	1.2	--	--	99	97	97	--	--	--
AC Metcalfe*	125	120	--	--	--	--	53.3	51.4	--	--	--	--	--	--	--	97	95	--	--	--	--
CDC Copeland*	127	122	--	--	--	--	50.9	49.1	--	--	--	--	--	--	--	97	91	--	--	--	--
Conrad*	125	120	--	--	--	--	52.7	50.4	--	--	--	--	--	--	--	98	94	--	--	--	--
Trial Mean	131	125	100	124	130		51.8	50.2	46.4	48.4	50.1		2.8	1.7		98	95	91	93	96	
C.V. %	3.6	5.3	6.4	6.3	6.0		1.2	1.2	2.6	1.7	2.3		61.8	122		0.7	1.8	4.2	3.4	1.5	
LSD 5%	6.7	9.4	9.1	11.1	11.0		0.9	0.9	1.7	1.2	1.6		2.4	2.8		0.9	2.5	5.4	4.4	2.0	
LSD 10%	5.5	7.8	7.6	9.3	9.2		0.7	0.7	1.4	1.0	1.4		2.0	2.4		0.8	2.1	4.5	3.7	1.7	

*2-row

Conlon suffered damage from rodents in 2016 and 2017. Data is not presented.

Oat Summary, Langdon 2014-2018

	Height (in)						Protein (%)						Lodging (0-9)				
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**12**	**15**	**16**	**17**	**3yr**
AC Pinnacle	44	48	44	51	40	45	10.6	8.1	7.9	8.5	11.9	9.4	2.0	1.5	5.5	6.7	4.6
Beach	47	51	47	53	35	45	10.4	10.6	9.5	10.1	13.3	11.0	0.0	0.4	4.0	3.4	2.6
CDC Dancer	45	48	44	52	36	44	8.6	8.1	7.9	7.9	9.9	8.6	0.0	1.3	5.7	5.0	4.0
HiFi	44	47	43	52	36	44	9.7	9.5	8.6	10.2	11.5	10.1	1.7	2.6	5.5	3.4	3.8
Hytest	45	50	45	51	37	44	10.3	13.2	11.4	12.8	14.2	12.8	3.4	4.7	7.2	4.3	5.4
Killdeer	39	44	40	46	32	39	11.2	9.3	8.2	9.3	11.5	9.7	2.0	2.6	5.5	5.2	4.4
Otana	46	50	42	51	38	44	16.0	9.7	8.4	9.7	12.3	10.1	5.9	4.1	6.7	6.1	5.6
Rockford	44	48	44	52	37	44	11.4	10.2	9.4	10.6	12.3	10.8	0.2	2.0	4.7	5.4	4.0
Souris	40	45	43	47	34	41	10.1	8.6	8.0	9.3	11.2	9.5	0.0	0.9	3.0	2.6	2.2
Stallion	45	48	43	52	38	44	8.4	12.6	10.1	10.9	12.8	11.3	5.9	1.7	8.0	5.1	4.9
CDC Minstrel	42	45	43	50	33	42	9.5	7.0	7.3	7.4	9.2	8.0	0.4	0.3	3.7	3.4	2.5
Newburg	48	50	47	55	38	47	9.5	9.1	7.7	9.3	11.4	9.5	2.6	3.2	7.5	6.3	5.7
Leggett	41	48	46	49	35	43	8.7	11.7	10.0	11.7	12.8	11.5	0.5	3.0	4.3	5.4	4.2
Jury	49	51	45	55	38	46	9.2	9.9	8.0	9.9	10.5	9.5	4.2	2.3	6.5	5.3	4.7
Paul*	46	49	43	55	38	45	8.5	15.1	13.4	13.8	17.1	14.8	--	1.0	6.0	5.0	4.0
Deon	46	48	42	52	36	43	10.2	11.8	8.7	10.0	12.7	10.5	--	0.6	4.3	3.6	2.8
Hayden	--	--	44	52	35	44	--	--	8.3	10.5	11.8	10.2	--	--	6.0	4.3	--
CS Camden	--	--	40	49	35	41	--	--	8.9	9.5	11.4	9.9	--	--	2.5	0.5	--
GM 423	--	--	44	52	--	--	--	--	8.8	9.4	--	--	--	--	5.8	6.6	--
Furlong	46	47	45	--	--	--	10.6	9.9	9.1	--	--	--	1.2	0.9	3.2	--	--
Goliath	52	52	45	--	--	--	12.9	10.9	9.1	--	--	--	--	0.3	5.3	--	--
Trial Mean	44	48	43	52	37		10.4	--	--	--	--		1.4	1.8	5.1	4.4	
C.V. %	3.4	3.2	6.3	2.7	4.3		--	--	--	--	--		129	81.7	35.2	37.6	
LSD 5%	2.1	2.2	3.8	1.9	2.6		--	--	--	--	--		2.6	2.1	2.5	2.3	
LSD 10%	1.8	1.8	3.2	1.6	2.1		--	--	--	--	--		2.2	1.8	2.1	2.0	

*Naked-hull variety.

Oat Summary, Langdon 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Days to Head					
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**
AC Pinnacle	180	177	151	191	184	175	38.9	36.9	34.9	37.6	40.9	37.8	58	66	63	62	52	59
Beach	138	174	146	201	164	170	42.3	40.8	37.0	41.2	41.6	39.9	55	63	61	60	51	57
CDC Dancer	175	176	132	192	182	169	38.5	39.4	36.3	39.5	41.0	38.9	56	64	61	61	52	58
HiFi	171	159	139	191	179	170	40.1	37.2	35.8	40.9	40.8	39.2	56	64	62	60	52	58
Hytest	127	139	102	142	139	128	42.0	41.8	38.5	41.5	42.5	40.8	54	63	57	56	51	55
Killdeer	178	161	154	192	192	179	39.4	37.7	35.9	38.6	39.8	38.1	55	62	58	58	51	56
Otana	144	135	100	185	192	159	39.2	34.8	34.3	37.9	41.0	37.7	57	64	62	61	53	59
Rockford	152	149	125	192	178	165	41.3	38.4	36.8	42.5	41.7	40.3	56	64	63	60	52	58
Souris	184	138	136	189	165	164	40.7	36.6	34.8	39.9	39.9	38.2	55	64	61	60	51	57
Stallion	157	160	107	169	183	153	41.9	41.2	35.9	40.9	42.1	39.6	55	64	60	60	53	58
CDC Minstrel	178	160	145	219	181	182	39.5	34.9	33.2	37.7	40.2	37.0	55	64	59	59	52	57
Newburg	176	162	139	179	178	165	40.0	37.8	33.7	40.0	40.0	37.9	55	63	60	59	52	57
Leggett	165	190	157	194	195	182	40.9	39.3	37.1	40.7	41.2	39.7	55	64	61	60	52	58
Jury	166	151	128	176	208	170	41.1	38.7	34.9	41.0	40.3	38.7	56	63	60	60	52	57
Paul*	134	127	99	165	149	137	43.9	45.1	44.2	46.2	47.4	45.9	58	65	65	63	52	60
Deon	163	186	162	204	182	182	40.5	39.2	35.5	39.9	40.4	38.6	57	65	63	61	52	59
Hayden	--	--	134	195	169	166	--	--	38.3	43.2	41.2	40.9	--	--	59	59	52	57
CS Camden	--	--	174	229	208	204	--	--	34.1	37.5	38.7	36.8	--	--	61	61	52	58
GM 423	--	--	123	193	--	--	--	--	33.5	38.6	--	--	--	--	65	62	--	--
Furlong	186	157	152	--	--	--	38.8	38.7	37.0	--	--	--	58	64	65	--	--	--
Goliath	165	171	132	--	--	--	43.8	40.4	36.2	--	--	--	56	65	63	--	--	--
Trial Mean	163	158	136	186	181		40.6	38.8	35.8	40.7	41.0		56	64	61	60	52	
C.V. %	6.8	7.6	12.4	6.6	5.8		3.3	2.0	3.1	2.4	1.1		1.2	1.1	1.5	1.1	1.2	
LSD 5%	15.5	16.9	23.8	17.2	17.2		1.9	1.1	1.5	1.3	0.7		0.9	1.0	1.3	0.9	1.0	
LSD 10%	13.0	14.2	19.9	14.4	14.3		1.6	0.9	1.3	1.1	0.6		0.8	0.9	1.1	0.8	0.8	

*Naked-hull variety.

Flax Summary, Langdon 2014-2018

	Yield (bu/a)						Test Weight (lbs/bu)						Lodging (0-9)			Height (in)						Days to Flower					
Variety	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**16**	**17**	**2yr**	**14**	**15**	**16**	**17**	**18**	**3yr**	**14**	**15**	**16**	**17**	**18**	**3yr**
Carter*	40	36	40	48	38	42	52.1	53.0	52.1	53.0	53.0	52.7	0.5	0.0	0.3	25	26	27	27	24	26	49	46	50	57	49	52
CDC Bethune	39	38	39	49	42	43	52.3	51.9	52.2	52.9	52.7	52.6	0.5	0.0	0.3	26	30	28	28	26	27	48	48	50	57	48	52
CDC Glas	43	41	41	54	43	46	51.2	50.8	50.8	51.1	51.8	51.2	0.2	0.1	0.2	26	29	26	25	27	26	51	50	51	58	49	53
CDC Sanctuary	38	41	33	54	44	44	51.5	50.7	51.0	49.7	52.4	51.0	1.7	1.2	1.5	25	28	25	26	23	25	52	49	50	58	48	52
CDC Sorrel	38	40	34	49	41	41	51.8	52.3	51.2	51.9	52.7	51.9	2.0	1.1	1.6	27	31	26	29	25	27	52	48	51	58	49	53
Nekoma	38	37	38	52	42	44	52.3	52.6	52.1	52.9	52.7	52.6	0.6	0.2	0.4	26	30	27	28	23	26	48	47	49	57	50	52
Omega*	36	36	33	46	39	39	52.4	53.1	52.2	52.5	53.4	52.7	1.0	0.4	0.7	25	26	24	26	22	24	50	47	51	57	48	52
Pembina	38	37	38	52	43	44	52.0	52.8	51.2	53.0	53.0	52.4	0.3	0.2	0.3	26	29	27	27	24	26	51	49	50	57	49	52
Prairie Blue	40	38	40	51	39	43	51.7	51.7	51.4	52.0	52.4	51.9	0.4	0.0	0.2	25	28	25	26	25	25	49	49	50	57	49	52
Prairie Sapphire	38	38	35	54	46	45	51.0	51.4	50.8	51.3	51.9	51.3	2.1	0.0	1.1	26	26	28	28	24	27	51	46	51	57	50	53
Prairie Thunder	42	37	39	53	43	45	52.0	51.5	52.2	52.2	52.4	52.3	0.4	0.1	0.3	27	30	28	29	27	28	50	49	51	57	53	54
Rahab 94	40	38	40	51	43	45	51.5	50.2	51.5	49.7	52.3	51.2	0.4	0.0	0.2	24	27	26	27	25	26	48	48	49	56	50	52
Webster	39	35	40	52	44	45	52.1	52.2	52.6	52.0	52.9	52.5	0.8	0.6	0.7	27	30	28	28	27	28	50	49	50	57	50	52
York	38	35	41	50	42	44	52.0	52.4	51.7	52.2	52.5	52.1	0.3	0.0	0.2	25	30	26	27	25	26	48	49	49	56	48	51
Bison	39	37	37	49	40	42	52.2	52.0	52.2	52.3	52.7	52.4	0.3	0.1	0.2	26	29	28	28	25	27	48	46	50	57	49	52
Gold ND*	37	36	38	52	43	44	52.2	52.3	52.1	52.2	53.1	52.5	0.7	0.1	0.4	27	30	26	28	27	27	50	50	52	57	52	54
CDC Neela	39	39	37	46	38	40	51.9	51.9	51.4	52.4	52.4	52.1	1.6	0.0	0.8	25	28	26	26	23	25	52	48	50	57	49	52
ND Hammond	--	--	--	49	39	--	--	--	--	51.1	52.5	--	--	0.0	--	--	--	--	26	25	--	--	--	--	56	48	--
Prairie Grande	35	37	42	50	--	--	51.4	51.0	51.6	52.3	--	--	0.8	0.0	0.4	22	27	25	27	--	--	47	46	49	55	--	--
Shape	38	40	44	53	--	--	51.3	51.4	51.4	52.3	--	--	0.0	0.0	0.0	25	27	28	27	--	--	49	45	50	56	--	--
CDC Plava	--	--	31	46	--	--	--	--	51.4	50.7	--	--	4.0	0.0	2.0	--	--	25	24	--	--	--	--	49	56	--	--
CDC Arras	40	37	--	--	--	--	51.8	51.9	--	--	--	--	--	--	--	26	30	--	--	--	--	49	47	--	--	--	--
Hanley	37	37	--	--	--	--	52.0	52.2	--	--	--	--	--	--	--	25	30	--	--	--	--	48	48	--	--	--	--
Lightning	38	35	--	--	--	--	52.3	52.1	--	--	--	--	--	--	--	27	28	--	--	--	--	48	48	--	--	--	--
Linott	39	35	--	--	--	--	52.2	51.9	--	--	--	--	--	--	--	25	30	--	--	--	--	49	48	--	--	--	--
McGregor	40	39	--	--	--	--	51.7	51.8	--	--	--	--	--	--	--	25	29	--	--	--	--	49	48	--	--	--	--
Neche	38	37	--	--	--	--	52.2	52.5	--	--	--	--	--	--	--	27	30	--	--	--	--	48	47	--	--	--	--
Trial Mean	39	37	38	51	42		51.9	51.9	51.7	52.0	52.6		0.8	0.2		26	29	27	27	25		50	48	50	57	50	
C.V. %	7.9	5.7	7.3	6.6	7.9		0.5	1.0	0.8	1.8	0.5		124	340		4.2	4.8	6.3	5.0	6.2		2.2	1.1	1.7	0.8	2.2	
LSD 5%	NS	3.0	4.0	4.7	NS		0.4	0.7	0.6	1.3	0.4		1.5	1.1		1.5	1.9	2.4	1.9	2.5		1.5	0.7	1.2	0.7	1.8	
LSD 10%	NS	2.5	3.3	3.9	NS		0.3	0.6	0.5	1.1	0.3		1.2	0.9		1.3	1.6	2.0	1.6	2.1		1.3	0.6	1.0	0.6	1.5	

*Yellow seeded.

Canola - Liberty Link, Clearfield and Sulfonylurea Varieties, Langdon 2017-2018

Company/Brand	Variety	Type[1]	Blackleg Rating[2]	Status[3]	Clubroot Resistant	Days to First Flower			Days to End Flower			Days to Mature			% Cover[4]		
						17	18	2yr	17	18	2yr	17	18	2yr	17	18	2yr
Bayer CropScience	InVigor L252	H,LL,TR	R	CA	No	49	41	45	68	57	63	98	85	92	88	99	94
Bayer CropScience	InVigor L140P	H,LL,TR	R	CA	No	48	39	44	67	56	62	97	82	90	85	99	92
Bayer CropScience	InVigor L230	H,LL,TR	R	CA	No	46	39	43	63	55	59	96	83	90	88	100	94
Bayer CropScience	InVigor L233P	H,LL,TR	R	CA	No	47	38	43	64	55	60	95	81	88	86	99	93
Bayer CropScience	InVigor L255P	H,LL,TR	R	CA	Yes	53	40	47	71	58	65	102	84	93	75	100	88
Bayer CropScience	L234P	H,LL,TR	R	CA	Yes	--	37	--	--	55	--	--	83	--	--	99	--
Canterra	CS2500 CL	H,CL,TR	R	CA	No	--	39	--	--	58	--	--	85	--	--	99	--
Cibus	C5522	H,SU,TR	R	CA	No	49	38	44	71	57	64	101	85	93	94	97	96
Cibus	exp201803	H,SU,TR	R	EXP	No	--	38	--	--	60	--	--	85	--	--	92	--
Cibus	exp2011801	H,SU,TR	R	EXP	No	--	40	--	--	60	--	--	86	--	--	94	--
Dyna-Gro	DG200CL	H,CL,TR	R	CA	No	48	40	44	68	59	64	97	86	92	96	99	98
Victory/Cargill	V32-1CL	H,CL,HO	R	CA	No	47	40	44	64	58	61	95	85	90	90	99	95
Croplan [5]	HyCLASS 955	H,RR,TR	R	CA	Yes	46	36	41	63	53	58	95	83	89	78	98	88
Dekalb [5]	71-14BL	H,RR,TR	R	CA	No	46	37	42	65	54	60	97	84	91	79	97	88
Trial Mean						49	39		68	58		98	84		79	97	
C.V. %						1.7	1.2		1.7	1.7		1.3	1.5		12.0	2.5	
LSD 5%						1.2	0.7		1.7	1.4		1.8	1.8		13.5	3.4	
LSD 10%						1.0	0.6		1.4	1.3		1.5	1.5		11.3	2.9	

[1]H-Hybrid, LL-Liberty Link, CL-Clearfield System, SU-Sulfonylurea, TR-Traditional Oil Type, HO-High Oleic Oil Type.

[2]Blackleg Rating: MR-Moderately Resistant, R-Resistant. Rating provided by company.

[3]Status: CA-Commercially available, EXP-Experimental.

[4]% Cover-Visual rating of percent area of plot covered by plant growth. This is a measure of stand and vigor. Plants were at 5-6 leaf stage.

[5]Roundup Ready check variety.

Canola - Liberty Link, Clearfield and Sulfonylurea Varieties, Langdon 2016-2018

Company/Brand	Variety	Height (in)			Lodging (0-9)			Oil[1] (%)			Yield[1] (lbs/a)				
		17	18	2yr	17	18	2yr	17	18	2yr	2016	2017	2018	2yr	3yr
Bayer CropScience	InVigor L252	46	49	48	0.0	1.8	0.9	53.3	44.8	49.1	2792	4047	3997	4022	3612
Bayer CropScience	InVigor L140P	47	46	47	1.8	2.8	2.3	49.5	43.2	46.4	2672	4032	3285	3659	3330
Bayer CropScience	InVigor L230	45	44	45	0.0	1.8	0.9	52.3	43.6	48.0	2779	3559	3580	3570	3306
Bayer CropScience	InVigor L233P	47	44	46	1.0	2.5	1.8	50.9	43.3	47.1	2866	3770	3198	3484	3278
Bayer CropScience	InVigor L255P	51	46	49	0.0	2.0	1.0	53.5	44.9	49.2	--	3807	3749	3778	--
Bayer CropScience	L234P	--	44	--	--	3.5	--	--	42.7	--	--	--	3371	--	--
Canterra	CS2500 CL	--	48	--	--	1.8	--	--	43.7	--	--	--	3563	--	--
Cibus	C5522	48	45	47	0.8	2.5	1.7	49.5	42.0	45.8	2250	3478	3388	3433	3039
Cibus	exp201803	--	44	--	--	2.0	--	--	41.1	--	--	--	2771	--	--
Cibus	exp2011801	--	51	--	--	1.8	--	--	42.7	--	--	--	3504	--	--
Dyna-Gro	DG200CL	47	48	48	0.3	3.5	1.9	51.1	43.5	47.3	2798	4008	3448	3728	3418
Victory/Cargill	V32-1CL	44	46	45	0.5	2.8	1.7	48.8	42.9	45.9	--	3602	3365	3484	--
Croplan [2]	HyCLASS 955	37	40	39	1.0	5.3	3.2	55.0	45.9	50.5	2640	3547	3477	3512	3221
Dekalb [2]	71-14BL	42	40	41	0.5	3.0	1.8	54.7	45.2	50.0	--	3499	3700	3600	--
Trial Mean		45	45		0.5	2.5		51.4	43.5		2475	3499	3322		
C.V. %		8.7	7.2		187	36.2		2.1	1.6		10.1	9.7	6.3		
LSD 5%		5.5	4.6		NS	1.3		1.6	1.0		351	479	294		
LSD 10%		4.6	3.8		NS	1.1		1.3	0.8		294	400	245		

[1]8.5% moisture

[2]Roundup Ready check variety.

Canola - Roundup Ready, Langdon 2017-2018

Company	Variety	Type[1]	Blackleg Rating[2]	Status[3]	Clubroot Resistant	Days to First Flower			Days to End Flower			Days to Mature			% Cover[4]		
						17	18	2yr	17	18	2yr	17	18	2yr	17	18	2yr
BrettYoung	6074RR	H,TR	R	CA	No	48	39	44	70	59	65	99	85	92	75	94	85
BrettYoung	4187RR	H,TR	R	CA	Yes	52	42	47	71	59	65	102	85	94	74	95	85
BrettYoung	6090RR	H,TR	R	CA	Yes	--	42	--	--	60	--	--	85	--	--	98	--
Canterra	CS2100	H,TR	R	CA	No	46	39	43	66	58	62	97	85	91	77	98	88
Canterra	CS2300	H,TR	R	CA	No	49	41	45	71	59	65	101	86	94	74	98	86
Cargill	15RH1142	H,TR	R	EXP	Yes	49	41	45	70	60	65	100	86	93	76	96	86
Cargill	15RH1167	H,HO	R	EXP	Yes	50	42	46	70	59	65	100	84	92	78	98	88
Croplan	HyCLASS 930	H,TR	R	CA	No	45	36	41	64	54	59	96	80	88	63	98	81
Croplan	HyCLASS 955	H,TR	R	CA	Yes	46	37	42	64	54	59	96	81	89	67	97	82
Croplan	HyCLASS 730	H,TR	R	CA	Yes	--	36	--	--	53	--	--	80	--	--	100	--
Dekalb	DKL70-10RR	H,TR	R	CA	No	47	38	43	67	55	61	96	82	89	72	98	85
Dekalb	DKL71-14BL	H,TR	R	CA	No	45	37	41	65	55	60	95	83	89	70	99	85
Dekalb	DKL35-23	H,TR	MR	CA	No	46	36	41	66	54	60	95	79	87	70	97	84
Dekalb	DKL75-42CR	H,TR	R	CA	Yes	--	39	--	--	57	--	--	83	--	--	96	--
Dyna-Gro	DG533G	H,TR	R	CA	No	48	38	43	70	58	64	98	83	91	73	93	83
Dyna-Gro	DG540G	H,TR	R	CA	No	49	40	45	70	59	65	100	84	92	74	95	85
Integra	7150RR	H,TR	R	CA	No	45	36	41	63	54	59	96	81	89	71	94	83
Integra	7257RR	H,TR	R	CA	No	47	37	42	66	54	60	96	80	88	79	98	89
DuPont Pioneer	45CS40	H,TR	R	CA	Yes	48	39	44	69	57	63	99	83	91	65	100	83
DuPont Pioneer	45M35	H,TR	R	CA	No	48	38	43	68	56	62	97	82	90	86	100	93
DuPont Pioneer	45H33	H,TR	R	CA	Yes	--	39	--	--	58	--	--	84	--	--	97	--
Proseed	300 Mag	H,TR	R	CA	No	47	38	43	68	57	63	99	84	92	68	95	82
Proseed	PS 5000	H,TR	R	CA	Yes	46	41	44	64	58	61	96	85	91	74	96	85
Star	Star 402	H,TR	R	CA	No	45	38	42	64	56	60	98	83	91	69	97	83
Trial Mean						48	39		68	57		98	83		71	97	
C.V. %						1.8	1.4		1.9	1.2		1.1	1.7		15.6	3.1	
LSD 5%						1.2	0.7		1.8	0.9		1.5	2.0		NS	4.2	
LSD 10%						1.0	0.6		1.5	0.8		1.2	1.7		NS	3.5	

[1]H-Hybrid, TR-Traditional Oil Type, HO-High Oleic Oil Type.

[2]Blackleg Rating: S-Susceptible, MS-Moderately Susceptible, MR-Moderately Resistant, R-Resistant. Rating provided by company.

[3] Status: CA-Commercially available, EXP-Experimental.

[4] % Cover-Visual rating of percent area of plot covered by plant growth. This is a measure of stand and vigor. Plants were at 5-6 leaf stage.

Canola - Roundup Ready, Langdon 2016-2018

Company	Variety	Height (in)			Lodging (0-9)			Oil[1] (%)			Yield[1] (lbs/a)				
		17	18	2yr	17	18	2yr	17	18	2yr	16	17	18	2yr	3yr
BrettYoung	6074RR	48	41	45	0.0	1.3	0.7	50.4	43.9	47.2	2679	3949	3237	3593	3288
BrettYoung	4187RR	54	47	51	0.0	1.5	0.8	49.8	44.6	47.2	--	4257	3596	3927	--
BrettYoung	6090RR	--	53	--	--	1.3	--	--	42.9	--	--	--	3214	--	--
Canterra	CS2100	45	41	43	0.8	1.3	1.1	50.5	43.3	46.9	2752	3959	3312	3636	3341
Canterra	CS2300	53	46	50	0.0	1.3	0.7	49.9	43.8	46.9	--	4430	3382	3906	--
Cargill	15RH1142	49	42	46	0.0	1.0	0.5	49.2	42.8	46.0	--	3996	3121	3559	--
Cargill	15RH1167	50	43	47	0.0	1.0	0.5	48.9	43.8	46.4	--	3944	3367	3656	--
Croplan	HyCLASS 930	41	37	39	1.3	2.3	1.8	52.2	45.8	49.0	2910	3676	3189	3433	3258
Croplan	HyCLASS 955	41	37	39	1.7	2.3	2.0	51.8	45.5	48.7	2717	3575	3161	3368	3151
Croplan	HyCLASS 730	--	37	--	--	2.0	--	--	45.3	--	--	--	3352	--	--
Dekalb	DKL70-10RR	45	37	41	0.7	1.8	1.3	49.2	43.5	46.4	2917	3853	3010	3432	3260
Dekalb	DKL71-14BL	42	38	40	1.2	1.5	1.4	51.2	44.5	47.9	3156	3656	3179	3418	3330
Dekalb	DKL35-23	48	36	42	1.7	2.0	1.9	49.8	43.6	46.7	--	3356	2985	3171	--
Dekalb	DKL75-42CR	--	37	--	--	1.3	--	--	44.2	--	--	--	3247	--	--
Dyna-Gro	DG533G	48	41	45	0.0	1.3	0.7	49.3	43.8	46.6	2579	3951	3156	3554	3229
Dyna-Gro	DG540G	46	43	45	0.5	1.5	1.0	49.5	43.4	46.5	--	4165	3382	3774	--
Integra	7150RR	42	41	42	1.4	2.3	1.9	52.4	44.1	48.3	2653	3580	2826	3203	3020
Integra	7257RR	49	36	43	0.8	1.8	1.3	50.9	44.1	47.5	2711	4144	3132	3638	3329
Pioneer	45CS40	47	44	46	0.8	2.0	1.4	49.7	43.8	46.8	2735	3510	3183	3347	3143
Pioneer	45M35	49	38	44	0.5	1.5	1.0	51.9	45.9	48.9	--	4583	3338	3961	--
Pioneer	45H33	--	43	--	--	2.0	--	--	43.5	--	--	--	3075	--	--
Proseed	300 Mag	47	36	42	1.4	2.0	1.7	50.0	44.4	47.2	2549	4119	3125	3622	3264
Proseed	PS 5000	46	47	47	2.0	1.5	1.8	48.9	43.2	46.1	2518	3725	3275	3500	3173
Star	Star 402	45	38	42	0.3	1.5	0.9	53.2	46.4	49.8	2649	4155	3473	3814	3426
Trial Mean		48	41		0.7	1.7		50.3	44.0		2584	3868	3198		
C.V. %		7.8	10.3		114.0	33.8		1.7	1.6		10.1	9.4	6.6		
LSD 5%		5.2	5.9		1.1	0.8		1.2	0.8		367	512	297		
LSD 10%		4.4	4.9		0.9	0.7		1.0	1.0		307	428	248		

[1] 8.5% Moisture

Dry Bean Summary, Langdon 2015-2018[1]

Variety	Type	Days to Maturity	Plant Height	100 Seed Weight	Yield				
					2015	2017	2018	2 yr Avg.	3 yr Avg.
			(in.)	(g)	----------(lb/a)----------				
LaPaz	Pinto	95	18	33	2151	3730	2741	3236	2874
Lariat	Pinto	94	18	35	2133	3874	2861	3368	2956
Stampede	Pinto	91	16	33	1877	3144	3202	3173	2741
Windbreaker	Pinto	93	15	38	1930	3458	2552	3005	2647
Palomino	Pinto	95	17	36	--	3138	2864	3001	--
Monterrey	Pinto	94	18	33	--	3902	3068	3485	--
HMS Medalist	Navy	94	17	17	1724	3118	2567	2843	2470
Ensign	Navy	93	16	20	2087	2061	2563	2312	2237
T9905	Navy	93	14	20	2168	3948	2781	3365	2966
Eclipse	Black	92	16	18	1932	3858	2679	3269	2823
Loreto	Black	93	17	18	1607	2391	2722	2557	2240
Zorro	Black	94	17	19	1933	2738	3046	2892	2572
Merlot	Small Red	94	17	33	1544	2353	2284	2319	2060
Rosetta	Pink	94	17	28	--	3490	2875	3183	--
Powderhorn	Great Northern	93	17	34	--	3327	3227	3277	--
Trial Mean		93	17	28	1874	3251	2802		
C.V. %		1.2	9.6	2.8	10.4	8.2	8.2		
LSD 5%		1.9	NS	1.3	320	445	385		
LSD 10%		1.6	NS	1.1	266	370	319		

[1] The 2016 trial was abandoned due to excessive moisture.

Field Pea, Langdon 2016-2018

Variety	Days to 1st Flower	Mature	Canopy Ht. at Harvest	Harvest Ease[1]	1000 KWT	Test Weight	Protein[2]	Yield			Average	
								2016	2017	2018	2 year	3 year
		(days)	(in)	(0-9)	(g)	(lbs/bu)	(%)	bu/a				
Yellow Cotyledon Type												
Agassiz	46	81	30	2.5	259	64.2	24.2	40.0	80.2	92.3	86.3	70.8
DS Admiral	47	80	24	4.3	244	64.3	23.6	50.1	78.9	84.4	81.7	71.1
Mystique	50	83	34	1.5	283	64.1	24.0	34.8	81.7	94.7	88.2	70.4
Nette 2010	46	79	26	3.3	244	65.0	23.5	49.6	79.8	90.2	85.0	73.2
CDC Amarillo	50	82	31	1.3	256	64.4	23.7	38.8	87.5	88.1	87.8	71.5
CDC Saffron	49	81	24	2.3	265	64.4	25.0	43.8	75.0	86.5	80.8	68.4
AAC Carver	48	80	29	1.5	263	63.9	22.9	38.9	90.8	94.5	92.7	74.7
Earlystar	49	81	23	4.3	229	64.5	21.5	46.9	74.6	92.4	83.5	71.3
Jetset	47	80	27	4.5	261	63.9	25.7	56.9	73.5	91.9	82.7	74.1
Spider	50	81	27	1.5	257	64.4	24.8	42.8	79.5	88.0	83.8	70.1
CDC Inca	50	82	29	1.0	253	64.7	24.4	--	80.8	96.6	88.7	--
AAC Profit	50	83	29	1.3	259	64.4	25.3	--	--	99.9	--	--
Bridger	47	79	25	3.3	241	64.3	23.7	--	--	81.0	--	--
Durwood	49	82	31	1.0	275	64.2	25.4	--	--	91.3	--	--
Hyline	50	82	28	3.8	279	64.7	23.6	--	--	94.2	--	--
LG Amigo	49	82	28	2.5	230	64.5	25.6	--	--	79.4	--	--
Navarro	43	78	24	2.5	269	63.9	24.8	--	--	81.8	--	--
SW Midas	49	80	25	2.8	218	64.6	23.4	--	--	84.8	--	--
LG Sunrise	44	80	30	2.3	242	64.3	22.7	--	--	83.9	--	--
Salamanca	48	81	30	1.8	271	64.2	26.8	--	--	90.2	--	--
Green Cotyledon Type												
CDC Striker	47	78	16	6.8	203	63.6	23.6	42.7	85.4	89.0	87.2	72.4
Cruiser	45	78	21	6.8	212	63.6	24.9	28.6	70.5	77.7	74.1	58.9
Arcadia	47	78	19	5.3	199	63.6	23.6	44.3	81.0	84.0	82.5	69.8
AAC Comfort	54	86	27	1.5	303	63.7	24.4	--	74.8	93.4	84.1	--
CDC Greenwater	52	84	32	0.5	275	64.2	24.6	--	89.1	88.1	88.6	--
Shamrock	50	83	33	1.3	285	64.4	24.4	--	--	96.0	--	--
Trial Mean	48	81	27	2.7	253	64.2	24.2	42.4	80.2	89.0		
C.V. %	1.7	1.4	10.2	46.5	3.0	0.6	1.9	11.5	6.9	6.3		
LSD 5%	1.2	1.6	3.9	1.8	10.8	0.5	0.7	7.0	7.9	7.9		
LSD 10%	1.0	1.4	3.2	1.5	9.0	0.4	0.6	5.8	6.6	6.6		

[1] Harvest Ease: 1=plants standing erect, 9=plants laying horizontal.

[2] 0% moisture basis

Faba Bean, Langdon 2018

Variety	Plant Stand Seedling	Days to 1st Flower	Days to End Flower	Flower Duration	Days to Mature	Plant Height	Pod Height 1st Pod	1000 KWT	Protein[2]	Test Weight	Chocolate Brown Spot Inc.	Chocolate Brown Spot Severity	Chocolate Brown Spot Index	Yield[2]	Seed Yield 2-yr Avg.	Seed Yield 3-yr Avg.
	(ft^2)	(DAP[1])	(DAP[1])	(Days)	(DAP[1])	(in)	(in)	(g)	(%)	(lbs/bu)	--------(%)--------			(bu/a)	(bu/a)	(bu/a)
Boxer	4.7	45	79	34	102	32	13	523	25.0	63.7	49	8	3.9	69.9	94.8	91.8
Fanfare	4.9	47	79	32	103	35	13	511	25.0	64.2	65	13	8.4	70.3	96.0	97.2
Fabelle	5.2	46	77	32	99	34	12	516	27.0	63.2	51	5	2.5	80.0	--	--
Tabasco	5.1	45	78	33	100	33	13	386	22.4	63.3	49	8	3.7	66.8	78.9	79.8
Laura	5.7	45	79	34	102	33	13	496	25.2	64.0	46	7	3.5	74.3	94.5	99.7
Trial Mean	5.1	46	79	33	101	33	13	486	24.9	63.7	52	8	4.4	72.3		
C.V. %	19.9	2.6	0.7	3.5	1.4	6.6	12.4	3.6	2.9	0.8	15.1	37.6	47.6	6.4		
LSD 5%	NS	NS	0.8	1.8	2.2	NS	NS	27	1.1	0.7	12.7	4.7	3.2	7.1		
LSD 10%	NS	NS	0.7	1.5	1.8	NS	NS	22	0.9	0.6	9.9	3.8	2.6	5.8		

[1] DAP - Days after planting

[2] Yield and protein at 16% moisture.

Targeted plant stand was 4 plants/ft^2.

Conventional - Liberty Link Soybean, Langdon 2018

Brand	Variety	Maturity Group[1]	Maturity date[2]	Plant Height (in)	Protein (%)	Oil (%)	Yield 2018 (bu/a)	Yield 2 yr Avg. (bu/a)
Conventional:								
NDSU	ND Henson	0.0	8/29	30	33.6	16.8	50.1	51.2
Richland IFC	MK0249	0.2	9/1	30	34.4	15.2	42.0	43.6
Liberty Link:								
Allegiant	008L05	00.8	8/28	29	34.0	16.3	54.7	--
Legend	LS 0084LL	00.8	8/25	27	33.9	16.5	47.6	--
NorthStar	NS 0095LL	00.9	8/29	28	34.0	16.8	50.8	--
Roundup Ready Check Varieties:								
	RR2Y Check 1	00.6	8/28	32	32.6	16.3	49.6	50.4
	RR2XT Check 2	00.7	9/30	33	32.7	16.5	55.2	--
	RR2Y Check 3	00.8	8/26	30	32.4	16.3	51.0	--
	RR2Y Check 4	00.9	8/29	34	32.3	16.3	52.7	53.1
Trial Mean			8/30	31	33.1	16.5	50.6	
C.V. %			1.8	6.8	1.7	1.7	8.4	
LSD 5%			2.7	3.0	1.2	0.6	6.1	
LSD 10%			2.3	2.5	1.0	0.5	5.1	

[1]Maturity Group provided by company.

[2]Date of physiological maturity at 95% brown pod.

Yield, oil and protein reported at 13% moisture.

No lodging in trial.

Roundup Ready Soybean, Langdon 2018 *(page 1 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity date[3]	Plant Height (in)	Protein (%)	Oil (%)	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
								bu/a		
Allegiant	005X17	RR2XT	00.5	8/24	31.9	31.9	16.4	48.3	49.4	49.0
Allegiant	007X32N	RR2XT	00.7	8/22	26.6	32.1	16.6	48.2	--	51.5
Allegiant	008X30N	RR2XT	00.8	8/26	29.3	31.5	16.8	49.0	43.3	53.2
Allegiant	009X08	RR2XT	00.9	8/31	30.2	33.0	15.9	50.2	50.6	54.7
Allegiant	01R80	RR2Y	0.1	8/29	30.9	32.5	17.1	50.0	52.9	51.8
Allegiant	02X03	RR2XT	0.2	9/1	35.5	33.9	16.1	48.9	--	54.4
Channel	00717R2X	RR2XT	00.7	8/24	26.9	32.7	16.2	44.8	51.1	--
Channel	0218R2X	RR2XT	0.2	8/31	34.5	33.4	15.7	48.9	52.2	--
Dairyland	DSR-0200/R2Y	RR2Y	0.2	8/31	34.5	33.2	16.3	52.6	--	53.2
Dairyland	DSR-0225/R2Y	RR2Y	0.1	8/26	31.9	33.0	17.1	54.3	55.4	56.4
Dairyland	DSR-0509R	RR1	0.5	9/7	29.7	33.3	15.8	42.6	--	48.0
Dairyland	DSR-C709R	RR1	00.7	8/22	22.3	32.9	16.9	40.8	48.4	43.5
Dairyland	DSR-C999/R2Y	RR2Y	0.1	8/31	28.1	32.9	16.1	51.1	53.5	54.3
Dahlman	56009NRR2Y	RR2Y	00.9	9/2	30.4	34.8	15.5	45.3	48.6	51.5
Dahlman	5601RR2Y	RR2Y	0.1	8/30	31.1	32.8	17.0	48.1	54.0	52.7
Dahlman	68008XN	RR2XT	00.8	8/25	31.7	32.0	16.7	50.1	51.8	50.9
Dyna-Gro	S005XT38	RR2XT	00.5	8/22	30.7	31.8	16.3	48.8	52.5	50.1
Dyna-Gro	S007XT27	RR2XT	00.7	8/22	27.8	32.5	16.0	49.4	56.7	51.5
Dyna-Gro	S007XT59	RR2XT	00.7	8/23	28.9	32.5	16.4	50.7	--	50.6
Dyna-Gro	S009XT49	RR2XT	00.9	8/31	33.0	32.8	15.9	49.2	--	55.9
Dyna-Gro	S009XT68	RR2XT	00.9	8/30	30.2	32.8	15.8	49.1	53.9	51.4
Golden H.	GH00866	RR2Y	00.8	8/21	30.6	32.5	17.0	48.3	54.5	51.1
Golden H.	GH0145X	RR2XT	0.1	8/30	30.2	32.5	15.9	48.4	--	53.9
Hefty	H008R6	RR2Y	00.8	9/2	30.5	33.4	15.9	39.1	45.9	45.1
Hefty	H008X8	RR2XT	00.8	8/26	31.2	31.9	17.0	49.4	--	52.4
Hefty	H009X7	RR2XT	00.9	8/31	32.1	32.9	15.8	46.3	48.4	52.0
Hefty	H02R3	RR2Y	0.2	9/8	28.1	34.4	15.3	42.4	--	41.2
Hefty	H02X9	RR2XT	0.2	8/31	28.6	32.9	15.7	48.6	--	52.2
Integra	20087	RR2Y	00.8	9/1	26.9	34.3	15.5	48.5	55.1	52.2
Integra	20097	RR2Y	00.9	8/30	32.4	33.1	16.8	50.7	57.5	52.0
Integra	50069	RR2XT	00.6	8/23	26.5	31.5	16.6	46.9	51.8	50.4
Integra	50098	RR2XT	00.9	8/25	26.5	32.3	16.5	41.1	50.5	45.0
Legacy	LS-00737N RR2X	RR2XT	00.7	8/23	27.6	32.7	16.3	45.2	53.2	48.1
Legacy	LS-00937 RR2X	RR2XT	00.9	8/30	30.6	33.2	15.6	48.9	54.2	51.8
Legacy	LS-0135 RR2	RR2Y	00.9	8/29	35.0	32.8	16.6	50.3	57.6	52.9
Legacy	LS-0237 RR2X	RR2XT	0.2	9/1	32.0	33.3	16.2	46.4	52.4	51.7
Legacy	LS-0239 RR2X	RR2XT	0.2	8/31	31.3	33.1	15.5	50.0	--	52.5
Legend	LS 007R22	RR2Y	00.7	8/28	28.1	33.6	15.8	48.2	--	--
Legend	LS 007X956N	RR2XT	00.7	8/21	26.5	32.6	16.4	48.8	--	--
Legend	LS 009X852N	RR2XT	00.9	8/26	30.3	31.5	16.7	47.8	55.2	--

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our northern region. Langdon REC and Pembina County (Cavalier).

No lodging observed in trial.

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Langdon 2018 *(page 2 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity date[3]	Plant Height (in)	Protein (%)	Oil (%)	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
								bu/a		
Legend	LS 01X850	RR2XT	0.1	9/1	30.5	33.0	15.9	49.0	--	--
LG Seeds	LGS00663RX	RR2XT	00.6	8/25	25.8	32.8	16.3	42.2	--	47.8
LG Seeds	LGS00885R2	RR2Y	00.8	9/2	30.1	34.1	15.7	47.3	--	50.0
LG Seeds	LGS00899RX	RR2XT	00.8	8/27	28.2	32.5	16.6	45.9	--	--
LG Seeds	LGS00909R2	RR2Y	00.9	8/31	30.4	32.2	16.4	48.8	--	--
LG Seeds	LGS0111RX	RR2XT	00.6	8/31	32.0	33.8	15.9	48.6	--	52.6
NDSU	ND17009GT	GT	00.9	8/28	30.6	35.3	15.9	43.4	48.0	46.7
NDSU	ND18008GT	GT	00.8	8/23	27.3	33.6	16.7	38.6	--	41.1
NK Seed	S007-Y4	RR2Y	00.5	8/18	25.2	32.4	16.8	50.4	--	--
NK Seed	S009-J1	RR2Y	00.9	8/25	25.2	33.6	16.6	48.7	55.1	51.3
NK Seed	S01-C4X	RR2XT	0.1	8/31	29.8	31.6	16.5	50.3	--	52.7
NorthStar	NS 0064R2	RR2Y	00.6	8/23	25.9	33.0	16.8	46.2	--	54.1
NorthStar	NS 0111R2	RR2Y	0.1	8/30	33.2	32.1	17.2	50.4	--	--
NorthStar	NS 60053XR2	RR2XT	00.5	8/22	29.8	31.4	16.7	46.9	52.1	49.4
NuTech	6008R2	RR2Y	00.8	8/27	30.1	31.6	17.0	45.8	52.0	48.1
Peterson	16R01	RR2Y	0.1	8/29	33.6	32.1	17.2	51.3	53.8	54.7
Peterson	18X008N	RR2XT	00.8	8/24	31.1	32.3	16.3	49.5	54.4	51.4
Pioneer	P006A37X	RR2XT	00.6	8/20	25.6	32.1	16.8	43.8	--	--
Pioneer	P007A90R	RR1	00.7	8/20	26.8	32.7	16.4	49.4	54.3	--
Pioneer	P00A49X	RR2XT	0.0	8/29	27.7	32.4	16.9	46.1	--	--
Prairie	PB-00856R2	RR2Y	00.9	9/2	30.2	34.4	15.4	46.9	46.8	49.2
Proseed	50-08	RR2Y	00.8	9/2	29.3	33.8	16.0	45.3	53.1	51.7
Proseed	XT 60-09	RR2XT	00.9	8/31	29.0	33.2	15.7	47.6	52.1	51.2
Proseed	XT 70-09	RR2XT	00.4	8/28	30.6	31.9	17.2	48.5	--	50.7
Proseed	XT 80-20	RR2XT	0.2	8/31	30.3	32.9	15.6	48.6	--	51.8
REA	RX00619	RR2XT	00.6	8/17	26.2	32.0	16.9	47.2	--	50.7
REA	RX0228	RR2XT	0.2	8/30	32.3	32.6	16.4	47.0	50.8	52.5
REA	RX00749	RR2XT	00.7	8/20	28.6	32.6	16.1	46.2	--	48.9
REA	R00727	RR2Y	00.7	8/25	30.5	33.0	15.9	47.8	55.0	49.0
Thunder	3601 R2Y	RR2Y	0.1	8/29	32.2	32.5	17.3	50.9	--	51.0
Thunder	39005 R2Y	RR2Y	00.5	8/22	27.1	33.3	16.5	48.7	--	52.8
Thunder	Astro	RR2Y	00.8	8/30	31.9	33.2	15.6	50.8	52.5	55.2
Thunder	SB87009	RR2XT	00.9	8/31	32.1	33.7	15.5	49.5	51.5	54.0
Thunder	SB88007N	RR2XT	00.7	8/25	30.7	31.5	17.2	49.8	53.3	52.0
Thunder	SB89006N	RR2XT	00.6	8/21	26.6	32.2	16.2	48.3	--	48.3
Trial Mean				8/27	29.4	32.8	16.3	47.7		
C.V. %				1.7	8.2	1.8	2.1	6.8		
LSD 5%				2.4	3.4	1.2	0.7	4.5		
LSD 10%				2.0	2.8	1.0	0.6	3.9		

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our northern region. Langdon REC and Pembina County (Cavalier).

No lodging observed in trial.

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Pembina County 2018 *(page 1 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity date[3]	Plant Height (in)	Lodging (0-9)	Protein (%)	Oil (%)	Yield 2018 (bu/a)	Yield 2 yr Avg. (bu/a)	Yield 2-site Avg.[4] (bu/a)
Allegiant	005X17	RR2XT	00.5	9/2	38.8	0.0	32.3	16.4	49.6	47.2	49.0
Allegiant	007X32N	RR2XT	00.7	9/3	38.1	0.0	32.8	16.6	54.8	--	51.5
Allegiant	008X30N	RR2XT	00.8	9/3	39.2	0.4	30.9	17.4	57.3	48.9	53.2
Allegiant	009X08	RR2XT	00.9	9/7	40.9	0.7	33.3	15.8	59.2	54.7	54.7
Allegiant	01R80	RR2Y	0.1	9/8	39.6	0.8	32.7	17.2	53.5	49.1	51.8
Allegiant	02X03	RR2XT	0.2	9/9	44.3	1.9	33.2	16.4	59.8	--	54.4
Dairyland	DSR-0200/R2Y	RR2Y	0.2	9/6	43.0	1.3	32.7	16.4	53.7	--	53.2
Dairyland	DSR-0225/R2Y	RR2Y	0.1	9/8	39.6	1.4	32.6	17.6	58.4	51.1	56.4
Dairyland	DSR-0509R	RR1	0.5	9/13	36.4	0.2	32.1	16.5	53.4	--	48.0
Dairyland	DSR-C709R	RR1	00.7	9/5	34.0	0.0	32.9	16.6	46.2	50.3	43.5
Dairyland	DSR-C999/R2Y	RR2Y	0.1	9/7	36.8	0.3	33.2	16.4	57.4	57.6	54.3
Dahlman	56009NRR2Y	RR2Y	00.9	9/9	39.4	2.2	33.7	16.3	57.6	54.1	51.5
Dahlman	5601RR2Y	RR2Y	0.1	9/8	39.5	2.2	32.1	17.4	57.2	50.2	52.7
Dahlman	68008XN	RR2XT	00.8	9/5	39.1	1.1	30.7	17.2	51.6	46.5	50.9
Dyna-Gro	S005XT38	RR2XT	00.5	9/3	40.2	0.4	32.0	16.4	51.3	52.1	50.1
Dyna-Gro	S007XT27	RR2XT	00.7	9/3	35.7	0.1	32.4	16.7	53.6	55.2	51.5
Dyna-Gro	S007XT59	RR2XT	00.7	9/3	35.4	0.1	33.2	16.4	50.5	--	50.6
Dyna-Gro	S009XT49	RR2XT	00.9	9/6	40.6	1.0	33.7	15.6	62.6	--	55.9
Dyna-Gro	S009XT68	RR2XT	00.9	9/6	40.7	1.1	32.7	16.2	53.7	55.8	51.4
Golden H.	GH00866	RR2Y	00.8	9/4	40.9	0.0	32.8	17.3	53.9	57.2	51.1
Golden H.	GH0145X	RR2XT	0.1	9/9	40.3	1.4	31.2	16.4	59.3	--	53.9
Hefty	H008R6	RR2Y	00.8	9/9	38.2	3.6	33.6	16.1	51.1	50.8	45.1
Hefty	H008X8	RR2XT	00.8	9/5	36.7	0.5	31.3	17.4	55.3	--	52.4
Hefty	H009X7	RR2XT	00.9	9/8	40.3	2.2	33.1	15.7	57.6	50.6	52.0
Hefty	H02R3	RR2Y	0.2	9/14	35.3	1.2	33.5	15.6	40.0	--	41.2
Hefty	H02X9	RR2XT	0.2	9/7	39.0	1.4	33.1	15.4	55.7	--	52.2
Integra	20087	RR2Y	00.8	9/8	34.2	1.1	34.6	15.7	55.8	57.7	52.2
Integra	20097	RR2Y	00.9	9/6	40.2	1.1	32.3	17.4	53.2	53.3	52.0
Integra	50069	RR2XT	00.6	9/5	37.0	0.6	32.2	16.4	53.8	51.5	50.4
Integra	50098	RR2XT	00.9	9/4	35.1	0.5	32.6	16.5	48.8	--	45.0
Legacy	LS-00737N RR2X	RR2Y	00.7	9/6	35.5	0.0	32.6	16.2	50.9	52.7	48.1
Legacy	LS-00937 RR2X	RR2XT	00.9	9/7	37.8	1.9	32.3	15.8	54.6	53.5	51.8
Legacy	LS-0135 RR2	RR2Y	00.9	9/9	42.4	2.1	33.0	17.2	55.5	53.2	52.9
Legacy	LS-0237 RR2X	RR2XT	0.2	9/10	45.4	1.7	32.9	16.6	56.9	53.6	51.7
Legacy	LS-0239 RR2X	RR2XT	0.2	9/6	39.1	0.9	32.4	15.9	55.0	--	52.5

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our northern region. Langdon REC and Pembina County (Cavalier).

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Pembina County 2018 *(page 2 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity date[3]	Plant Height (in)	Lodging (0-9)	Protein (%)	Oil (%)	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
									----------bu/a----------		
LG Seeds	LGS00663RX	RR2XT	00.6	9/5	34.5	0.0	32.6	16.4	53.3	--	47.8
LG Seeds	LGS00885R2	RR2Y	00.8	9/8	41.0	0.3	34.3	15.8	52.7	--	50.0
LG Seeds	LGS0111RX	RR2XT	00.6	9/10	42.1	1.0	33.4	16.0	56.5	--	52.6
NDSU	ND17009GT	GT	00.9	9/5	39.0	0.3	35.7	15.9	50.0	50.2	46.7
NDSU	ND18008GT	GT	00.8	9/4	36.6	0.0	33.8	16.8	43.5	--	41.1
NK Seed	S009-J1	RR2Y	00.9	9/5	36.2	0.9	33.9	16.6	53.9	60.5	51.3
NK Seed	S01-C4X	RR2XT	0.1	9/8	41.3	1.0	31.4	16.6	55.1	--	52.7
NorthStar	NS 0064R2	RR2Y	00.6	9/4	37.1	0.8	33.2	17.0	62.0	--	54.1
NorthStar	NS 60053XR2	RR2XT	00.5	9/3	38.6	0.2	32.1	16.5	51.8	51.4	49.4
NorthStar	NS 60092XR2	RR2XT	00.9	9/5	36.9	0.3	32.8	16.1	50.0	--	--
NuTech	6008R2	RR2Y	00.8	9/5	39.4	1.4	30.9	17.5	50.3	53.7	48.1
Peterson	16R01	RR2Y	0.1	9/8	41.4	2.0	32.3	17.3	58.0	51.1	54.7
Peterson	18X008N	RR2XT	00.8	9/5	39.4	0.4	31.6	16.9	53.2	46.6	51.4
Prairie	PB-00856R2	RR2Y	00.9	9/9	37.0	1.7	33.7	16.1	51.5	49.1	49.2
Proseed	50-08	RR2Y	00.8	9/9	37.6	2.3	33.8	16.0	58.1	57.9	51.7
Proseed	XT 60-09	RR2XT	00.9	9/7	41.2	1.1	33.0	16.0	54.7	54.5	51.2
Proseed	XT 70-09	RR2XT	00.4	9/4	38.4	0.7	31.3	17.3	52.8	--	50.7
Proseed	XT 80-20	RR2XT	0.2	9/9	38.0	1.0	32.6	15.5	54.9	--	51.8
REA	R00727	RR2Y	00.7	9/5	37.5	0.4	32.2	16.4	50.2	54.1	49.0
REA	RX00619	RR2XT	00.6	9/1	35.7	0.0	32.0	17.0	54.2	--	50.7
REA	RX00749	RR2XT	00.7	9/3	36.6	0.1	32.8	16.6	51.5	--	48.9
REA	RX0228	RR2XT	0.2	9/9	42.2	0.9	32.5	16.2	58.0	55.3	52.5
Thunder	3601 R2Y	RR2Y	0.1	9/8	41.2	1.5	32.1	17.6	51.1	51.2	51.0
Thunder	39005 R2Y	RR2Y	00.5	9/3	35.0	0.4	33.9	16.1	56.9	--	52.8
Thunder	Astro	RR2Y	00.8	9/9	40.2	1.2	32.8	15.9	59.6	--	55.2
Thunder	SB87009	RR2XT	00.9	9/9	39.0	0.7	33.0	16.0	58.5	54.5	54.0
Thunder	SB88007N	RR2XT	00.7	9/7	37.1	2.0	32.2	17.0	54.2	56.2	52.0
Thunder	SB89006N	RR2XT	00.6	9/3	36.4	0.3	32.2	16.5	48.3	--	48.3
Trial Mean				9/6	38.7	0.9	32.7	16.5	53.9		
C.V. %				1.1	5.3	83.9	1.5	1.7	7.0		
LSD 5%				1.9	3.3	1.3	1.0	0.6	6.1		
LSD 10%				1.6	2.8	0.9	0.8	0.6	5.1		

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our northern region. Langdon REC and Pembina County (Cavalier).

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Nelson County 2018 *(page 1 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity	Plant Height	Protein	Oil	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
				date[3]	(in)	(%)	(%)	bu/a	bu/a	bu/a
Allegiant	005X17	RR2XT	00.5	8/28	30.4	32.6	16.8	42.6	--	47.3
Allegiant	008X30N	RR2XT	00.8	9/2	29.2	32.1	16.0	49.3	--	51.0
Allegiant	009X08	RR2XT	00.9	9/3	32.9	31.5	17.3	53.6	--	56.7
Allegiant	01R80	RR2Y	0.1	9/3	33.9	33.3	16.0	51.0	60.6	52.4
Allegiant	02X03	RR2XT	0.2	9/4	36.0	32.9	17.5	49.1	--	55.2
Allegiant	03X21N	RR2XT	0.3	9/6	33.0	33.6	16.5	53.6	--	58.7
Channel	00717R2X	RR2XT	00.7	9/1	27.5	32.1	16.7	47.8	59.2	53.3
Channel	0218R2X	RR2XT	0.2	9/4	32.4	32.5	16.4	45.8	54.9	48.1
Dairyland	DSR-0225/R2Y	RR2Y	0.2	9/2	34.2	32.6	17.6	53.3	61.8	56.3
Dairyland	DSR-0305/R2Y	RR2Y	0.3	9/6	32.4	33.1	16.7	55.8	63.0	55.6
Dairyland	DSR-0404/R2Y	RR2Y	0.4	9/9	31.0	33.4	16.1	52.4	61.6	54.7
Dairyland	DSR-0418/R2Y	RR2Y	0.4	9/9	31.6	33.6	16.0	53.0	59.9	54.6
Dairyland	DSR-0397/R2Y	RR2Y	0.3	9/7	33.6	34.4	15.5	54.9	61.7	55.1
Dairyland	DSR-0450R	RR1	0.4	9/5	32.1	34.4	16.1	47.5	55.9	--
Dairyland	DSR-C999/R2Y	RR2Y	00.9	9/5	29.6	32.7	16.8	53.0	--	56.8
Dairyland	DSR-0200/R2Y	RR2Y	0.2	9/1	32.5	33.2	16.4	45.8	--	48.7
Dairyland	DSR-0509R	RR1	0.5	9/11	31.0	33.2	16.6	47.7	--	51.1
Dyna-Gro	S009XT68	RR2XT	00.9	9/3	32.5	32.7	16.0	52.5	--	52.2
Dyna-Gro	S03XT29	RR2XT	0.3	9/5	30.6	33.3	15.7	51.2	--	51.6
Dyna-Gro	S04XT77	RR2XT	0.4	9/7	29.9	33.6	16.5	53.3	61.6	55.8
Golden H.	GH0339X	RR2XT	0.3	9/4	31.8	32.8	16.3	56.3	--	55.2
Golden H.	GH0391	RR2Y	0.3	9/3	28.8	33.8	16.1	49.4	59.9	53.7
Hefty	H02R3	RR2Y	0.2	9/14	31.1	33.7	15.4	44.9	58.9	40.8
Hefty	H03X8	RR2XT	0.3	9/8	32.0	33.0	15.8	46.6	56.9	52.6
Hefty	H04X8	RR2XT	0.4	9/12	29.1	34.3	16.3	51.2	--	52.4
Integra	20097	RR2Y	00.9	9/2	32.4	33.2	17.4	51.2	61.4	54.9
Integra	20126	RR2Y	0.1	9/3	30.9	34.0	16.7	49.9	60.6	55.1
Integra	20468	RR2Y	0.2	9/8	34.1	33.9	15.9	52.4	--	54.3
Integra	50098	RR2XT	00.9	8/30	25.9	32.9	16.3	43.0	--	47.7
Integra	50309N	RR2XT	0.3	9/6	31.7	32.9	15.7	55.2	--	56.2
Legacy	LS-0135 RR2	RR2Y	00.9	9/3	33.1	32.3	17.5	50.1	61.6	56.8
Legacy	LS-0237 RR2X	RR2XT	0.2	9/4	35.6	32.8	17.1	52.2	62.0	54.6
Legacy	LS-0239 RR2X	RR2XT	0.2	9/6	30.2	32.2	15.9	52.5	--	54.3
Legacy	LS-0334 RR2	RR2XT	0.2	9/10	31.3	34.4	15.8	57.4	63.6	55.7
Legacy	LS-0337N RR2X	RR2XT	0.3	9/7	31.2	33.9	16.0	56.0	64.4	55.5

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our southern region, Walsh County (Park River) and Nelson County (Pekin).

No lodging observed in trial.

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Nelson County 2018 *(page 2 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity	Plant Height	Protein	Oil	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
				date[3]	(in)	(%)	(%)	bu/a	bu/a	bu/a
Legacy	LS-0438N RR2X	RR2XT	0.4	9/9	30.3	34.4	16.3	53.6	61.9	54.3
Legend	LS 009X852N	RR2XT	00.9	9/2	29.8	31.7	17.3	47.2	--	--
Legend	LS 01X850	RR2XT	0.1	9/3	32.5	33.2	16.0	50.5	--	--
Legend	LS 02R21	RR2Y	0.2	9/2	34.3	33.5	16.5	51.2	--	--
LG Seeds	LGS00663RX	RR2XT	00.6	9/2	27.1	32.5	16.2	42.5	--	51.9
LG Seeds	LGS00899RX	RR2XT	00.8	9/3	30.5	31.5	17.2	48.5	--	54.4
LG Seeds	LGS0111RX	RR2XT	0.1	9/6	32.4	33.3	16.4	50.2	--	52.5
LG Seeds	LGS0355RX	RR2XT	0.3	9/8	31.7	32.5	15.7	50.3	--	48.7
LG Seeds	LGS0400RX	RR2XT	0.4	9/8	32.2	32.7	16.1	55.1	--	54.2
NDSU	ND17009GT	GT	00.9	9/2	32.9	35.7	16.2	45.2	52.7	50.1
NDSU	ND18008GT	GT	00.8	8/28	28.1	33.4	17.2	35.7	--	42.6
NorthStar	NS 60092XR2	RR2XT	00.9	8/31	28.5	32.3	16.7	45.0	58.3	--
NorthStar	NS 60264NXR2	RR2XT	0.2	9/6	32.5	32.3	16.0	54.4	--	56.4
NorthStar	NS 60442NXR2	RR2XT	0.3	9/6	30.0	33.8	16.3	54.1	60.8	57.2
Peterson	16R01	RR2Y	0.1	9/3	33.5	33.0	17.4	52.0	62.7	52.4
Peterson	17X04N	RR2XT	0.4	9/6	29.2	34.0	16.2	54.5	61.8	--
Prairie	PB-00928R2	RR2Y	0.1	9/5	29.9	32.5	16.8	55.4	62.6	59.1
Prairie	PB-0146R2	RR2Y	0.1	9/1	32.1	32.7	17.2	51.8	61.0	55.9
Proseed	50-08	RR2Y	00.8	9/7	32.2	34.6	15.8	46.0	--	49.5
Proseed	XT 60-09	RR2XT	00.9	9/3	32.8	33.0	16.2	50.9	--	52.6
Proseed	XT 70-09	RR2XT	00.4	9/1	30.6	31.7	17.0	46.8	--	51.7
Proseed	XT 80-20	RR2XT	0.2	9/6	31.0	32.7	15.9	50.6	--	52.4
REA	RX0228	RR2XT	0.2	9/4	34.3	32.9	16.5	42.9	54.8	49.9
Thunder	3503 R2Y	RR2Y	0.3	9/7	29.0	35.7	15.3	52.1	60.8	53.1
Thunder	3601 R2Y	RR2Y	0.1	9/3	33.5	32.6	17.7	51.2	61.1	53.0
Thunder	SB87009	RR2XT	00.9	9/3	34.8	33.7	15.6	55.6	60.4	52.9
Thunder	SB8903N	RR2XT	0.3	9/6	30.9	32.2	16.1	55.2	--	55.5
Trial Mean				9/4	31.4	33.1	16.4	50.4		
C.V. %				1.4	6.5	1.4	1.7	9.3		
LSD 5%				2.1	2.9	0.9	0.6	6.6		
LSD 10%				1.8	2.4	0.8	0.5	5.5		

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our southern region, Walsh County (Park River) and Nelson County (Pekin).

No lodging observed in trial.

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Walsh County 2018 *(page 1 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity date[3]	Plant Height (in)	Lodging (0-9)	Protein (%)	Oil (%)	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
									----------bu/a----------		
Allegiant	005X17	RR2XT	00.5	9/1	42.7	0.6	35.8	15.1	52.0	46.5	47.3
Allegiant	008X30N	RR2XT	00.8	9/2	42.6	1.5	35.8	15.0	52.7	46.8	51.0
Allegiant	009X08	RR2XT	00.9	9/5	44.9	1.7	33.8	16.1	59.8	58.3	56.7
Allegiant	01R80	RR2Y	0.1	9/6	48.2	2.6	35.7	15.1	53.7	50.6	52.4
Allegiant	02X03	RR2XT	0.2	9/7	47.6	3.0	34.9	16.7	61.2	54.9	55.2
Allegiant	03X21N	RR2XT	00.7	9/6	42.9	2.8	35.5	16.1	63.8	--	58.7
Channel	00717R2X	RR2XT	00.7	9/2	40.4	1.0	34.7	15.4	58.8	55.8	53.3
Channel	0218R2X	RR2XT	0.2	9/5	47.6	1.7	35.4	15.2	50.4	53.9	48.1
Dairyland	DSR-0225/R2Y	RR2Y	0.2	9/4	42.7	1.8	34.8	16.9	59.2	58.1	56.3
Dairyland	DSR-0305/R2Y	RR2Y	0.3	9/7	41.5	1.2	35.8	15.7	55.3	54.1	55.6
Dairyland	DSR-0404/R2Y	RR2Y	0.4	9/7	42.5	0.0	36.5	15.4	56.9	57.9	54.7
Dairyland	DSR-0418/R2Y	RR2Y	0.4	9/8	41.7	0.5	37.5	14.3	56.1	56.6	54.6
Dairyland	DSR-0397/R2Y	RR2Y	0.3	9/6	42.5	0.6	37.0	14.8	55.3	56.1	55.1
Dairyland	DSR-C709R	RR1	00.7	9/1	39.4	0.3	35.7	15.6	62.2	54.4	--
Dairyland	DSR-C999/R2Y	RR2Y	00.9	9/5	38.7	1.2	34.8	16.0	60.6	--	56.8
Dairyland	DSR-0509R	RR1	0.5	9/9	39.0	0.0	35.5	15.8	54.4	--	51.1
Dairyland	DSR-0200/R2Y	RR2Y	0.2	9/3	45.9	0.9	34.0	16.1	51.5	--	48.7
Dyna-Gro	S009XT68	RR2XT	00.9	9/4	45.6	0.8	36.5	14.6	51.8	--	52.2
Dyna-Gro	S03XT29	RR2XT	0.3	9/5	41.9	1.5	35.5	15.2	51.9	--	51.6
Dyna-Gro	S04XT77	RR2XT	0.4	9/6	41.4	0.9	36.4	15.6	58.3	60.4	55.8
Golden H.	GH0339X	RR2XT	0.3	9/6	42.6	3.1	34.4	15.5	54.1	--	55.2
Golden H.	GH0391	RR2Y	0.3	9/8	37.9	4.2	36.1	15.4	58.0	56.5	53.7
Hefty	H02R3	RR2Y	0.2	9/12	35.1	1.5	36.3	15.0	36.6	46.5	40.8
Hefty	H03X8	RR2XT	0.3	9/8	45.3	0.4	36.5	15.0	58.5	53.5	52.6
Hefty	H04X8	RR2XT	0.4	9/12	38.3	1.1	36.9	15.0	53.5	--	52.4
Integra	20097	RR2Y	00.9	9/5	45.5	2.9	33.7	17.3	58.5	55.8	54.9
Integra	20126	RR2Y	0.1	9/6	46.7	0.9	37.0	15.4	60.2	--	55.1
Integra	20468	RR2Y	0.2	9/7	42.0	2.1	36.6	14.8	56.1	58.4	54.3
Integra	50098	RR2XT	00.9	9/1	40.7	0.0	35.1	15.0	52.4	53.8	47.7
Integra	50309N	RR2XT	0.3	9/6	41.3	3.5	35.7	14.8	57.2	--	56.2
Legacy	LS-0135 RR2	RR2Y	00.9	9/6	45.2	2.9	33.9	17.0	63.4	59.7	56.8
Legacy	LS-0237 RR2X	RR2XT	0.2	9/7	46.6	2.9	36.2	15.6	56.9	56.1	54.6
Legacy	LS-0239 RR2X	RR2XT	0.2	9/6	41.7	3.2	35.1	15.3	56.0	--	54.3
Legacy	LS-0334 RR2	RR2XT	0.2	9/9	41.5	0.4	37.3	14.9	53.9	57.6	55.7
Legacy	LS-0337N RR2X	RR2XT	0.3	9/6	40.2	1.2	37.1	15.5	54.9	58.0	55.5
Legacy	LS-0438N RR2X	RR2XT	0.4	9/8	40.1	0.9	37.7	15.1	55.0	58.2	54.3
LG Seeds	LGS00663RX	RR2XT	00.6	9/3	39.0	0.7	33.9	16.0	61.3	--	51.9
LG Seeds	LGS00899RX	RR2XT	00.8	9/4	42.4	2.4	34.6	16.1	60.2	--	54.4
LG Seeds	LGS00909R2	RR2Y	00.9	9/4	42.0	2.0	34.1	16.4	53.2	--	--
LG Seeds	LGS0111RX	RR2XT	00.6	9/6	42.6	2.1	36.1	15.3	54.7	--	52.5

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our southern region, Walsh County (Park River) and Nelson County (Pekin).

Yield, oil and protein reported at 13% moisture.

Roundup Ready Soybean, Walsh County 2018 *(page 2 of 2)*

Brand	Variety	Herb. Trait[1]	Maturity Group[2]	Maturity	Plant Height	Lodging	Protein	Oil	Yield 2018	Yield 2 yr Avg.	Yield 2-site Avg.[4]
				date[3]	(in)	(0-9)	(%)	(%)	----------bu/a----------		
LG Seeds	LGS0355RX	RR2XT	0.3	9/5	39.8	2.3	36.4	14.3	47.0	--	48.7
LG Seeds	LGS0400RX	RR2XT	0.4	9/7	44.4	0.5	35.6	15.2	53.2	--	54.2
NDSU	ND17009GT	GT	00.9	9/6	46.9	4.1	37.8	15.8	55.0	51.4	50.1
NDSU	ND18008GT	GT	00.8	9/3	39.0	1.3	35.8	15.7	49.4	--	42.6
NK Seed	S009-J1	RR2Y	00.9	9/1	38.1	0.0	35.7	15.3	49.2	--	--
NK Seed	S01-C4X	RR2XT	0.1	9/6	43.0	2.8	34.1	16.2	61.7	--	--
NK Seed	S03-G9	RR2Y	0.3	9/8	39.7	5.2	36.3	15.8	57.8	--	--
NorthStar	NS 0111R2	RR2Y	0.1	9/5	47.0	2.4	34.6	16.7	60.4	57.1	--
NorthStar	NS 60264NXR2	RR2XT	0.2	9/6	45.9	3.0	35.8	15.0	58.3	--	56.4
NorthStar	NS 60442NXR2	RR2XT	0.3	9/7	38.5	0.1	36.6	15.3	60.2	--	57.2
NuTech	6008R2	RR2Y	00.8	9/3	43.6	2.0	33.0	16.7	52.4	52.2	--
Peterson	16R01	RR2Y	0.1	9/2	44.8	1.5	34.6	16.8	52.7	51.2	52.4
Peterson	18X008N	RR2XT	00.8	9/1	40.9	1.7	33.9	16.1	51.4	51.8	--
Prairie	PB-00928R2	RR2Y	0.1	9/4	38.8	1.2	36.2	15.4	62.7	61.0	59.1
Prairie	PB-0146R2	RR2Y	0.1	9/4	47.1	2.9	34.6	16.9	60.0	55.3	55.9
Proseed	50-08	RR2Y	00.8	9/6	40.5	1.3	36.3	15.5	53.0	55.2	49.5
Proseed	XT 60-09	RR2XT	00.9	9/5	44.2	1.0	35.9	14.9	54.3	54.0	52.6
Proseed	XT 70-09	RR2XT	00.4	9/3	42.3	2.2	33.9	16.6	56.5	--	51.7
Proseed	XT 80-20	RR2XT	0.2	9/6	42.7	3.0	33.9	15.7	54.1	--	52.4
REA	RX0228	RR2XT	0.2	9/6	47.0	1.3	34.9	15.8	56.9	56.1	49.9
Thunder	3503 R2Y	RR2Y	0.3	9/8	41.9	1.1	38.0	14.8	54.0	54.3	53.1
Thunder	3601 R2Y	RR2Y	0.1	9/2	44.8	1.3	34.7	16.9	54.7	54.7	53.0
Thunder	SB87009	RR2XT	00.9	9/3	45.3	1.3	35.8	14.7	50.2	52.5	52.9
Thunder	SB8903N	RR2XT	0.3	9/8	41.3	2.7	35.7	14.7	55.8	--	55.5
Trial Mean				9/5	42.1	1.5	35.5	15.6	55.8		
C.V. %				1.9	5.9	69.6	2.0	2.6	13.1		
LSD 5%				2.7	3.5	1.5	1.4	0.8	10.2		
LSD 10%				2.3	2.9	1.3	1.2	0.7	8.5		

[1]Herbicide Trait - RR2XT= RR2Xtend, GT= Glyphosate Tolerant

[2]Maturity Group provided by company.

[3]Date of physiological maturity at 95% brown pod.

[4]A 2-site average of our southern region, Walsh County (Park River) and Nelson County (Pekin).

Yield, oil and protein reported at 13% moisture.

Oil Sunflower, Langdon 2018 *(page 1 of 2)*

Brand	Hybrid	Hybrid Type[1]	Status[2]	Days to Flower (days)[3]	Days to Mature (days)[3]	Plant Height (in)	Oil (%)	Test Weight (lbs/bu)	Harvest Moist. (%)	Yield @ 10% moisture 2016 (lbs/a)	2017 (lbs/a)	2018 (lbs/a)	Average 2yr (lbs/a)	Average 3yr (lbs/a)
Croplan	3845 HO	HO,DMR	CA	68	108	58	38.7	31.4	18	--	3209	2557	2883	--
Croplan	432 E	EX,NS,DMR	CA	63	110	60	35.0	30.3	15	2449	3193	2570	2881	2737
Croplan	450 E HO	EX,HO,DMR	CA	69	110	63	39.5	30.2	18	--	3394	2824	3109	--
Croplan	455 E HO	EX,HO,DMR	CA	66	109	64	39.2	30.6	17	3356	3801	2818	3310	3325
Croplan	545 CL	CL,NS,DMR	CA	70	109	61	40.1	31.2	18	3465	3365	2451	2908	3094
Croplan	549 CL	CL,NS,DMR	CA	64	106	64	39.4	29.8	16	2880	3778	3165	3471	3274
Croplan	557 CL HO	CL,HO,DMR	CA	72	108	62	39.3	30.3	18	--	--	2399	--	--
Pioneer	P63HE60	EX,HO,DMR	CA	64	108	58	37.7	30.1	16	2704	3006	2728	2867	2813
Pioneer	P63HE90	EX,HO,DMR	CA	67	109	66	39.5	31.3	17	3476	3281	2725	3003	3161
Pioneer	P64HE101	EX,HO,DMR	CA	70	111	64	38.6	31.9	19	--	--	2679	--	--
LCS	18-001HO	HO	Exp	72	109	65	41.4	30.2	19	--	--	2694	--	--
LCS	18-002HO	HO	Exp	66	109	66	38.8	30.1	15	--	--	2415	--	--
LCS	18-003HOCLP	CP,HO	Exp	69	108	60	36.7	27.4	16	--	--	2978	--	--
LCS	18-004HO	HO	Exp	68	105	64	37.7	27.5	16	--	--	1885	--	--
LCS	18-005LN	Trad.	Exp	71	109	67	40.0	31.6	15	--	--	2686	--	--
LCS	18-006HO	HO	Exp	69	110	63	39.0	30.1	16	--	--	2613	--	--
LCS	18-007LN	Trad.	Exp	68	109	67	37.5	29.5	16	--	--	3022	--	--
LCS	18-008HOCL	CL,HO	Exp	68	109	61	36.8	29.4	16	--	--	2453	--	--
LCS	18-010LNCLP	CP,Trad.	Exp	68	108	62	38.4	32.3	17	--	--	2662	--	--
LCS	18-012LNCLP	CP,Trad.	Exp	67	108	61	37.4	29.3	16	--	--	2751	--	--
Nuseed	Badger DMR	CL,NS,CON,DMR	CA	66	106	63	36.0	27.4	16	3799	3728	1942	2835	3156
Nuseed	Camaro II	CL,NS,DMR	CA	69	107	59	38.9	31.2	16	3068	3457	2504	2980	3010
Nuseed	Falcon	EX,NS	CA	69	109	58	41.0	32.8	18	3038	2888	2090	2489	2672

[1]Type: HO = High Oleic, NS = NuSun, Trad. = Traditional (linoleic), CL = Clearfield, CP = Clearfield Plus, EX = ExpressSun, DMR = Downy Mildew Resistant, CON = ConOil

[2]Status: CA-Commercially available, Exp-Experimental, CK-Long term hybrid check

[3]Days after planting

Oil, harvest yield and test weight were adjusted to 10% moisture.

Oil Sunflower, Langdon 2018 *(page 2 of 2)*

Brand	Hybrid	Hybrid Type[1]	Status[2]	Days to Flower	Days to Mature	Plant Height	Oil	Test Weight	Harvest Moist.	Yield @ 10% moisture 2016	2017	2018	Average 2yr	3yr
				(days)[3]	(days)[3]	(in)	(%)	(lbs/bu)	(%)	lbs/a				
Nuseed	N4H302 E	EX,HO	CA	66	106	60	40.5	27.6	17	--	3082	2611	2846	--
Nuseed	N4HM354	CL,NS,DMR	CA	64	106	58	40.2	31.7	16	3508	3066	2572	2819	3049
Nuseed	N4H470 CL Plus	CP,HO,DMR	CA	69	110	62	42.4	31.4	19	--	--	2733	--	--
Nuseed	N5LM307	CL,NS,CON,DMR	CA	61	107	59	35.4	28.5	16	--	--	2380	--	--
NuTech	63C4 CL	CL,NS,DMR	CA	63	105	56	38.7	30.5	17	3191	3111	2414	2762	2905
NuTech	64H6	EX,HO,DMR	CA	66	106	64	38.9	29.3	14	--	--	3027	--	--
NuTech	68H7	EX,HO,DMR	CA	68	110	65	38.5	33.4	19	3439	2505	2154	2330	2700
NuTech	68M5	EX,NS,DMR	CA	68	111	65	38.1	32.1	17	--	--	2528	--	--
NuTech	69M2	EX,NS,DMR	CA	69	112	64	40.7	32.0	19	--	3512	3353	3433	--
Proseed	E 12G25 CL	CL,NS	Exp	66	107	68	37.7	30.4	17	3487	3364	2781	3073	3211
Proseed	E 362436	NS,DMR	CA	67	107	65	37.0	31.5	17	--	2954	2843	2899	--
Proseed	E 50016 CL	CP,NS,DMR	CA	68	110	60	37.9	31.0	17	--	3425	2640	3033	--
Proseed	E-21 CL	CL,NS,DMR	CA	69	110	66	36.2	28.5	22	--	2488	2112	2300	--
Proseed	E-31 CL	CL,NS,DMR	CA	67	108	61	36.9	28.2	16	2665	2940	2424	2682	2677
Proseed	E-71 CL	CL,NS,DMR	CA	68	108	60	37.0	28.6	16	--	2859	2406	2632	--
Proseed	E-72	NS,DMR	CA	71	109	64	39.0	30.7	18	--	2841	2193	2517	--
Proseed	E-73	CL,NS,DMR	CA	68	106	60	36.5	26.4	16	--	3118	2011	2564	--
USDA[4]	894	Trad.	CK	65	106	63	38.3	30.3	15	2263	2841	2607	2724	2570
USDA[5]	Honeycomb NS	NS	CK	58	98	56	36.1	28.1	14	--	2085	2888	2487	--
Trial Mean				67	108	62	38.4	30.1	17	3114	3177	2578		
C.V. %				1.9	1.5	3.8	3.1	3.0	6.7	10.2	9.9	15.2		
LSD 5%				2.1	2.7	3.9	1.9	1.5	1.8	528	514	637		
LSD 10%				1.8	2.3	3.2	1.6	1.2	1.5	441	430	533		

[1]Type: HO = High Oleic, NS = NuSun, Trad. = Traditional (linoleic), CL = Clearfield, CP = Clearfield Plus, EX = ExpressSun, DMR = Downy Mildew Resistant, CON = ConOil

[2]Status: CA-Commercially available, Exp-Experimental, CK-Long term hybrid check

[3]Days after planting

[4]Long-term hybrid check [5]Early maturing check

Oil, harvest yield and test weight were adjusted to 10% moisture.

Confection (non-oil) Sunflower, Langdon 2018

Brand	Hybrid	Status[4]	Days to Flower	Days to Mature	Plant Height	Test Weight	Harvest Moist.	Seed over screen			Yield @ 10% moisture			Average	
								22/64	20/64	18/64	2016	2017	2018	2 yr	3 yr
			(days)[6]	(days)[6]	(in)	(lbs/bu)	(%)	---------% over---------			----------lbs/a----------				
CanSun	Exp 64588[2]	Exp	64	105	62	21.8	17	72	93	96	--	--	2471	--	--
Nuseed	NSKM53777[1,3]	Exp	65	109	55	24.4	21	80	96	98	--	3116	2268	2692	--
Nuseed	Panther DMR[3]	CA	64	110	61	24.5	19	55	86	96	3146	2863	2530	2697	2846
Red River Comm.	2215	CA	64	108	60	23.7	17	69	92	96	3666	2861	2502	2682	3010
Red River Comm.	2310	CA	65	107	64	23.8	17	59	90	96	--	--	2179	--	--
Red River Comm.	2414	CA	66	107	63	23.7	18	59	88	95	--	--	2075	--	--
Red River Comm.	2215 CL[1]	CA	66	108	62	24.6	21	53	85	95	3477	2760	2551	2656	2929
USDA[5]	924	CK	61	107	54	25.5	19	29	70	94	2861	2440	2510	2475	2604
Trial Mean			64	108	60	24.0	19				3230	2983	2386		
C.V. %			4.6	0.9	9.5	5.0	8.0				9.0	9.7	11.3		
LSD 5%			NS	1.6	NS	NS	2.6				515	514	NS		
LSD 10%			NS	1.3	NS	1.7	2.1				422	421	NS		

[1]CL-Clearfield, [2]ExpressSun, [3]Downy mildew resistant.

[4]Status: CA-Commercially available, Exp-experimental, CK-Long term hybrid check[5].

[6]Days after planting.

Harvest yield and test weight were adjusted to 10% moisture.

Industrial Hemp Variety Performance in North Dakota – 2018
NDSU Langdon Research Extension Center

Bryan K. Hanson[1], Burton L. Johnson[2], Travis W. Hakanson[1], Lawrence E. Henry[1], and Venkat Chapara[1].
[1]North Dakota State University Langdon Research Extension Center, Langdon, ND; [2]North Dakota State University, Plant Sciences, Fargo, ND.

An industrial hemp variety trial (*Cannabis sativa* L.*,* THC level of 0.3% or less) was conducted at the NDSU Langdon Research Extension Center (REC) in 2018. The objective of the study was to screen varieties (Table 1) from various sources, monitor and record plant growth and development, determine grain and dry stalk yield, note pest incidence, and record agronomic traits. Variety trials were previously conducted in 2015, 2016 and 2017 at the REC. The 2015 trials were the first industrial hemp evaluations in North Dakota in over 70 years, and provided grain and fiber yield for Canadian and French varieties. The 2016 trial was lost due to herbicide drift, replanted and lost again to saturated soil conditions.

Table 1. Industrial hemp varieties and characteristics for the Langdon REC 2018 trial.

Variety	Country	Company†	Type	Purpose
CRS-1	Canada	HGI	Dioecious	Grain
CFX-1	Canada	HGI	Dioecious	Dual
CFX-2	Canada	HGI	Dioecious	Grain
Grandi	Canada	HGI	Dioecious	Grain
Katani	Canada	HGI	Dioecious	Grain
Picolo	Canada	HGI	Dioecious	Grain
Canda	Canada	PIHG	Monoecious	Dual
Delores	Canada	PIHG	Monoecious	Dual
Joey	Canada	PIHG	Monoecious	Dual
X-59	Canada	Terramax	Dioecious	Grain

†HGI (Hemp Genetics International)
PIHG (Parkland Industrial Hemp Growers)

- Dual purpose varieties are bred to be used for both grain and fiber production.
- Dioecious varieties have separate male and female plants.
- Monoecious varieties have separate male and female flowers on the same plant.
- Plant height is an important consideration in determining end use of the crop. Shorter varieties tend to have less fiber and are more suited to grain production.
- Dual purpose varieties are generally taller.

Materials and Methods

Seeding date was June 6 with plants emerging six to seven days later. The seeding rate was 12 pure live seeds/ft^2 and was adjusted for germination and 1000 kernel weight (kwt) with an additional 25 percent added to allow for seedling mortality. Planting depth was one-half inch. Plot size was 21 feet long x 4 feet wide and consisted of four 12 inch spaced rows. The experimental design was a randomized complete block with four replications. The previous crop was soybeans. The fiber dry stalk yield harvest date was August 8. Fiber harvest consisted of one linear 10 foot row cut from each plot. The plant samples were air-dried and leaves were removed prior to weighing to determine dry stalk yield. Grain harvest occurred on September 6. A small plot combine was used to harvest the plots. Samples were dried, then processed to determine yield, test weight and 1000 kwt. Plant samples of all varieties, which included leaves and flowering heads, were sent for laboratory analysis of THC. All samples tested less than the 0.3% THC limit for industrial hemp classification.

Results and Discussion

Pure live seed emergence (PLSE) among the varieties averaged 86% (Table 2) while 2017 PLSE averaged 73%. Both 2017 and 2018 PLSE values were approximately two to three times (or more) greater than the previous industrial hemp studies at the Langdon REC, in 2015 and 2016, where PLSE ranged from 3 to 61%. Rainfall, after planting which can result in soil crusting and reduced emergence, was much greater in 2015 and 2016. There were significant differences among industrial hemp varieties for seedling mortality that ranged from 5 to 26% in 2018. Seed/seedling mortality for traditional crops such as wheat, corn, and soybean commonly ranges from 10 to 15% under good/average conditions. The variety CFX-1 (26%) had the highest seedling mortality but final plant stands for all varieties were near or above the 12 plants/ft^2 target plant population. Fiber dry stalk yield was greatest for the dual-purpose varieties Canda, Delores, and Joey which also had the greatest plant height. Canda had significantly higher 1000 kwt compared to the other varieties. Average test weight of the varieties were low this year, averaging 36.6 lbs/bu, compared to the 2017 average of 41.5 lbs/bu. The standard test weight for hemp is 44 lbs/bu. Yields of industrial hemp varieties averaged 1031 lbs/a with a range of 802 to 1236 lbs/a. This was below the 1907 lbs/a average yield in 2017. CFX-1 had the highest 2 and 3-year average yield. Stored subsoil moisture was below average in April and May coming into the spring planting season. Rainfall for June and July was near normal but 1.32 inches below normal in August. There was no rainfall from July 24 to August 25. The lower than optimum test weight and yield can be associated with plant stress during the grain filling period.

Table 2. Grain and fiber yield and various agronomic traits of Canadian industrial hemp varieties.

Variety	Plant Stand (ft^2)	PLSE[1] (%)	Seedling Mortality (%)	Plant Height (inches)	Fiber Dry Stalk Yield (lb/a)	1000 KWT (g)	Test Weight (lb/bu)	Grain Yield (lb/a)	Grain Yield[2] 2-yr Avg. (lb/a)	Grain Yield[3] 3-yr Avg. (lb/a)
CRS-1	14.0	88	12	65	5873	15.4	35.6	1135	1513	1362
CFX-1	11.8	74	26	56	4379	15.4	37.4	1236	1644	1550
CFX-2	14.1	89	11	54	4482	15.3	38.1	1031	1490	1389
Grandi	13.4	84	16	50	3639	14.9	37.7	1157	1443	--
Katani	14.5	91	9	53	3395	14.6	39.0	1164	1492	--
Picolo	14.1	88	12	53	3603	14.1	38.5	1085	1386	--
Canda	13.4	84	16	68	6699	16.7	36.1	802	1404	1357
Delores	15.3	96	4	69	7199	15.4	33.6	817	1388	--
Joey	13.1	82	18	68	7048	16.0	36.1	905	1433	--
X-59	13.5	85	15	58	4943	15.0	33.6	979	1500	--
Mean	13.7	86	14	59	5126	15.3	36.6	1031		
C.V. %	9.3	9.3	55.9	4.5	8.1	5.0	3.0	10.6		
LSD 5%	1.9	11.6	11.6	3.9	606	1.1	1.6	158		
LSD 10%	1.5	9.6	9.6	3.2	503	0.9	1.3	131		

[1] Pure live seed emergence
[2] 2017 and 2018
[3] 2015, 2017, and 2018

Acknowledgements

Appreciation is extended to Hemp Genetics International Inc., Canada; Parkland Industrial Hemp Growers, Canada; Terramax, Canada; for their interest in the study and providing the seed, the North Dakota State Board of Agricultural Research and Education (SBARE) New and Emerging Crops, and North Dakota Agricultural Products Utilization Commission (APUC) for funding support.

Seeding Date and Cultivar Influence on Soybean Performance in Northeastern North Dakota

Bryan Hanson, Travis Hakanson, Lawrence Henry

Soybeans have become an important crop in the northeast region of North Dakota. Seeding date and cultivar selection are two important production decisions that producers make in order to maximize production. The objective of this study was to determine the relationship between cultivar maturity and seeding date on yield and agronomic traits.

Methodology:
The field design was a randomized complete block in a split-plot arrangement with four replications. Seeding dates were May 15, May 24, June 4, June 14, and June 25. Three Roundup Ready cultivars were used with maturity ratings of 00.5, 00.9 and 0.1. An established stand density of 180,000 plants/a was the target. Plot size was 3.5' x 21' with seven six inch rows. Net Return $/a = yield x $7.50 bu/a.

Results:
Cultivars seeded June 25 did not mature prior to the first killing freeze on September 29. Only height of 1st pod and plant height data are reported for all seeding dates. There were no significant differences in plant stands between seeding dates or cultivars (data not shown). Statistically significant seeding date by cultivar interactions occurred on some agronomic traits but only means averaged over cultivars or seeding dates are examined in this report (Table 1). Plant and pod height decreased with later planting dates with the 0.1 cultivar having the greatest height. Percent grain protein increased and oil content decreased at later planting dates. There were significant interactions between seeding dates and cultivars for yield and net return. Yields were the greatest at the earliest seeding date and decreased at each of the later subsequent dates (Figure 1). The yield difference between the May 15 and June 14 seeding dates for the 00.5, 00.9 and 0.1 cultivars were 13.6, 21.4, and 23.7 bu/a, respectively. Cultivar maturities of 0.1 and 00.9 had higher yields at the May 15 and May 24 seeding date, but at the latest seeding date the 00.5 cultivar had the highest yield. Net Return $/a results followed the same trends as yield.

Table 1. Seeding date effects on various agronomic traits averaged over cultivars.

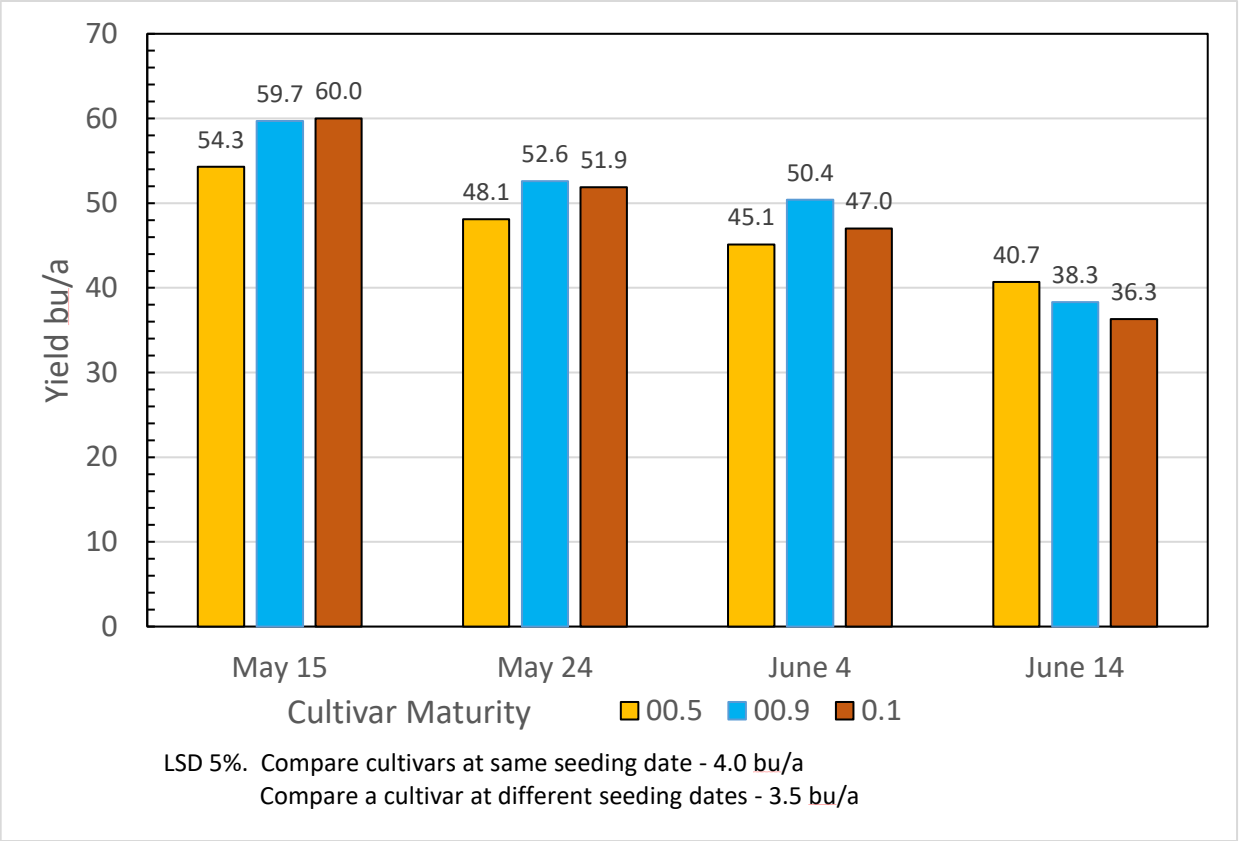
Seeding Date	Plant Height	Height of 1st Pod	Days to Mature	Grain Protein	Oil	1000 KWT	Test Weight
	inches	inches	DAP[1]	%	%	g	lbs/bu
May 15	31	4.6	102	32.8	15.9	181	54.3
May 24	29	5.1	100	32.5	15.8	176	54.8
June 4	30	5.1	98	32.3	14.4	171	56.2
June14	27	3.8	91	31.7	14.0	179	54.3
June 25	23	3.6	--[2]	--	--	--	--
Mean	28	4.4	97	32.3	15.1	177	54.9
C.V. %	6.1	16.0	0.6	0.3	1.6	4.6	1.1
LSD 5%	1.4	0.6	0.5	0.4	0.2	6.9	0.5

Cultivar effects on various agronomic traits averaged over seeding dates

Cultivar Maturity	Plant Height	Height of 1st Pod	Days to Mature	Grain Protein	Oil	1000 KWT	Test Weight
	inches	inches	DAP[1]	%	%	g	lbs/bu
00.5	26	4.0	94	31.7	15.4	167	55.6
00.9	28	4.5	97	32.2	15.2	174	54.9
0.1	30	4.7	102	33.1	14.6	190	54.3
LSD 5%	1.1	0.5	0.5	0.3	1.7	6.0	0.4

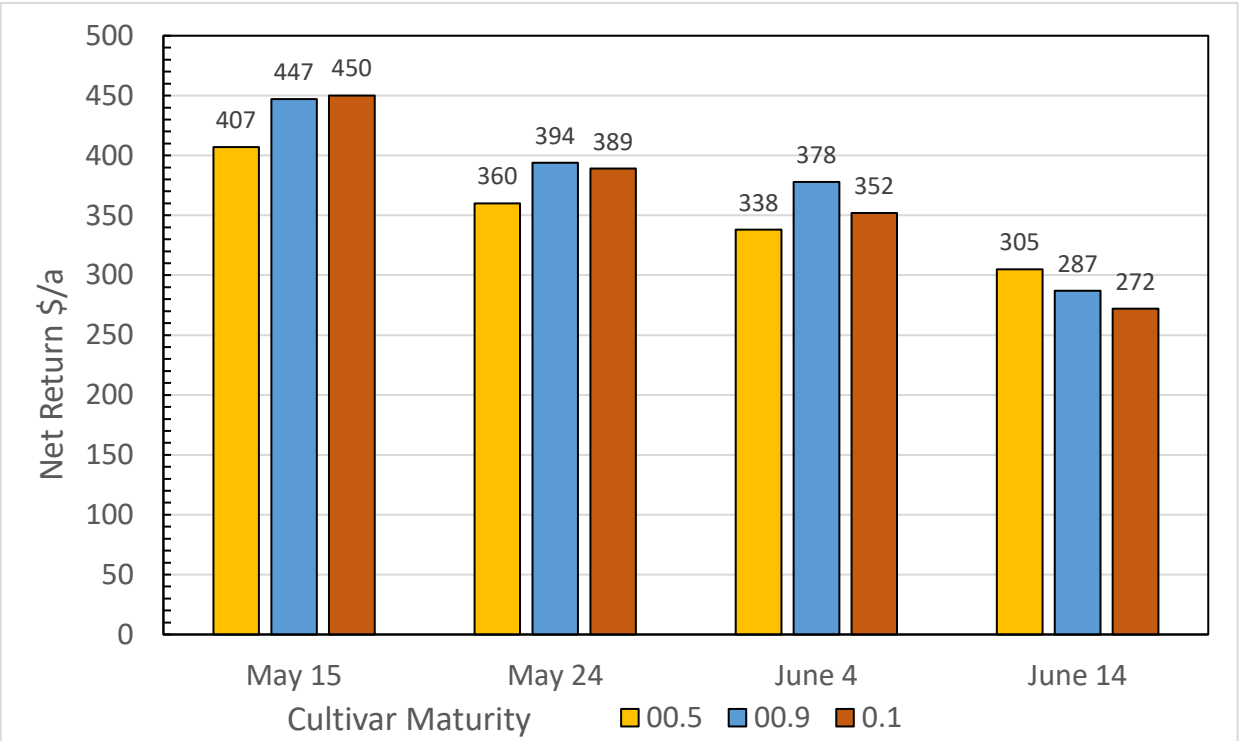
[1]Days after planting. [2]Cultivars seeded on June 25 did not mature prior to the first killing freeze.

Figure 1. Seeding date and cultivar effect on soybean yield.



LSD 5%. Compare cultivars at same seeding date - 4.0 bu/a
Compare a cultivar at different seeding dates - 3.5 bu/a

Figure 2. Seeding date and cultivar effect on net return $/a.



LSD 5%. Compare cultivars at same seeding date - 30 $/a
Compare a cultivar at different seeding dates - 37 $/a

Increased Spread of Clubroot to New Fields in Cavalier County

Project Title: Surveying Fields and Creating Awareness on the Identification and Management Plan of Clubroot of Canola in Northeastern North Dakota

Survey done by: Venkat Chapara (Project Investigator (PI)), Ron Beneda (CHS Agronomist), Lesley Lubenow, Naeem Kalwar, and Anitha Chirumamilla (Cavalier County Ag Extension Agent).

Collaborators: Dr. Kishore Chittem and Dr. Luis del Rio, Department of Plant Pathology, NDSU, Fargo, ND.

An ongoing clubroot survey program over the past three years in seven counties of North Dakota indicates a significant threat to canola as a cash crop if proper attention is not given to longer crop rotations, resistant varieties and equipment sanitation particularly in Cavalier County.

Survey Procedure: Clubroot scouting was done visually by inspecting canola roots. The disease survey was conducted in seven northeastern counties (Pembina, Walsh, Nelson, Ramsey, Towner, Rolette and Cavalier) of North Dakota. County selection was based on canola acreage and assumptions of clubroot propagules in all directions through equipment, soil, and water movement to neighboring counties of Cavalier. In each county, one field in every 5,000 acres was scouted. Soil samples were collected from the positive and likely positive clubroot fields with an intent to know the pH of the infected soil. In all, a minimum of 5-10 fields per county were targeted for scouting. The survey was done in two phases.

1st Phase: Flowering (10% flowered)

In the growing season, plants were sampled from distinct stunted patches or prematurely senescing plants in the field. Patches visible from the edge of the field were examined by digging plants and observing the roots for symptoms of clubroot.

2nd Phase: After Swathing

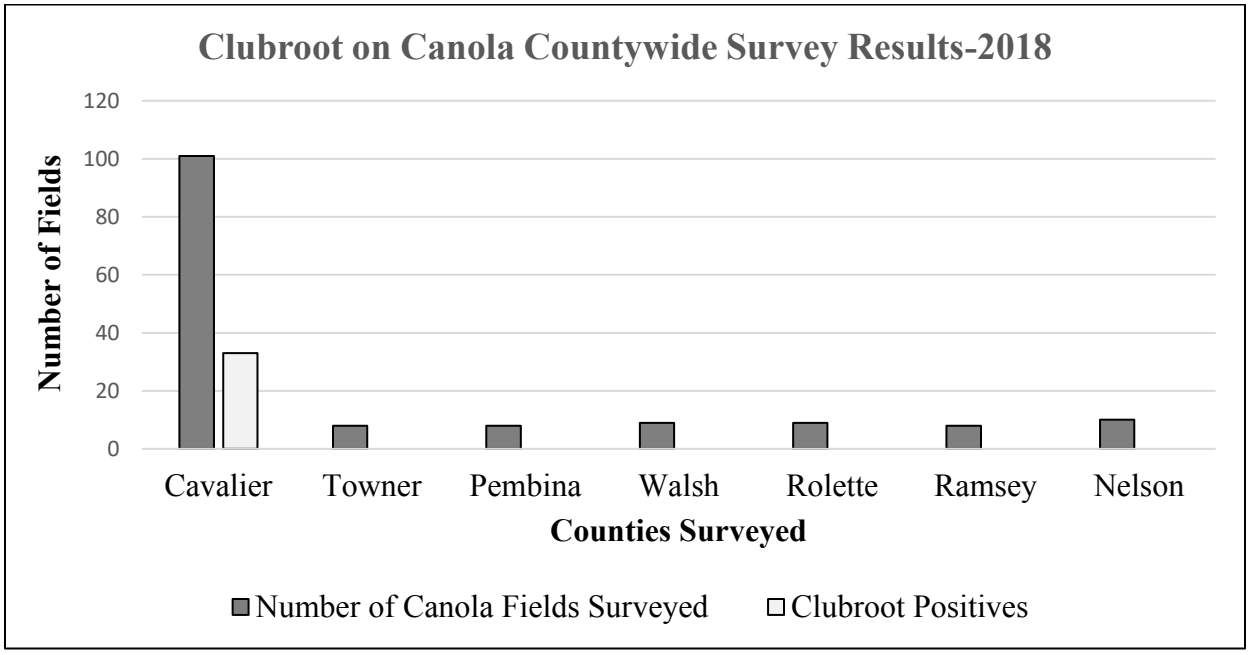
Scouting at swathing followed the methodology in Canada by the Alberta Agricultural and Rural Development (AARD) for effective clubroot disease surveying. Reports by the AARD indicate that the incidence of clubroot is highest in the field entrances. The survey was done from the main entrances/approaches in a field. The survey group walked along in a "W" pattern by stopping at 10 spots and uprooting 10 consecutive stems from the ground at each spot. Excess soil was shook off. Roots were visually examined for the presence of galls. At sample sites where infection was observed or suspected, root specimens with galls, along with soil, were double bagged and labeled with the field location. Soil samples from fields that may be infected with clubroot were submitted to Dr. Luis del Rio's laboratory for molecular analysis and to the NDSU soil-testing laboratory for pH determination. Each sampling point was separated by 100 meters. In all, roots of 100 stems were evaluated for the presence of clubroot and incidence was noted.

Results: The survey indicated that Cavalier County, compared to the other counties in the survey, is the only county with several canola fields that are severely infected with clubroot (Figure 1).

The survey conducted at the 1st phase was more productive in identifying clubroot positive fields. Most clubroot-infected fields that were identified this year had canola plants wilting at flowering stage in patches.

In all, 153 fields have been scouted in 2018 over seven counties. There were 101 fields scouted in Cavalier County and 33 of those fields were found to be infected with clubroot (Figure 1).

Figure 1: Fields surveyed in 2018 for the prevalence of clubroot in seven Northeast ND counties.

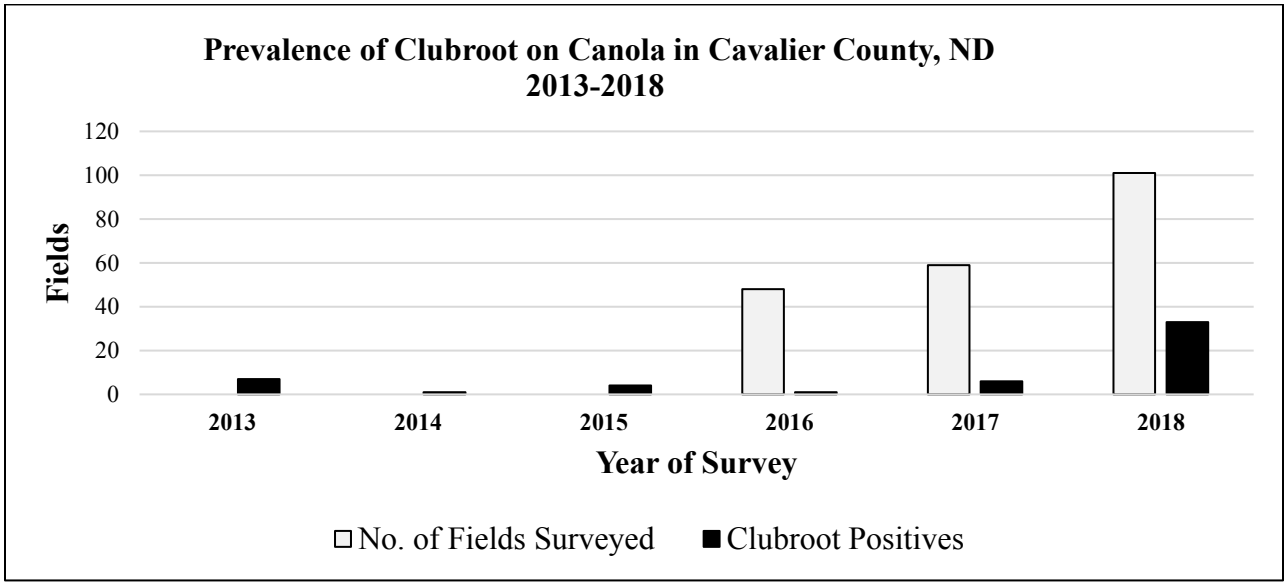


Note: Annual surveys for the occurrence of clubroot indicate that clubroot is spreading and is more widespread than hypothesized. The survey results indicate clubroot has been established countywide in Cavalier County. Growers who suspect clubroot in their field are encouraged to contact Dr. Venkat Chapara at the Langdon REC (701-256-2582), Dr. Anitha Chirumamilla at the Cavalier County Extension office (701-256-2560), Dr. Luis del Río in the Department of Plant Pathology (701-231-8362), or the NDSU Extension Service (701-231-8363).

In general, clubroot infections express symptoms on canola plants when soil samples show about 80,000 spores per gram of soil (Canadian Research). The NDSU canola pathology program, led by Dr. del Río, has the capability to perform laboratory tests to verify clubroot spore presence in soil samples. We encourage growers to send soil samples for quick confirmation of clubroot in your soil.

Growers should consider implementing longer crop rotations in clubroot identified fields. When canola comes up in the rotation, consider available clubroot resistant canola varieties. Clean your equipment thoroughly after working in a clubroot infected field. The primary mechanism of spores spreading between fields is the movement of infested soil on farm equipment. Yield losses of up to 25% were recorded in severely infected canola fields in Cavalier County this year. The occurrence of clubroot in fields with acidic soils seems to increase, and decrease as the pH gets closer to 7.0 and above.

Figure 2: Rapid spread of clubroot since its first report in 2013 in Cavalier County.



In 2013, clubroot was found initially in seven fields and has increased to 33 fields by 2018. Clubroot has established itself in Cavalier County in fields having acidic pH (Figure 2).

Determination of Soil pH: Soil samples from clubroot positive fields and the clubroot suspected fields were collected as per the procedure described by the Manitoba Agriculture, Food and Rural Development (MAFRD), Canada. The soil samples were submitted to the NDSU soil-testing laboratory in Fargo. The soil pH in the clubroot-infested fields of Cavalier County ranged from 4.5 to 6.4 (acidic soils are known to favor clubroot disease development).

Clubroot on Canola Awareness Meetings: Clubroot on canola awareness meetings were conducted in northeastern ND counties. There were ten in Cavalier County, two in Pembina County, and two in Walsh County during the growing season. Results of the survey were shared at the end of the growing season to growers and other commodity groups. Ramsey, Towner, Rolette and Nelson counties were updated on the survey at Lake Region Roundup on January 4, 2018. The sharing of information continued with clubroot alerts through weekly county Ag Alerts, news articles in county newspapers, northeastern ND extension agent radio talks, special alerts through Agweek, and online alerts delivered during the crop season by the PI and collaborators of this project.

Outcome: Meetings on creating awareness of clubroot on canola and its management in various counties showed measurable improvement in growers understanding the disease. Several growers came forward to cooperate in clubroot management research. Phone calls during the growing season and requests for personal visits to growers' fields with clubroot concerns increased. Knowledge of crop rotation, planting resistant varieties and sanitation implementation were the major topics of awareness meetings, and these will be continued in the future to safeguard canola production in North Dakota.

Acknowledgements:

The authors acknowledge funding support from the ND Crop Protection Product Harmonization Board, North Central Canola Research Program, and the Northern Canola Growers Association.

Special thanks to all the growers with phone call requests to visit their fields for clubroot diagnosis and to the NDSU Agriculture Extension Agents who assisted with the survey and in conducting clubroot awareness meetings in respective counties.

Evaluation of Various Chemicals, Cruciferous Hosts and Canola Cultivars to Manage Clubroot on Canola in Field Conditions

Venkat Chapara

Objective 1: To evaluate the effects of adding fungicides and pH-altering soil amendments to soil to manage clubroot on canola in field conditions.

Nine treatments consisting of fungicides and various compounds (Table 1) that can alter pH of soil were amended to soil and were compared with the non-treated check to evaluate their efficacy against clubroot pathogen under field conditions.

Treatments of wood ash, pellet lime, beet lime and gypsum were applied seven days before planting into the soil at a depth of three to four inches and thoroughly mixed in the soil with a rototiller.

Whereas, the rest of the treatments were drenched just before planting into the soil at a depth of three to four inches and were mixed thoroughly in the soil with a rototiller.

Table 1: List of products that were amended in the soil to manage clubroot on canola.

PRODUCT	TRADE NAME	DOSAGE
CYAZOFAMID	Ranman	7.5 l/ha
FLUAZINAM	Allegro	2000 g/ha
PCNB	Blocker	67.5 kg/ha
WOOD ASH	Fly Ash	7.5 t/ha
CALCIUM CARBONATE	Pellet Lime	7.5 t/ha
BEET LIME	Versa Lime	15 t/ha
GYPSUM	Gypsum	7.5 t/ha
NANO-PARTICLE	Zn	500 mg Zn
NON-IONIC SURFACTANT	Aqua-Gro 2000	10 g/m just before planting incorporated into rows
NON-TREATED	Check	Non-Treated Control

Variety: DKL 30-42 RR

Plot Size: 3 ft. x 5ft.

Planted: First week of June (Hand planted after thorough tillage with a rototiller.)

Field Design: Randomized complete block design (RCBD) with four replications.

Clubroot Evaluated: End of July in both years, 2017 and 2018.

Rating scale used: Clubroot rating scale: 0 = no galling, 1 = a few small galls (small galls on less than 1/3 of roots), 2 = moderate galling (small to medium-sized galls on 1/3 to 2/3 of roots), 3 = severe galling (medium to large-sized galls on more than 2/3 of roots) (S.E. Strelkov). A Clubroot Disease Index (CRDI) has been calculated using the incidence and severity data of clubroot obtained.

Figure 1: Efficacy of soil amendments to manage clubroot incidence in field conditions.

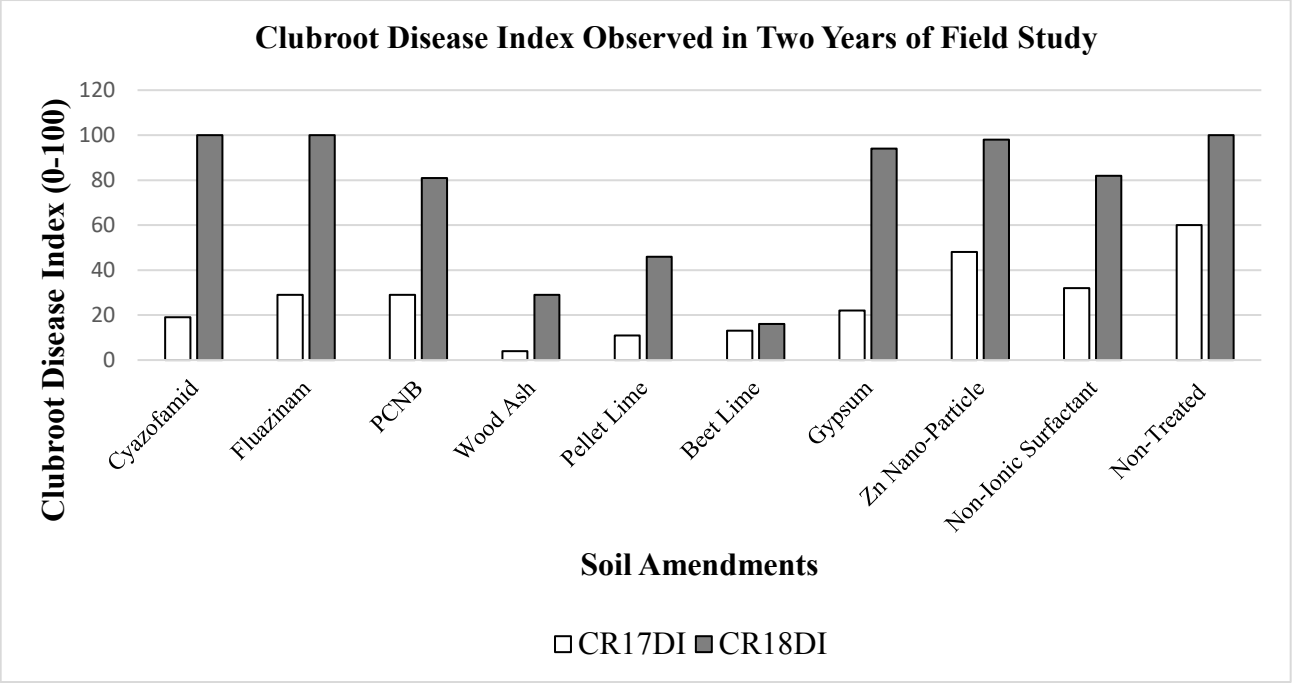


Figure 2: Soil pH before and after application of soil amendments to manage clubroot on canola in 2017.

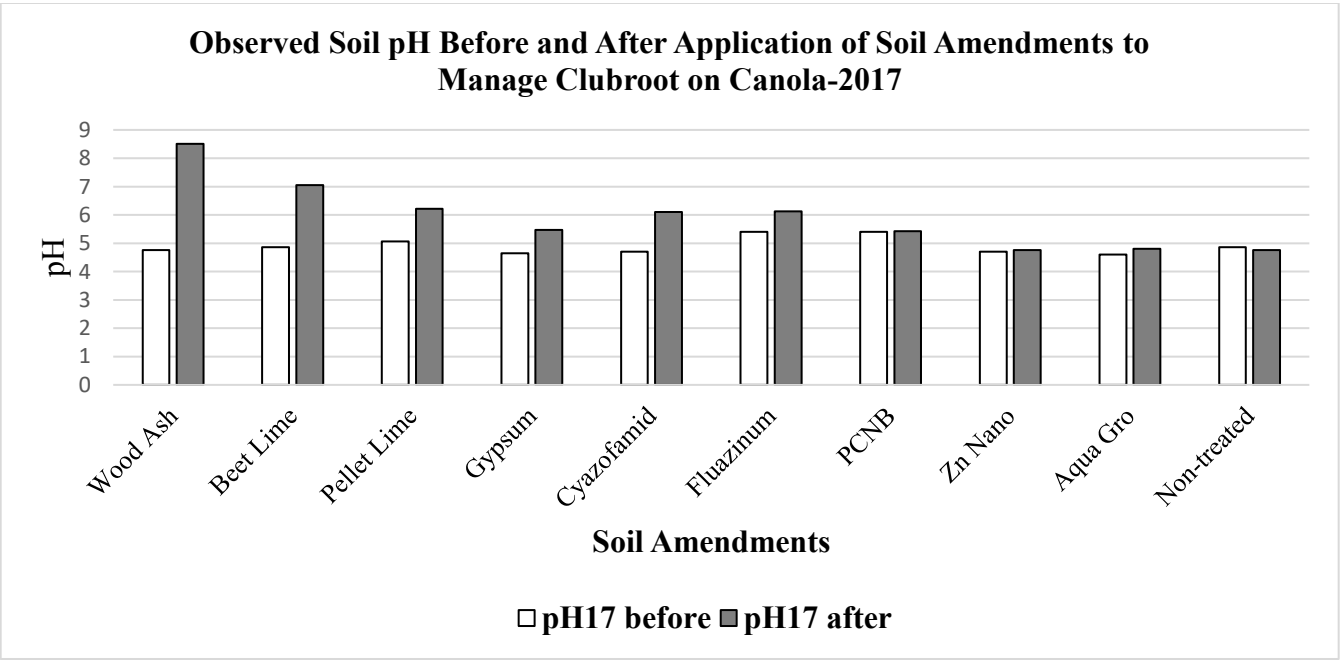
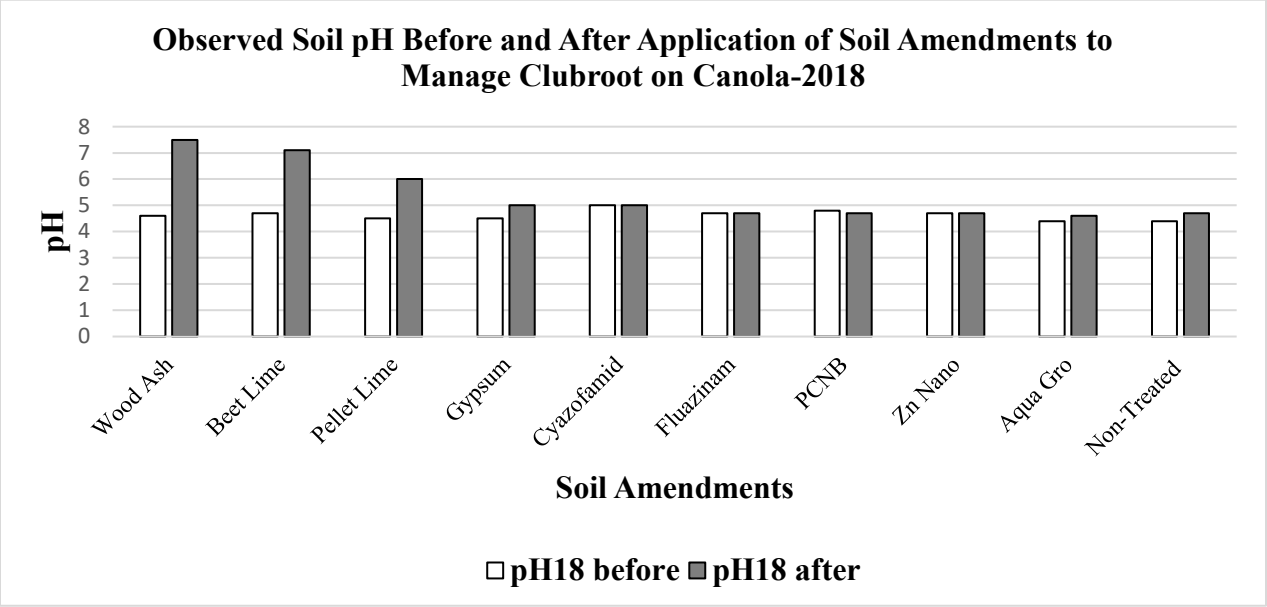


Figure 3: Soil pH before and after application of soil amendments to manage clubroot on canola in 2018.



Results and Conclusions: Significant differences in clubroot disease severity index (DSI) (Figure 1: CR17DI and CR18DI) were observed in the treatment of beet lime followed by wood ash and calcium carbonate compared to the other treatments tested in both years of current research. However, results of wood ash are not recommended for use in grower fields in consideration of poor seedling emergence and plant population (data not shown). Results of wood ash require further testing at lower dosages. In general, emergence and growth of many crops are negatively affected with increase in basic pH. This could be one reason for low emergence in wood ash treated plots. Lower clubroot disease severity index (CRDSI) was observed in respective treatments due to alteration in pH on log scale by 1.5 to 3 points in the treated plots on application of beet lime, wood ash and pellet lime. Based on two years of clubroot disease data using beet lime at 15 t/ha proved to be a viable option to manage clubroot. However, growers should keep in mind the cost, practical feasibility of using beet lime at high dosage and the extent of ease in application over larger areas in the field. If clubroot has been observed only in few isolated spots in the field, beet lime would work effectively in managing the disease for that particular year of application. In current research, there were significant differences in CR18DSI versus CR17DSI, which can be attributed to the soil population of viable resting spores of clubroot pathogen in the research ground. In general, continuous exposure of canola or other brassica crops year after year on the same research ground adds billions of spores to that ground. This might have resulted in higher DSI in the treatments tested in 2018.

Objective 2: To evaluate the symptoms caused by clubroot pathogen on various hosts of brassica family in field conditions.

Cruciferous host plants: Eleven host plants from brassica (cruciferous) family were planted in both years of this research.

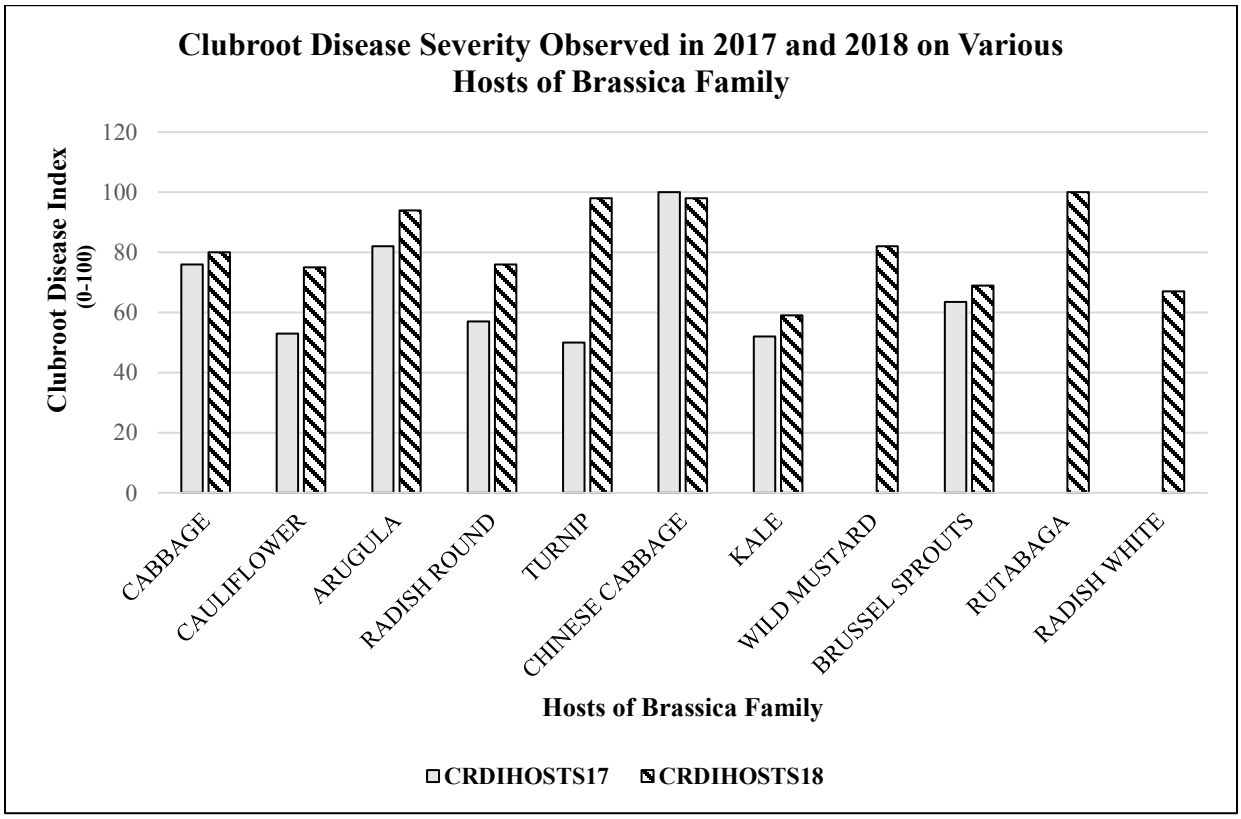
Plot Size: 3 ft. x 5ft.

Planted: First week of June (Hand planted after thorough tillage with a rototiller.)

Field Design: Randomized complete block design (RCBD) with four replications.

Clubroot Evaluated: Last week of July.

Figure 4: Clubroot Disease Index (CRDI) on various cruciferous hosts.



Results: Out of the 11 cruciferous hosts planted, only seeds of shepherd's purse did not germinate. The remaining 10 host plants showed positive response to clubroot infection with high clubroot disease index (CRDI). Rutabaga and radish white were only tested in 2018. The brassica family crops that were planted (including weeds or volunteers) in clubroot infected fields added additional amounts of inoculum to the soil that resulted in more clubroot infections in this year's trial.

Objective 3: To evaluate the resistance potential of commercial canola cultivars against clubroot pathogen in field conditions.

Plot Size: 3 ft. x 5ft.

Canola Varieties: Ten commonly cultivated canola varieties were planted to determine the level of resistance against clubroot (Table 2).

Table 2: Commonly cultivated canola varieties in Cavalier County.

No.	Cultivar	Clubroot Response
1	**DKL 30-42**	Susceptible
2	**InVigor L252**	Susceptible
3	**InVigor L233P**	Susceptible
4	**Integra 7150RR**	Susceptible
5	**Integra 7257RR**	Susceptible
6	**45CS40**	CR
7	**45H33**	CR
8	**InVigor L241C**	CR
9	**L255P**	CR
10	**Nexera 1022RR**	Susceptible

Note: CR=Clubroot Resistant

Planted: First week of June (Hand planted after thorough tillage with a rototiller.)

Field Design: Randomized complete block design (RCBD) with four replications.

Clubroot Evaluated: Last week of July.

Clubroot Disease Index (CRDI):

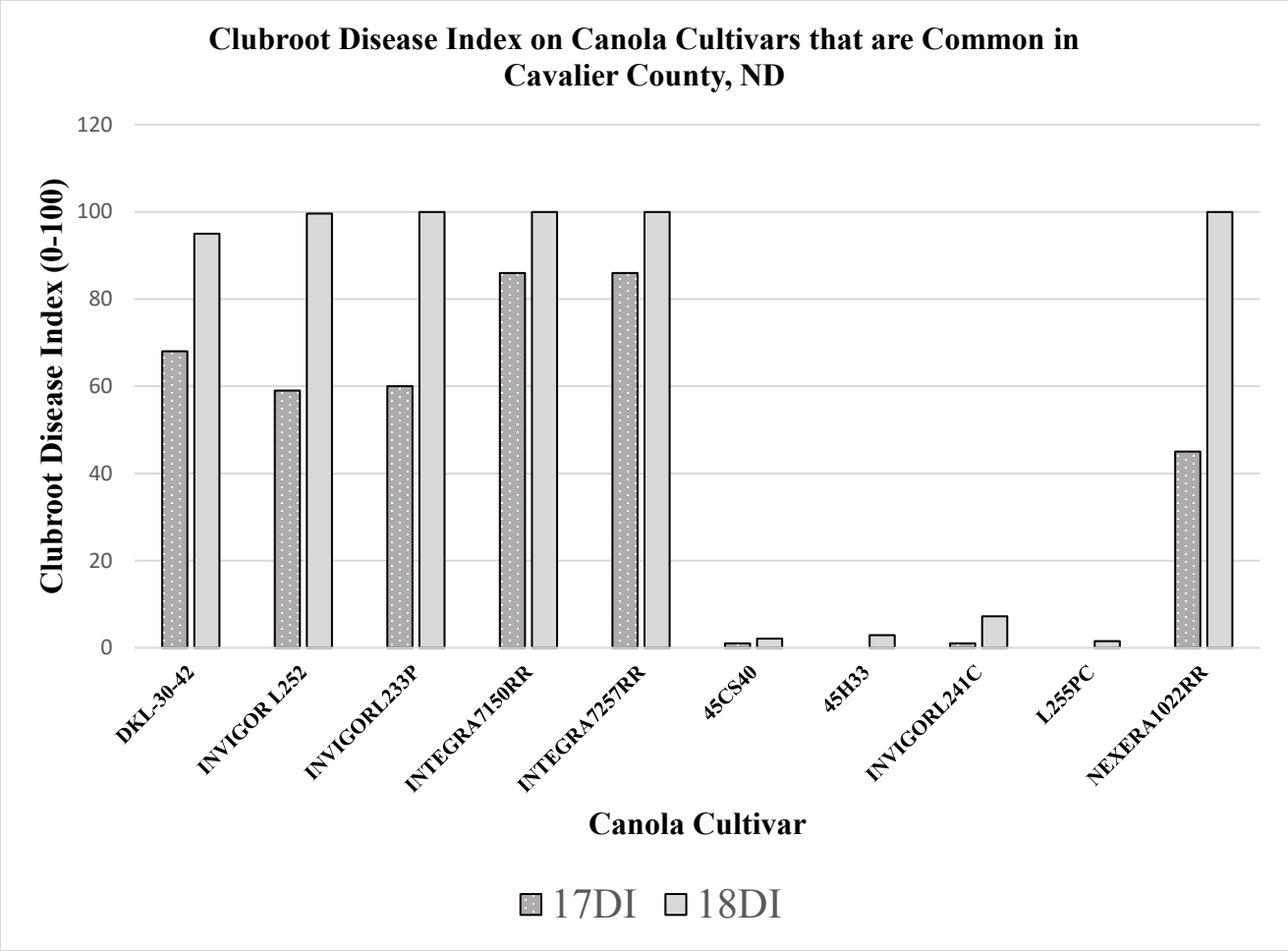
CRDI: <30% of Susceptible Check = Resistant (R)

CRDI 30-69% = Intermediate (I)

CRDI ≥70% = Susceptible (S)

Note: To validate a clubroot research trial, the susceptible check should have > 60% of Disease Index.

Figure 5: Mean clubroot incidence (%) on various commercial cultivars of canola.



Results: Canola cultivars InVigor L255PC, 45H33, 45CS40 and InVigor L241C showed resistance to clubroot and were significantly different from the other varieties tested. The added population of brassica crops that were grown last year explains the difference in the Clubroot Disease Index between years.

Future Research: The addition of commercial cultivars to this list will be very helpful to the growers.

<u>Case Study</u>: Clubroot incidence observed in a field that has not been exposed to brassica crops including canola for the past five years.

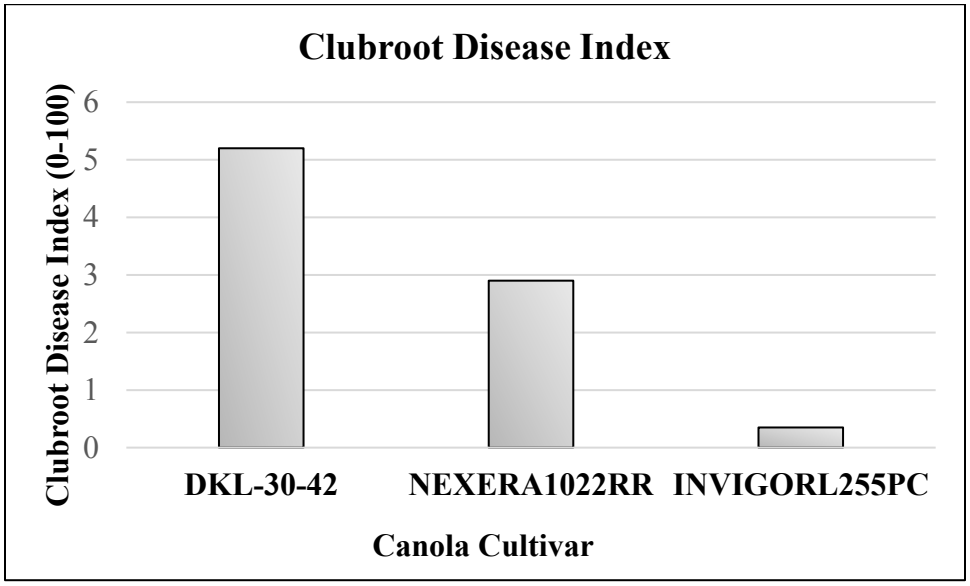
Objective: To test the presence of clubroot pathogen in the soil and its infection potential in soil where canola has not been grown for five years.

Methodology: A field with clubroot on canola identified in 2013 was used. Soil samples were collected before planting and at 56 days after planting canola varieties. Three canola varieties (one clubroot resistant, InVigor L255PC, and two clubroot susceptible varieties, DKL 30-42 and Nexera 1022R) were hand planted in plots of 3 ft. x 5 ft. dimensions and replicated four times in a randomized complete block design.

Varieties were evaluated 56 days after planting for their incidence and severity of clubroot. Based on incidence and severity data a Clubroot Disease Index was calculated.

Results: Soil samples at planting were molecularly tested by Dr. Chittem (Post-Doctoral Associate with Dr. del Rio, NDSU Department of Plant Pathology) for presence of clubroot pathogen in the soil. A faint band has been observed in the molecular analysis. Similar results have been obtained in field evaluation of Clubroot Disease Index on all three varieties evaluated (Figure 6). Data indicates the presence of low levels of clubroot pathogen and resting spore infection potential even after five years without canola. Likewise, this data supports the recommendation of a five-year crop rotation practice in clubroot-infected fields.

Figure 6: Clubroot disease index observed on three varieties planted after five years of clubroot confirmation.



Note: Currently waiting on clubroot resting spore population per gram of soil results from Dr. Chittem, which will aid in grower decision to grow clubroot resistant varieties.

Acknowledgements: The author acknowledges funding support from the Northern Canola Growers Association.

Barry Coleman and the NCGA Board Members
Amanda Arens, LREC Research Specialist
Canola growers in Cavalier County who offered their land for research and who supplied the commercial seed varieties.
Greg Engel, Wilbur-Ellis
Dave Nowatzki, Pioneer
Wilbur-Ellis
Jon Vanderberg, Bayer
Simplot, Langdon, ND
Dr. Brian Jenks, NCREC Weed Scientist
Jordan Ullyott, Nester Majait, and Justina Klindt, LREC Seasonal Employees
Industry personnel who supplied the chemicals.
Anitha Chirumamilla, Cavalier County Ag Extension Agent (Assisted with evaluation and photography.)
Kishore Chittem, Post doc of Dr. del Rio, Department of Plant Pathology, NDSU Fargo (Confirmed clubroot positives molecularly.)

Management of Blackleg in Canola with Fungicides

Venkat Chapara and Amanda Arens

A research trial was conducted at the Langdon Research Extension Center with an objective to evaluate the performance of experimental fungicides to manage blackleg in canola. The trial was planted on May 21, 2018, with the Roundup Ready variety "DKL 30-42" in a randomized complete block design replicated four times. The trial location followed state recommended practices for land preparation, fertilization, seeding rate and weed control.

The plot size was 5 ft. wide x 16 ft. long with a canola border between each plot. Eight experimental compounds were tested for their efficacy versus the fungicide Headline and a non-treated check. Two applications of fungicides were applied at the 2-4 leaf stage and 14 days after the first application using a CO_2-pressurized backpack style sprayer with a three-nozzle boom (XR-8002) at 10 GPA. Canola was inoculated with ascospores of the fungi-causing blackleg two times within three days at the 2-4 leaf stage to assure blackleg infection in the trial.

The severity of blackleg infection was evaluated on 100 plants (25 plants per replication) after swathing on August 25. Individual plants were uprooted, cut through the basal part of the stem and scored on the percent of diseased tissue visible in the cross-section. The ratings were zero when no diseased tissue was visible in the cross-section, and 100 if the diseased tissue occupied 100% of the cross-section with significant constriction of affected tissues, drying of tissue, brittle tissue or the plant was completely dead.

Results: Significant differences were observed among the treatments for blackleg incidence and blackleg severity index (DSI) when compared to the untreated check. However, there were no differences observed in yield and test weights.

Table 1: Efficacy of commercially available fungicides in managing blackleg and their influence on yield and test weight.

			Blackleg			
Treatments	**Dosage (oz/A)**	**Application Timing**	**Incidence (%)**	**DSI (0-5)**	**Yield (lbs/a)**	**Test Weight (lbs/bu)**
NON-TREATED CHECK	NA	NA	59	1.44	2736	51.76
EXPERIMENTAL 1	8.22	2-4 leaf stage	22	0.30	3034	52.01
EXPERIMENTAL 2	12.33	2-4 leaf stage	35	0.51	2815	52.17
EXPERIMENTAL 3	16.44	2-4 leaf stage	46	0.73	2797	52.08
EXPERIMENTAL 4	13.70	2-4 leaf stage	39	0.57	2816	52.12
EXPERIMENTAL 5	13.70	2-4 leaf stage	37	0.59	2857	52.04
EXPERIMENTAL 6	5.48	2-4 leaf stage	34	0.43	2826	52.12
EXPERIMENTAL 7	3.43	2-4 leaf stage	40	0.60	2861	52.24
EXPERIMENTAL 8	5.48	2-4 leaf stage	33	0.46	2744	52.07
HEADLINE	5.48	2-4 leaf stage	42	0.89	2848	51.96
Mean			**39**	**0.65**	**2833**	**52.05**
C.V. %			**29**	**63**	**8.2**	**0.41**
LSD 5%			**16**	**0.59**	**NS**	**NS**
p-Value (α at 0.05%)			**0.01**	**0.03**	**NS**	**NS**

Surfactant @ 6.4 fl. oz/A was added in treatments Exp 7, Exp 8 and Headline.

*Blackleg Mean Severity: Calculated by multiplying the category value (0-5) times actual severity (0.2, 0.4, 0.6, 0.8, 1.0), and summing, then dividing by the infected plant count.

Acknowledgements: Bryan Hanson, Travis Hakanson and Lawrence Henry for their technical support.

Fungicide Evaluation to Manage White Mold in Canola

Venkat Chapara and Amanda Arens

A research trial was conducted at the Langdon Research Extension Center with an objective to evaluate the performance of fungicides to manage white mold in canola. The trial was planted on May 21, 2018 with the Roundup Ready canola variety "DKL 30-42" in a randomized complete block design replicated four times. The trial location followed state recommended practices for land preparation, fertilization, seeding rate and weed control. The plot size was 5 ft. wide x 16 ft. long with a canola border on either side of each plot. The trial was irrigated with an overhead sprinkler system set at 10 minutes every two hours from 7:00 PM to 6:00 AM beginning one week before the start of bloom to four weeks after bloom to help increase disease infection levels. Fungicides were applied at 20% bloom using a CO_2-pressurized backpack style sprayer with a three-nozzle boom (XR-8002) at 20 GPA and repeated 12 days after first spray. The amount of white mold infection obtained in the research plots was natural. Fifty plants were rated within each plot and the level of incidence and severity levels were recorded for each plant prior to swathing (August 18) on a 0-5 scale, where 1=superficial lesions or small branch infected; 2=large branch(es) dead; 3=main stem at least 50% girdled; 4=main stem girdled but plant produced good seed; 5=main stem girdled, much reduced yield. A white mold disease severity index (DSI) was calculated with weighted mean of incidence and number of plants in each severity rating.

Table 1: Efficacy of commercially available fungicides in managing white mold and their influence on yield and test weight.

		WHITE MOLD ON CANOLA			
Treatments	**Dosage/A**	**Incidence (%)**	**DSI (0-5)**	**Yield (lbs/A)**	**Test Weight (lbs/bu)**
Non-treated Check	CHK	27.5	1.16	3248	50.6
EXPERIMENTAL	13.7 oz + .125 v/v	9.0	0.42	3566	50.9
PROLINE+NIS	5 oz + .125 v/v	16.5	0.79	3529	50.7
PRIAXOR+NIS	4 oz + .125 v/v	21.5	1.05	3716	50.8
QUASH+NIS	3 oz + .125 v/v	20.0	0.81	3571	50.7
TOPSIN	1.0 lb	17.0	0.76	3556	50.8
QUASH+TOPSIN	3 oz + ½ lb	18.0	0.83	3828	50.5
MEAN		**18.5**	**0.83**	**3574**	**50.7**
C.V. %		**43.2**	**49.5**	**11.4**	**0.58**
LSD 5%		**NS**	**NS**	**NS**	**NS**
p-Value (α at 0.05%)		**NS**	**NS**	**NS**	**NS**

Treatments were applied at 20% bloom and 12 days after first spray.

Results: No significant differences in white mold incidence, disease severity index (DSI), test weight, or yield were observed among the fungicides tested and the non-treated check (p-value non-significant). Dry weather during the growing season played a role in lower white mold incidences in the trial.

Acknowledgements: Bryan Hanson, Travis Hakanson and Lawrence Henry for their technical support.

EFFECT OF EXTENDED-RELEASE BLENDS CONTAINING NITROGEN AND SULFUR VERSUS STRAIGHT FERTILIZERS ON THE YIELD AND QUALITY OF CANOLA SEED IN NORTHEAST NORTH DAKOTA

By

Naeem Kalwar (Extension Soil Health Specialist)

Introduction

Nitrogen and sulfur are two of the thirteen essential plant nutrients that plant roots absorb from the soil. Nitrogen is not only an essential component of all proteins but is also taken up by the plants in large quantities. Its deficiency often results in stunted and slow growth along with chlorosis. Being a secondary plant nutrient, sulfur is also required in higher quantities by the plants. Apart from being a structural component of the amino acids, proteins, vitamins and enzymes, sulfur is also essential for the production of chlorophyll.

In order to fulfill these nutritional requirements, producers often apply physical blends of urea and ammonium sulfate (AS). While a physical blend may have the nutrient quantities applicators would be aiming for, once spread on the field it may result in uneven nutrient streaking. In addition, nitrogen and sulfur can leach to deeper depths and become unavailable to plants. In order to improve fertilizer efficiency, one option could be to apply "extended-release fertilizers," which optimize nitrogen and sulfur uptake during most of the growing season.

Objectives

Considering the high sulfur requirements of canola versus most crops, a fertilizer trial was conducted in 2018 on behalf of Anuvia Plant Nutrients. The objective of the trial was to compare the effects of extended-release blends containing nitrogen and sulfur (SymTRX20S and 171113-2) in combination with straight fertilizers versus a mix of straight fertilizers, on the yield and quality of canola seed.

Trial Location

Trial site was located at the NDSU Langdon Research Extension Center, Langdon, North Dakota.

Soil Analysis Report

Site	Depth (in.)	NO3-N (lbs/a)	P (ppm)	K (ppm)	O.M . %	SO_4-S (ppm)	EC (dS/m)	pH	SAR	Cl (ppm)	HCO3 (ppm)
Langdon REC	0-6"	39	32	392	7.70	114.14	0.60	6.0	0.56	25.95	180.62
	6-20"	48	10	194	4.60	228.08	0.72	7.5	1.19	23.57	153.77

Treatments and Replications

In order to determine fertilizer rates, North Dakota State University recommendations for northeast North Dakota were used (North Dakota Fertilizer Recommendation Tables and Equations. SF-882, Revised, 2018). Based on the soil analysis results, no treatment received potassium, whereas, five pounds of phosphorous was applied to all treatments. For nitrogen, 150 pounds per acre rate was used as a baseline. However, a credit of 43.5 pounds was given for the soil available nitrate-nitrogen along with a 40 pound credit for soybean being the previous crop. The final recommended nitrogen rate used was 66.5 pounds per acre. For sulfur, 30 pounds per acre rate was used.

There were a total of seven treatments including control with four replications. Treatment-1 was control, which received recommended rates of nitrogen and phosphorous through the straight fertilizers. Treatment-2 and 3 received recommended rates of nitrogen, phosphorous and sulfur through the extended-release blends in

combination with the straight fertilizers. Treatment-4 received recommended rates of nitrogen, phosphorous and sulfur through straight fertilizers. Treatment-5 and 6 received recommended rates of nitrogen and phosphorous along with 83% of the recommended sulfur rate through extended-release blends in combination with the straight fertilizers. Treatment-7 received recommended rates of nitrogen and phosphorous along with 83% of the recommended sulfur rate through straight fertilizers.

Details of the treatments, fertilizers, blends and nutrient quantities per acre are in the table below.

Treat. #	Fertilizer Type / Blend	Explanation	N (lb/ac)	P (lb/ac)	K (lb/ac)	S (lb/ac)
T1	Urea + MAP + KCL	Full rates of N, P and K with no S (control)	66.5	5	0	0
T2	SymTRX20S + Urea + MAP + KCL	Full rates of N, P, K and S	66.5	5	0	30
T3	171113-2 + Urea + MAP + KCL	Full rates of N, P, K and S	66.5	5	0	30
T4	AMS + Urea + MAP + KCL	Full rates of N, P, K and S	66.5	5	0	30
T5	SymTRX20S + Urea + MAP + KCL	Full rates of N, P, K and 83% rate of S	66.5	5	0	25
T6	171113-2 + Urea + MAP + KCL	Full rates of N, P, K and 83% rate of S	66.5	5	0	25
T7	AMS + Urea + MAP + KCL	Full rates of N, P, K and 83% rate of S	66.5	5	0	25

Note:

- Full rates of all fertilizer types were hand-broadcasted and harrowed-in before planting on May 20th, 2018.
- SymTRX20S was an extended-release blend (16-1-0-20S).
- 171113-2 was an extended-release blend (16-3-0-19S).

Design and Plot Size

Trial was planted in a randomized complete block design. Each plot size was 15 X 25 feet including borders.

Planting

Location	Variety	Planting Date	Seed Rate (pounds/acre)	Row Space
Langdon REC	Liberty Link Canola	May 25, 2018	3.5	15 inches

Harvesting

Plots were swathed on August 23rd and combined on September 4th, 2018.

Results and Discussion

Data was analyzed using SAS statistical package 9.4 at 95% confidence interval.

Statistically, no significant differences were found for yield (cleaned), test weight, weight of 1000 seeds, seeds per pound and oil percentage.

For yield numerically, Treatment-7 yields were the highest, whereas, Treatment-3 yields were the lowest.

For test weight numerically, Treatment-5 had the highest test weight, whereas, Treatment-6 was the lowest.

For the weight of 1000 seeds numerically, Treatment-4 weighed the most, whereas, Treatment-1 had the lowest weight.

For number of seeds per pound numerically, Treatment-1 had the highest number of seeds, whereas, Treatment-4 had the lowest number of seeds per pound.

For oil percentage numerically, Treatment-4 had the highest oil percentage, whereas, Treatment-5 had the lowest.

Statistical data is in the table below.

Treatments	Yield per acre (lbs)	Test Weight (lbs/bu)	1000 Seed Weight (g)	Seeds per Pound	Oil (percentage)
1	3241	50.7	3.50	129623	41.4
2	3108	51.0	3.53	128394	41.6
3	2780	50.7	3.59	126163	41.3
4	3081	50.9	3.62	125451	41.8
5	3172	51.1	3.61	125885	41.0
6	3135	50.6	3.61	125573	41.7
7	3371	51.0	3.54	128033	41.2
HIGH MEAN	3371	51.1	3.62	129623	41.8
LOW MEAN	2780	50.6	3.50	125451	41.0
MEAN	3127	50.8	3.57	127017	41.5
C.V. %	9.4	1.0	3.42	3.34	2.1
LSD	438	0.7	0.1818	6317	1.3
No. OF REPS	4	4	4	4	4
F-VALUE	1.51	0.75	0.60	0.60	0.45
Pr > F (α 0.05)	0.2305	0.6187	0.7254	0.7269	0.8375

Summary

Numerically, highest canola yield (3371 pounds per acre) was recorded for Treatment-7, which received a total of 66.5 pounds of nitrogen, 5 pounds of phosphorous and 24.9 pounds of SO_4-S per acre through a combination of straight fertilizers.

Numerically, highest test weight (51.1 pounds per bushel) was recorded for Treatment-5, which received a total of 66.5 pounds of nitrogen, 5 pounds of phosphorous and 24.9 pounds of SO_4-S per acre through the extended-release blend of SymTRX20S in combination with straight fertilizers.

Numerically, highest weight for 1000 seeds (3.62 grams) was recorded for Treatment-4, which received a total of 66.5 pounds of nitrogen, 5 pounds of phosphorous and 30 pounds of SO_4-S per acre through a combination of straight fertilizers.

Numerically, highest number of seeds per pounds (129,623) was recorded for Treatment-1 (control), which received a total of 66.5 pounds of nitrogen and 5 pounds of phosphorous through straight fertilizers.

Numerically, highest oil percentage (41.82%) was recorded for Treatment-4, which received a total of 66.5 pounds of nitrogen, 5 pounds of phosphorous and 30 pounds of SO_4-S per acre through a combination of straight fertilizers.

DETERMINING THE ECONOMIC RESPONSE OF SODIC SOILS TO REMEDIATION BY GYPSUM, ELEMENTAL SULFUR AND VERSALIME IN NORTHEAST NORTH DAKOTA ON TILED FIELDS

Naeem Kalwar (Extension Soil Health Specialist)

INTRODUCTION

Saline and sodic soils have been reported in North Dakota since the 1960s. NDSU Extension Bulletin No. 2 reported more than one million acres are affected by high salt levels, whereas, more than two million acres are said to have excessive levels of sodicity (Salt Affected Problem Soils in North Dakota, Their Properties and Management by Gordon A. Johnsgard, reprinted in 1974). Another study by Brennan J., and M. Ulmer reported 5.8 million saline acres in North Dakota (Salinity in the Northern Great Plains, Natural Resources Conservation Service, Bismarck, N.D. 2010). That is 15% of the 39 million acres of cropland in North Dakota. This is a result of high salt and sodium (Na^+) levels in the soil parent material and the underlying sodium-rich shale present in the bedrock below the soil sediments. Rising groundwater depths and resulting capillary rise of soil water leads to the accumulation of excessive soluble salts (salinity) and Na^+ causing sodicity in the topsoil.

Saline soils will have excessive levels of soluble salts in the soil water, which are a combination of positively and negatively charged ions (for example, table salt; Na^+Cl^-). High levels of ions (positive and negative) from soluble salts restrict normal water uptake by plant roots, even when soils are visibly wet, resulting in drought-stressed plants (osmotic effect).

Saline soils having higher levels of calcium (Ca^{2+})-based salts will have good structure. That happens as Ca^{2+} ions encourage aggregation of soil particles called flocculation (clumping together), resulting in well-defined pores facilitating free water movement through the soil profile.

In contrast to saline soils, sodic soils are highly saturated with Na^+ ions at the soil cation exchange sites (negative charges of clay and humus particles that attract positively charged chemical ions). High Na^+ levels compared to Ca^{2+} in combination with low salt levels can promote "soil dispersion", which is the opposite of flocculation. Soil dispersion causes the breakdown of soil aggregates, resulting in poor soil structure (low "tilth" qualities). Due to the poor soil structure, sodic soils have dense soil layers, resulting in very slow permeability of water through the soil profile. Due to poor soil structure, when wet, sodic soils will be gummy and may seem as if they have "no bottom" to them, and when dry, they can be very hard.

Note: if Na^+ is present as a salt, it will not cause dispersion as its positive charges will be neutralized by the negatively charged chemical ions such as sulfates (SO_4^{2-}) or chloride (Cl^-). However, high levels of Na^+ based salts in the soil water can result in sodicity due to the exchange of Na^+ from soil water to cation exchange sites.

OBJECTIVES

Remediation of soil sodicity requires application of amendments that add Ca^{2+} to the soil, followed by salinity remediation practices of improving soil drainage and lowering the groundwater depths. Ca^{2+} displaces Na^+ from the clay and humus particles (cation exchange sites) and Na^+ moves into soil water where it converts into a salt (Na_2SO_4) and leaches out with rain or irrigation water.

An effective way to lower groundwater depths is to install a field tile drainage system. Since tiles are generally three to four-feet below the surface, the efficiency of a tile drainage system depends upon the permeability of soil layers above the tiles. This requires analyzing soils for salts and Na^+ causing sodicity. In cases of high Na^+ levels causing

sodicity, not adding Ca^{2+} can render tiling ineffective. Salinity and sodicity levels can be determined by sampling the areas in question and getting the samples analyzed by a soil laboratory for Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR). For detailed information on sampling and testing soils for salts and sodicity, please refer to the NDSU Publication: SF-1809; "Soil Testing Unproductive Areas." Another NDSU publication that provides detailed information regarding the suitability of soils for tiling is: SF-1617; "Evaluation of Soils for Suitability for Tile Drainage Performance."

Challenges for landowners considering tiling could be:

1. **What if soil sodicity levels are high in the fields they would like to tile?**
2. **In cases of high sodicity levels, what should they do first, tile or apply the amendments?**

In July 2014, the Langdon Research Extension Center (LREC) tiled a field that had excessive levels of sodicity and moderately high levels of soluble salts. This consisted of 12 research plots with three replications. In order to replicate field conditions, the project site was tiled in July 2014 prior to starting sodicity remediation by applying soil amendments that are suitable and easily available to northeast North Dakota growers. Soil amendments were applied in July and August of 2015, one year after tiling.

The following objectives were set in order to achieve research goals.

- Can tiling be successful on sodic or saline-sodic soils prior to starting sodicity remediation?
- Comparing the relationship between varying groundwater depths and resulting soil salt and sodicity levels.
- Analyzing water samples from the lift station, upstream and downstream for human and livestock health.

TRIAL LOCATION AND SITE DESCRIPTION

This trial site is located at the NDSU Langdon Research Extension Center, Langdon, North Dakota. As per the USDA Web Soil Survey, soil series are a mix of Cavour-Cresbard and Hamerly-Cresbard loams.

TRIAL DESIGN AND PLOT SIZE

Trial design is randomized block. Each plot is 325 X 80 feet (0.6 acre).

METHODOLOGY

Soil Chemical Analysis

Four-foot deep soil samples in 12" increments were collected from each plot in September 2014, right after tiling. Using the same protocol, the site was sampled again in June 2016 (two years after tiling and one year after applying the amendments), in June 2017 (three years after tiling and two years after applying the amendments) and in June of 2018 (four years after tiling and three years after applying the amendments). Sampling depths were separated in 12-inch increments and each sampling activity included 48 soil samples (12 plots x 4 depths = 48 samples). All samples were analyzed for Electrical Conductivity or EC (salts), Sodium Adsorption Ratio or SAR (sodicity), pH, calcium carbonate equivalent or CCE, bicarbonates (HCO_3^-), chlorides (Cl^-), sulfates (SO_4^{2-}), saturation percentage, calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+) and nitrate-nitrogen (NO_3-N^-) for zero to four-foot depths. Soil phosphorus (P) and organic matter percent (O.M. %) were analyzed for the 0-12 inch and 12-24 inch depths. In addition, cation exchange capacity (CEC) was analyzed for the first foot.

Weekly Groundwater Depth Measurements

Groundwater depths were measured on a weekly basis in 2015, 2016, 2017 and 2018 from May-October through the seven-foot deep observation wells, which were installed in each plot in May 2015.

Water Sample Analysis

Water samples were collected from the lift station, upstream and downstream in November of 2015, May, July and September of 2016, May and August of 2017, and June 2018. These samples were analyzed by the ND Department of Health for Group 2 complete mineral chemistry, Group 7 trace metals and Group 30 nutrients.

Treatments and Replications

Soil amendment rates were calculated to bring the SAR (SAR-final) numbers to an acceptable level of 3 in the first foot. This was done by deducting three from the actual SAR numbers (SAR-initial). SAR-final values were converted into Exchangeable Sodium Percentage (ESP) by using the formula given in "Diagnosis and Improvement of Saline and Alkali Soils" (USDA Salinity Laboratory Staff, Agriculture Handbook No. 60, 1954, Page-26). Gypsum rates were then calculated by using a standard formula given in the same handbook (page-49). For each ton of 100% pure gypsum, 0.19 ton of 100% pure elemental sulfur was applied (Reclaiming Saline, Sodic, and Saline-Sodic Soils. University of California, ANR Publication 8519, August 2015). Considering the very low solubility of Versalime, for each ton of 100% pure gypsum, three tons of VersaLime were applied. Differences in amendment purities were compensated by using the formula given in "Reclaiming Sodic and Saline/Sodic Soils" (Drought Tips Number 92-33, University of California Cooperative Extension, 1993).

The following treatments were applied in three replications.

i. Control.
ii. Full rate of 99.5% pure gypsum to lower soil SAR-final levels to 3.
iii. Full rate of VersaLime to lower the soil SAR-final levels to 3.
iv. Full rate of 90% pure elemental sulfur (S°) to lower the soil SAR-final levels to 3.

Details of amendment rates for each treatment and replication are in Table 1.

Table 1. Details of amendment rates for each treatment.

Treatments and Replications	99.5% Gypsum tons/plot	90% Elemental Sulfur tons/plot	VersaLime tons/plot
R1T1	0	0	0
R1T2	4.47	0	0
R1T3	0	0	8.74
R1T4	0	2.10	0
R2T1	0	0	0
R2T2	7.25	0	0
R2T3	0	0	30.45
R2T4	0	0.61	0
R3T1	0	0	0
R3T2	10.67	0	0
R3T3	0	0	22.93
R3T4	0	2.16	0
Total	22.40	4.87	62.14

Note: Gypsum and elemental sulfur were applied on June 29th, whereas, VersaLime was applied on July 23rd, 2015. After spreading, all of the amendments were rototilled into the soil. Control plots were also rototilled for uniformity purposes. Control structures for all of the treatments were fully opened right after the incorporation of the amendments in order to simulate free drainage and achieve maximum leaching conditions.

RESULTS AND DISCUSSION

The findings below are based on the statistical analysis of the effects of soil amendments (treatments) and average annual growing-season groundwater depths on the 2014, 2016, 2017 and 2018 soil EC (salinity), SAR (sodicity) and pH levels measured at zero to four-foot depths by using SAS package 9.4 at 95% confidence interval. The 2014 results represent soil samples collected at the time when field was tiled, 2016 results represent samples collected two years after tiling and one year after the application of soil amendments, 2017 results are for samples collected three years after tiling and two years after applying the amendments and 2018 results are for the samples collected four years after tiling and three years after applying the amendments.

Soil EC, SAR and pH Levels at the Time of Tiling (2014)

At the time of tiling, all plots had moderately high EC levels with control plots having the lowest levels (mean = 7.39 dS/m) and gypsum plots having the highest levels (mean = 9.58 dS/m). The soil SAR levels in all of the plots were high to very high with control plots having the lowest levels (mean = 12.58) and gypsum plots having the highest levels (mean = 18.36). Soil pH of all plots were close to neutral. Details are in Table 2.

Table 2. The Treatment means of the Soil EC, SAR and pH Levels at the time of Tiling (2014).

Soil Property	2014 Treatment Means			
	Control	Gypsum	VersaLime	E-Sulfur
EC (dS/m)	7.39	9.58	9.19	8.91
SAR	12.58	18.36	16.33	16.58
pH	7.05	7.04	7.14	6.94

Effect of Soil Amendments on EC, SAR and pH Levels

Differences in Soil EC Levels

Statistically, there were significant differences in the annual soil EC levels among treatments and between replications (Table 3) compared to the EC levels at the time of tiling (2014).

Table 3. Statistical Differences in Soil EC (dS/m) Levels.

Source	Mean Square	P > F
Year	202.87	<.0001
Treatment	43.48	<.0001
Replication	40.91	<.0001
Soil Depths	8.50	0.1584
Year vs Treatment	1.11	0.9799
Treatment vs Soil Depths	2.27	0.8924
Year vs Treatment vs Soil Depths	1.12	1.0000

The 2016, 2017 and 2018 soil EC levels were significantly lower than 2014. However, EC levels increased in 2017 and 2018 significantly compared to 2016 due to drier weather and resulting capillary rise (wicking up) of soil water. In addition, soil EC levels of gypsum, E-Sulfur (elemental sulfur) and VersaLime treatments were significantly higher than the control treatments. There were no significant differences among rest of the treatments. In terms of subsurface salinity, EC levels in the 12-24 inch depths remained significantly higher than the EC levels in 36-48 inch depths. Overall, highest EC levels were measured in 12-24 inch depths, followed by 24-36 inch, 0-12 inch and 36-48 inch depths. Details are in Table 4.

Table 4. Soil EC (dS/m) Level Differences between Years, Treatments and Soil Depths.

Annual Means	
2014	8.77
2016	3.75
2017	6.59
2018	6.24
Treatment Means	
Control	4.92
E-Sulfur	6.74
Gypsum	6.77
VersaLime	6.93
Means for Soil Depths	
0-12 inch	6.17
12-24 inch	6.85
24-36 inch	6.46
36-48 inch	5.87

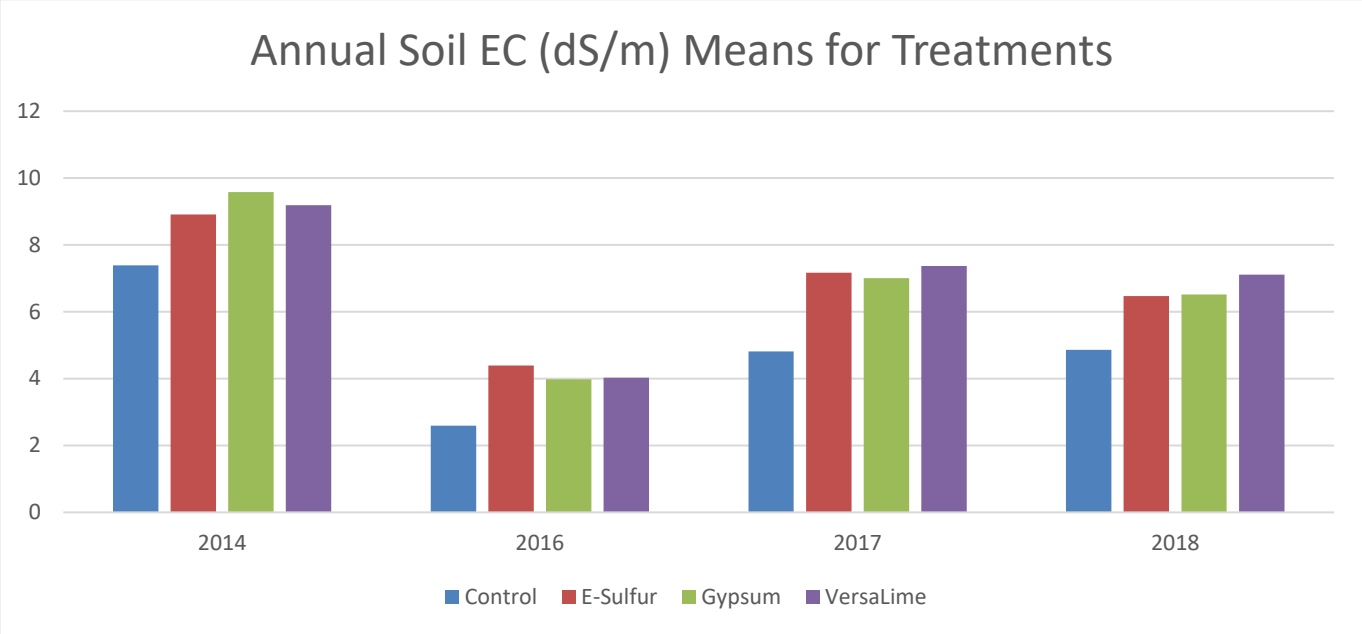
Based on the differences in the annual means of soil EC levels (Table 5), in 2016, EC levels dropped significantly compared to 2014 despite higher rainfall and shallower average annual growing-season groundwater depths. In 2017 and 2018, EC levels remained lower than 2014, however, compared to 2016, EC levels increased despite lower average annual growing-season groundwater depths due to drier weather. That could be attributed to the increased capillary rise of soil water due to increased evapotranspiration. In 2018, EC levels remained more or less the same like 2017.

Table 5. Annual Differences in the Means of Soil EC (dS/m) Levels among Treatments.

	Least Square Means			
Year	**Control**	**E-Sulfur**	**Gypsum**	**VersaLime**
2016	2.59	4.39	3.98	4.03
2014	7.39	8.91	9.58	9.19
Difference	-4.80	-4.52	-5.60	-5.16
2017	4.81	7.17	7.01	7.37
2014	7.39	8.91	9.58	9.19
Difference	-2.58	-1.74	-2.57	-1.82
2018	4.86	6.47	6.52	7.11
2014	7.39	8.91	9.58	9.19
Difference	-2.53	-2.44	-3.06	-2.08
2017	4.81	7.17	7.01	7.37
2016	2.59	4.39	3.98	4.03
Difference	2.22	2.78	3.03	3.34
2018	4.86	6.47	6.52	7.11
2016	2.59	4.39	3.98	4.03
Difference	2.27	2.08	2.54	3.08
2018	4.86	6.47	6.52	7.11
2017	4.81	7.17	7.01	7.37
Difference	0.05	-0.70	-0.49	-0.26

The chart below (Figure 1) has the annual soil EC means for the four treatments.

Figure 1. Annual Means of Soil EC (dS/m) Levels for all Four Treatments.



Differences in Soil SAR Levels

Statistically, there were significant differences in the annual soil SAR (sodicity) levels among treatments and soil depths (Table 6) compared to the levels at the time of tiling (2014).

Table 6. Statistical Differences in Soil SAR Levels.

Source	Mean Square	P > F
Year	119.38	0.0074
Treatment	370.94	<.0001
Replication	9.23	0.7244
Soil Depths	456.08	<.0001
Year vs Treatment	39.54	0.2018
Treatment vs Soil Depths	20.54	0.6901
Year vs Treatment vs Soil Depths	17.13	0.9611

In 2018, soil SAR levels increased significantly versus the rest of the years. The soil SAR levels of control treatments remained significantly lower than the rest of the treatments. In addition, SAR levels in the gypsum treatments remained significantly higher than the rest of the treatments. The 0-12 and 12-24 inch soil depths had significantly lower SAR levels that the 24-36 and 36-48 inch depths. Overall, soil SAR levels increased with soil depths. Details are in Table 7.

Table 7. Soil SAR Level Differences between Years, Treatments and Soil Depths.

Annual Means	
2014	15.96
2016	16.45
2017	15.15
2018	18.82
Treatment Means	
Control	13.00
E-Sulfur	16.88
Gypsum	19.79
VersaLime	16.72
Means for Soil Depths	
0-12 inch	13.69
12-24 inch	14.78
24-36 inch	17.28
36-48 inch	20.63

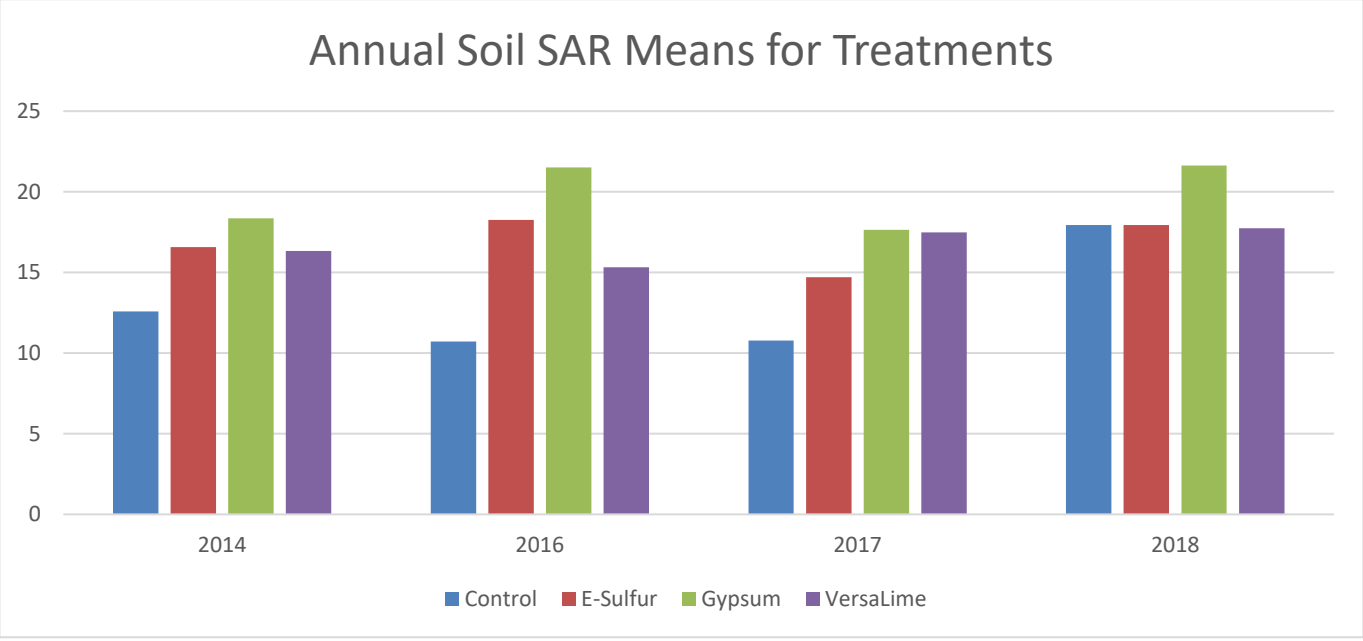
Based on the differences in the annual means of soil SAR levels (Table 8), in 2018 SAR levels increased in all treatments, notably in control versus 2014, 2016 and 2017. Whereas, in 2016 and 2017, SAR levels fluctuated irrespective of the treatments.

Table 8. Annual Differences in the Means of Soil SAR (sodicity) Levels among Treatments.

	Means			
Year	**Control**	**E-Sulfur**	**Gypsum**	**VersaLime**
2016	10.72	18.26	21.51	15.32
2014	12.58	16.58	18.36	16.33
Difference	-1.86	1.68	3.15	-1.01
2017	10.77	14.71	17.64	17.48
2014	12.58	16.58	18.36	16.33
Difference	-1.81	-1.87	-0.72	1.15
2018	17.95	17.95	21.64	17.75
2014	12.58	16.58	18.36	16.33
Difference	5.37	1.37	3.28	1.42
2017	10.77	14.71	17.64	17.48
2016	10.72	18.26	21.51	15.32
Difference	0.05	-3.55	-3.87	2.16
2018	17.95	17.95	21.64	17.75
2016	10.72	18.26	21.51	15.32
Difference	7.23	-0.31	0.13	2.43
2018	17.95	17.95	21.64	17.75
2017	10.77	14.71	17.64	17.48
Difference	7.18	3.24	4.00	0.27

The chart below (Figure 2) has the annual soil SAR means for the four treatments.

Figure 2. Annual Means of Soil SAR Levels for all Four Treatments.



Differences in Soil pH Levels

Statistically, there were significant differences in the annual soil pH levels (Table 9). In addition, pH levels significantly differed for soil depths.

Table 9. Statistical Differences in Soil pH Levels.

Source	Mean Square	P > F
Year	9.82	<.0001
Treatment	0.07	0.3206
Replication	0.14	0.1240
Soil Depths	1.65	<.0001
Year vs Treatment	0.03	0.8555
Treatment vs Soil Depths	0.04	0.6892
Year vs Treatment vs Soil Depths	0.03	0.9809

The 2016, 2017 and 2018 soil pH levels were significantly higher than the pH levels in 2014. However, there were no significant differences in soil pH during 2016, 2017 and 2018. The lower soil pH levels in 2014 can be attributed to the lower soil moisture levels at the time of sampling (September 2014) compared to rest of the years. There were no significant differences in soil pH among the four treatments. Soil pH in the 36-48 inch depth remained significantly higher than the 0-12 and 12-24 inch depths. Overall, soil pH levels increased with soil depths due to the increased soil moisture levels. Details are in Table 10.

Table 10. Annual Differences in Soil pH Levels.

Annual Means	
2014	7.04
2016	7.90
2017	7.92
2018	8.01
Treatment Means	
Control	7.72
E-Sulfur	7.66
Gypsum	7.74
VersaLime	7.75
Means for Soil Depths	
0-12 inch	7.48
12-24 inch	7.67
24-36 inch	7.81
36-48 inch	7.91

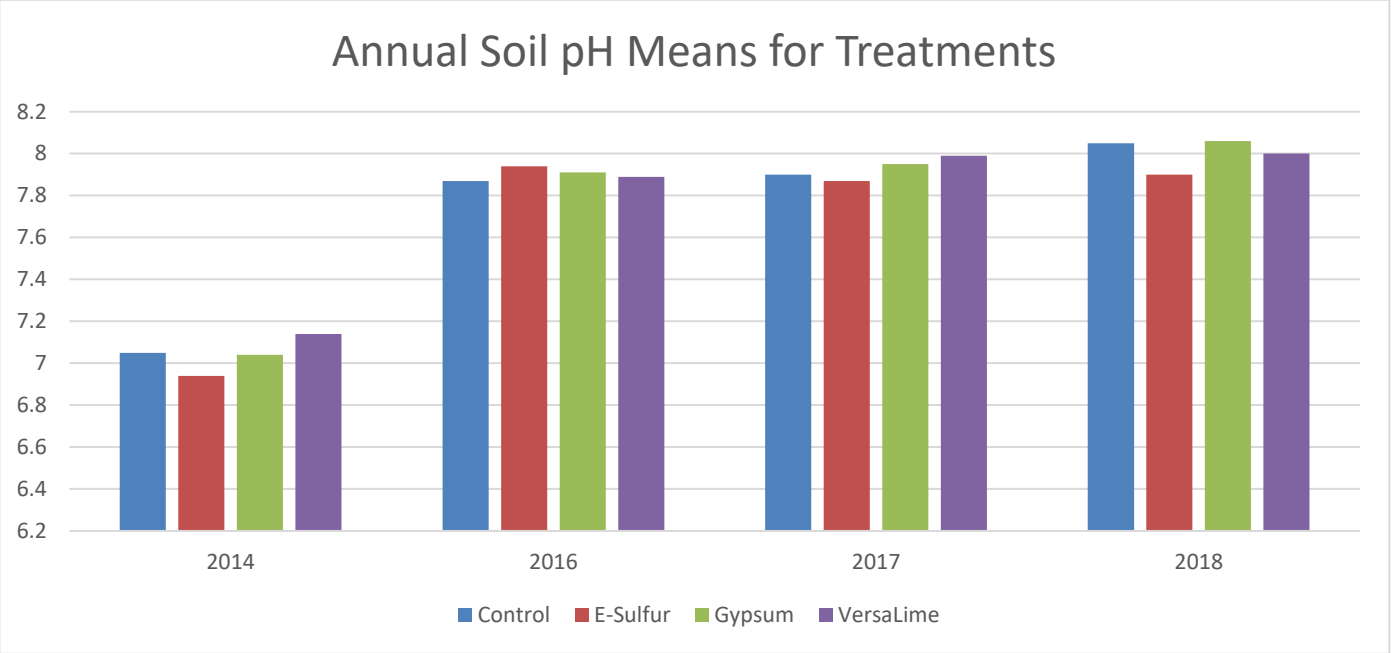
Based on the differences in the annual means of soil pH (Table 11), 2014 pH levels were lower than the rest of the years due to the lower soil moisture conditions at the time of sampling (September 2014). In 2016, 2017 and 2018, soil samples were collected in June when moisture levels were higher.

Table 11. Annual Differences in the Means of Soil pH Levels among Treatments.

	Means			
Year	**Control**	**E-Sulfur**	**Gypsum**	**VersaLime**
2016	7.87	7.94	7.91	7.89
2014	7.05	6.94	7.04	7.14
Difference	0.82	1.00	0.87	0.75
2017	7.90	7.87	7.95	7.99
2014	7.05	6.94	7.04	7.14
Difference	0.85	0.93	0.91	0.85
2018	8.05	7.90	8.06	8.00
2014	7.05	6.94	7.04	7.14
Difference	1.00	0.96	1.02	0.86
2017	7.90	7.87	7.95	7.99
2016	7.87	7.94	7.91	7.89
Difference	0.03	-0.07	0.04	0.10
2018	8.05	7.90	8.06	8.00
2016	7.87	7.94	7.91	7.89
Difference	0.18	-0.04	0.15	0.11
2018	8.05	7.90	8.06	8.00
2017	7.90	7.87	7.95	7.99
Difference	0.15	0.03	0.11	0.01

The chart below has the annual soil pH means for the four treatments (Figure 3).

Figure 3. Annual Means of Soil pH Levels for all Four Treatments.



Effect of Average Annual Growing-Season Groundwater Depths on EC, SAR and pH Levels

For statistical analysis, 2016, 2017 and 2018 average annual growing-season groundwater depths were measured at zero to seven foot depths. However, since observation wells were installed in 2015, Table 12 contains differences between 2015, 2016, 2017 and 2018 average annual growing-season groundwater depths. Based on the data in Table 12, 2016 groundwater depths were shallower than the 2015, 2017 and 2018 depths. The lowest average annual growing-season groundwater depths were recorded in 2018 groundwater.

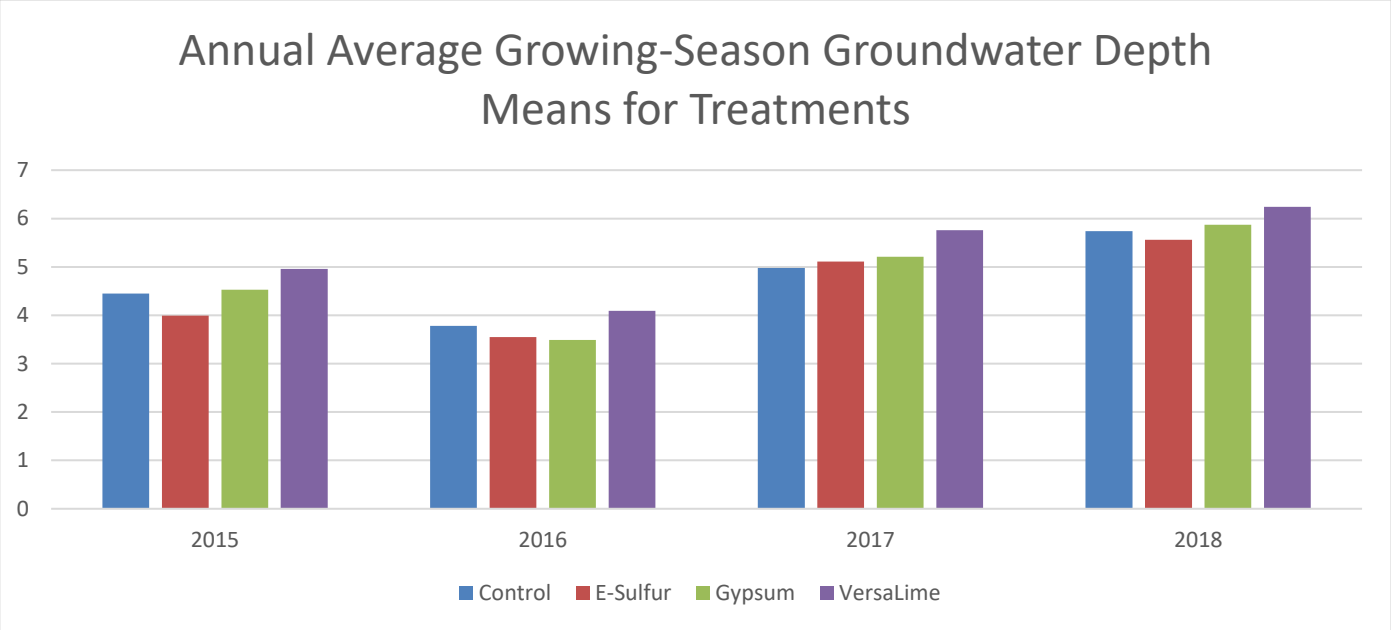
Table 12. Average Annual Growing-Season Groundwater Depth Differences among Treatments in feet.

	Average Annual Growing-Season Groundwater Depths in feet			
Year	**Control**	**E-Sulfur**	**Gypsum**	**VersaLime**
2015	4.45	3.99	4.53	4.96
2016	3.78	3.55	3.49	4.09
Difference	0.67	0.44	1.04	0.87
2015	4.45	3.99	4.53	4.96
2017	4.98	5.11	5.21	5.76
Difference	-0.53	-1.12	-0.68	-0.80
2015	4.45	3.99	4.53	4.96
2018	5.74	5.56	5.87	6.24
Difference	-1.29	-1.57	-1.34	-1.28
2016	3.78	3.55	3.49	4.09
2017	4.98	5.11	5.21	5.76
Difference	-1.20	-1.56	-1.72	-1.67
2016	3.78	3.55	3.49	4.09

2018	5.74	5.56	5.87	6.24
Difference	-1.96	-2.01	-2.38	-2.15
2017	4.98	5.11	5.21	5.76
2018	5.74	5.56	5.87	6.24
Difference	-0.76	-0.45	-0.66	-0.48

Figure 4 has the average annual growing-season groundwater depths for the four treatments in feet.

Figure 4. Annual Means of Average Growing-Season Groundwater Depths for all Four Treatments in feet.



This fluctuation in the groundwater depths is also reflective of a very wet 2016 versus drier weather in 2017 and 2018 (Table 13).

Table 13. Four-year Rainfall versus Evapotranspiration Data of the NDSU Langdon Research Extension Center, North Dakota Agricultural Weather Network (NDAWN) Station.

Time Period	Total Potential Evapotranspiration (Penman)	Total Rainfall (inches)	Total Normal Rainfall (inches)
April 1 – Oct. 31, 2015	41.37”	18.46”	16.68”
April 1 – Oct. 31, 2016	35.29”	24.91”	
April 1 – Oct. 31, 2017	38.72”	10.24”	
April 1 – Oct. 31, 2018	38.28”	11.41”	

Differences in Soil EC Levels

Statistically, there were significant differences in the soil EC levels due to the changes in the average annual growing-season groundwater depths (Table 14).

Table 14. Statistical Differences in Soil EC (dS/m) Levels.

Source	Mean Square	F-value	P > F
Replication	4.77	1.22	0.2994
Year	23.14	5.89	0.0035
Groundwater Depth	234.457	59.72	<.0001

The 2016 soil EC levels were significantly lower than the 2017 EC levels. In 2017, EC levels increased due to drier weather (Table 13) resulting in capillary rise despite lower groundwater depths.

Differences in Soil SAR Levels

Statistically, there were no significant effects on soil SAR levels (Table 15) due to the changes in the average annual growing-season groundwater depths. However, 2018 SAR levels were significantly higher than the SAR levels at the time of tiling (2014).

Table 15. Statistical Differences in Soil SAR Levels.

Source	Mean Square	F-value	P > F
Replication	73.99	1.90	0.1537
Year	180.99	4.64	0.0112
Groundwater Depth	4.54	0.12	0.7331

There were no significant differences in the 2016, 2017 and 2018 soil SAR levels due to the changes in the average annual growing-season groundwater depths.

Differences in Soil pH Levels

Statistically, there were no significant effects of the average annual growing-season groundwater depths on soil pH levels (Table 16).

Table 16. Statistical Differences in Soil pH Levels.

Source	Mean Square	F-value	P > F
Replication	0.07	1.10	0.3363
Year	0.05	0.88	0.4165
Groundwater Depth	0.18	2.77	0.0981

In addition, there were no significant differences in the 2016, 2017 and 2018 soil pH levels due to the changes in the average annual growing-season groundwater depths.

Quality of Water Draining from the Research Project Site for Human and Livestock Health

All minerals, trace elements and nutrients affecting human and livestock health, were found to be within the acceptable limits in the samples draining out of the Langdon REC Groundwater Management Research Project site.

CONCLUSION

Based on the four-year data, changes in soil EC (salinity) levels were consistent with the fluctuations in the annual rainfall and evapotranspiration data. Tiling the saline-sodic site alone did not seem to make a big difference as the highest annual decrease in EC levels was recorded in 2016 with shallower groundwater levels and higher seasonal rainfall (24.91”). Drier weather in 2017 and 2018, resulted in an increase in EC levels despite lower annual average growing-season groundwater depths. That could be due to the absence of a decent amount of rain to push the salts deeper and increased evapotranspiration resulting in capillary rise of soil water. Consistently higher SAR (sodicity) levels could also be contributing to the slower leaching of excessive salts from the top four feet of soil due to the poor permeability.

Soil sodicity levels remained inconsistent three years after applying the amendments and the site being tiled for four years. This could be due to the absence of a decent amount of rain to dissolve the amendments and create the desired chemical reaction for the conversion of sodicity into salinity.

The changes in soil pH were found to be consistent with soil moisture availability at the time of sampling. No effects of soil amendments were observed on pH three years after application.

Producers and landowners, who are thinking about tiling entire fields, may want to consider looking at the following points before making a final decision:

- Under drier weather, **"tiling may not be necessary as average annual growing-season groundwater depths may lower naturally."**
- If the potential fields have unproductive or marginal areas, **"they should be sampled three to four feet deep and analyzed for EC (salinity) and SAR (sodicity) levels."**
- Tiling saline fields alone under drier weather **"will not lower salinity as moving the excess salts into deeper depths will also require a decent amount of rain."**
- Under drier weather, **"salinity levels can increase despite tiling due to the increased evaporation and resulting capillary rise of soil water."**
- Tiling sodic or saline-sodic fields alone **"will not remediate sodicity and will require application of amendments."**
- If sodicity problems are established, **"amendments should always be applied before tiling in order for the amendments to convert sodicity into salinity."**
- Conversion of sodicity into salinity by amendments **"may take years, especially under drier weather."**

Langdon REC Foundation Seed Stocks Program

The Langdon REC supports a Foundation Seed Stocks Program to help increase and distribute the newest NDSU varieties of HRSW, Durum, Barley, Soybeans and Flax. We also periodically increase seed for the University of Minnesota and South Dakota Ag Experiment Station. Each year approximately 500 acres are planted for the FSS program. The harvested acreage is available for sale to producers and seedsmen in the region. The varieties of crops that are available for the 2019 growing season are listed below:

HRSW – Glenn, Faller, Prosper, Linkert, Bolles, ND VitPro
Barley – Lacey
Flax – Omega, ND Hammond
Soybeans - ND Henson, ND17009GT, ND18008GT

Growers who have grown seed for certification in one of the last four years who request seed prior to December 1st will be guaranteed an allocation. Any seed inventories available after December 1st will be sold on a first come, first serve basis. Seed availability and prices may be obtained by calling the Langdon Research Extension Center at 701-256-2582.

Visit our website at www.ag.ndsu.edu/langdonrec/

NDSU Langdon Research Extension Center

9280 107th Ave. N.E., Langdon, ND 58249
(701) 256-2582 • fax (701) 256-2580

Website: **www.ag.ndsu.edu/langdonrec**
Email: **NDSU.Langdon.REC@ndsu.edu**
Facebook: **www.facebook.com/langdonrec**

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

NDSU | EXTENSION