Ag. Report No. 35

Thirty-Fifth Annual Western Dakota Crops Day Research Report 2018

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NDSU | HETTINGER RESEARCH EXTENSION CENTER

35th Annual Western Dakota Crops Day

December 20, 2018

Hettinger Armory

MST

9:00 AM Registration

Coffee and doughnuts. Free time to view exhibits and visit with Program Sponsors.

10:00 Early Bird Drawing and Opening Announcements

10:10 Crop Variety Updates and Highlights of Ongoing Regional Crop Production Research

Dr. Caleb Dalley, Weed Scientist, NDSU Hettinger Research Extension Center.
Ryan Buetow, Extension Agronomist, NDSU Dickinson Research Extension Center.
Dr. Chris Graham, Extension Agronomist, SDSU West River Ag Center, Rapid City, SD.
Patrick Wagner, SDSU Extension Entomology Field Specialist, Rapid City, SD.

11:50 Adams County Commodity Elections

12:00 Lunch

Provided by Program Sponsors. Free time to visit with sponsors.

1:00 Crop Variety Updates and Highlights of Ongoing Crop Production Research (cont.)

John Rickertsen, Research Agronomist, NDSU Hettinger Research Extension Center.

1:30 Salinity, Sodicity, Alkalinity, Acidity; What are these things?

Chris Augustin, Extension Specialist Soil Health, NDSU North Central REC, Minot, ND.

2:15 Stop the Bleeding.

Dwayne Beck, Research Manager, Dakota Lakes Research Farm, Pierre, SD.

3:00 Conclusion

Drawing for door prizes, coffee and opportunity to visit with sponsors.

Acknowledgments

The Hettinger Research Extension Center gratefully acknowledges and thanks the following companies and organizations for their financial support and participation in this year's Western Dakota Crops Day. Those listed below have provided for the noon meal and have made this event possible. We greatly appreciate their commitment and support.

2018 Western Dakota Crops Day Sponsors

Hettinger Area Chamber of Commerce
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North Dakota Grain Growers Association
North Dakota Soybean Council
Proseed
Pulse USA
Southwest Ag
Southwest Grain
Stone Mill LLC

We also acknowledge and thank the following individuals for their willingness to cooperate with us at off-station plot sites and in providing us with materials for this publication. Their participation has enabled us to compile the enclosed information which would not otherwise be possible.

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Dan Christman, Hettinger
USDA – ARS Northern Great Plaines Research Center, Mandan
Keith Gietzen, Glen Ullin
Pat Doll, Hannover
Les Johnson, Bison, SD

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Interpreting Statistical Analysis

Field research involves the testing of one or more variables such as crop varieties, fertilizer rates, weed control methods, planting dates, etc. Field testing of such variables is conducted in order to determine which variety, fertilizer rate, herbicide, date, etc. is best for the particular area of production. The main objectives of crop production research are to determine the best means of producing a crop and how to maximize yield and economic return from farming.

Agricultural researchers use statistics as a tool to help differentiate production variables so meaningful conclusions can be drawn from the data gathered from research trials. Attempts are made to control human error and environmental conditions such as soil variability by replicating the variable in question. For example, there were four plots (replications) of the every variety grown in the Hettinger HRSW variety trial. These plots are randomly placed throughout the trial to help eliminate differences that might be a result of soil or other variations.

The coefficient of variation (C.V.%) listed at the bottom of each data column is a relative measure of the amount of variation recorded for a particular trait expressed as a percentage of the mean for that trait. It is a measure of the precision or effectiveness of the trial and the procedures used in conducting it. The numbers that you see in the tables are an average of all four replications. The C.V. for yield in the 2017 Hettinger HRSW variety trial was 11.1% meaning that there was a 11.1 percent average variation between high and low yields among replications. In summation, a trial with a C.V. of 6% is more precise and reliable than a trial with a C.V. of 18%. When comparing yields, trials with a C.V. less than 15% are generally considered reliable.

To determine if one variety, fertilizer rate, herbicide, planting date, etc. is better than another, use the least significant difference (LSD 5%) value at the bottom of each data column. The LSD 5% value is a statistical method of indicating if a trait like yield differs when comparing two hybrids. If the yield of hybrid A exceeds hybrid B by more than the LSD value, you can conclude that under like environmental conditions, hybrid A is expected to significantly out-yield hybrid B. The LSD value allows you to separate variety yields or any other variable and determine whether or not they are actually different.

For example, in the HRSW trial at Hettinger, the variety Elgin ND averaged 60.8 bu/ac in 2018 compared to WB9653 at 50.2 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 10.6 bu/ac between the varieties (60.8 – 50.2) to the LSD 5% value of 8.4 bu/ac. Since the 10.6 bu/ac difference is more than the LSD value of 8.4 bu/a, the varieties do differ significantly in yield. If the difference between these two varieties would have been 6.5 bu/ac, their difference would have been less than 8.4 bu/ac; therefore, the yield difference between these varieties would not have been significant.

When selecting a variety or hybrid evaluate as much performance information as possible. Give more weight to information from trials close to home and look at relative performance over many locations and years. Performance averaged over many tests is called “yield stability.”
Good yield stability means that, while a variety may or may not be the best yielder at all locations, it ranks high in yielding potential at many locations and years. A hybrid that ranks in the upper 20% at all locations exhibits better yield stability than one that is the top variety at one location but ranks in the lower 40% at the other locations.

Weather Summary - Hettinger

Frost Free Days

	28ºF	32ºF	50% Probability 32ºF
Date of Last Frost	April 28	May 11	May 20
Date of First Frost	September 28	September 28	September 16
Frost Free Days	**153**	**140**	**119**

Precipitation (inches)

Month	2013-14	2014-15	2015-16	2016-17	2017-18	63 Year Average
October	4.4	0.1	2.0	0.9	0.0	1.1
November	0.2	1.0	0.0	0.4	0.2	0.5
December	0.5	0.0	0.5	0.1	0.2	0.3
January	0.1	0.1	0.2	0.6	0.3	0.4
February	0.3	0.0	0.4	0.2	0.6	0.4
March	0.6	0.2	0.2	0.9	0.3	0.7
April	1.6	1.0	3.7	1.2	1.6	1.6
May	1.6	4.0	1.0	0.6	1.7	2.7
June	5.1	5.2	0.9	0.3	3.7	3.3
July	0.9	1.0	1.5	1.7	2.7	2.0
August	5.2	1.9	1.7	1.8	0.9	1.8
September	1.3	0.9	2.3	1.9	1.7	1.4
April-Sept.	**14.3**	**13.1**	**8.9**	**5.6**	**10.6**	**11.4**
Total	**21.7**	**15.4**	**14.4**	**10.6**	**13.9**	**16.2**

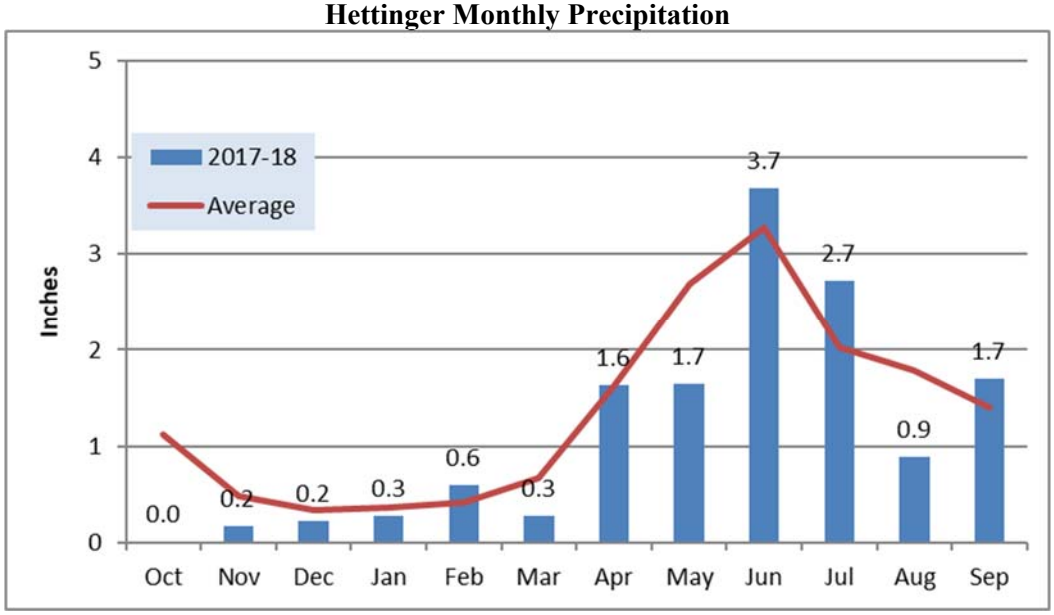
Air Temperature (ºF)

Month	2013-14	2014-15	2015-16	2016-17	2017-18	63 Year Average
October	39.7	46.6	48.5	48.1	44.9	45.5
November	28.8	21.3	32.4	39.5	32.4	29.9
December	12.9	23.4	23.9	10.1	19.0	19.7
January	16.6	21.6	20.1	11.8	17.1	15.5
February	10.1	19.1	32.0	24.6	6.0	20.0
March	26.5	38.0	38.8	34.1	27.4	29.1
April	39.1	43.2	44.2	43.6	35.1	42.5
May	52.8	50.2	54.2	55.2	58.7	53.6
June	59.5	64.6	68.7	66.1	65.4	63.1
July	66.4	70.4	72.0	76.3	69.1	70.1
August	66.0	69.3	69.0	66.8	67.8	68.7
September	56.4	64.1	60.7	58.2	56.3	58.0
Average	**39.6**	**44.3**	**47.0**	**44.5**	**41.6**	**43.0**

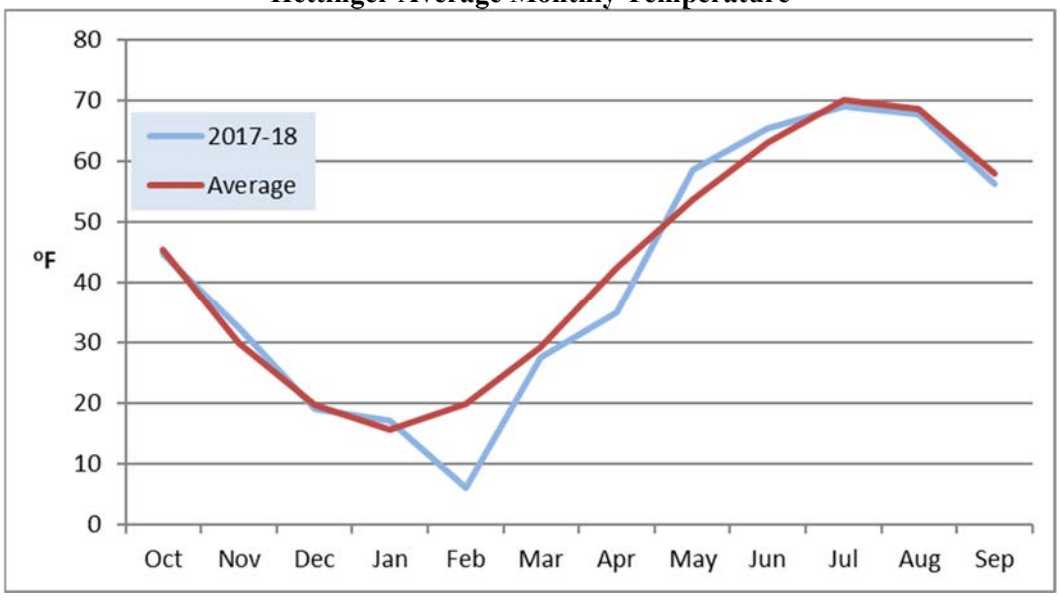
Corn Growing Degree Days (GDD)

Month	2014	2015	2016	2017	2018	46 Year Average
May	245	185	298	297	371	262
June	330	444	545	519	467	423
July	526	595	626	699	579	588
August	504	578	568	520	511	537
September	313	462	380	339	321	325
Total	**1918**	**2264**	**2417**	**2374**	**2249**	**2134**

Hettinger Monthly Precipitation



Hettinger Average Monthly Temperature



2018 Weather Summary for the Dickinson Research Extension Center Ranch Headquarters, Manning, ND.

	---Maximum temp.---		---Minimum temp.---		-----Precipitation ------		-Small grains GDD[1]-		-----Corn GDD[2] -----	
Month	Long Term 1983 - 2018	Current Year	Long Term 1983 - 2018	Current Year	Long Term 1983 - 2018	Current year	Long Term 1983 - 2018	Current year	Long Term 1983 - 2018	Current year
	----------°F ----------		----------°F ----------		----- inches -----					
November - 17	39.7	38.8	18.9	19.0	0.54	0.09				
December - 17	26.6	26.8	7.4	8.5	0.44	0.67				
January	24.9	24.5	5.6	5.6	0.42	0.01				
February	29.0	16.9	9.1	-4.6	0.43	0.41				
March	40.2	33.9	18.8	13.1	0.77	1.27				
April	54.4	45.9	29.1	20.0	1.43	0.48	333	263		
May	66.5	71.1	40.9	45.4	2.61	1.22	673	813	256	357
June	76.0	80.5	50.6	53.2	3.19	4.23	925	1045	401	509
July	83.7	82.8	55.7	54.6	2.32	2.01	1169	1137	611	564
August	82.7	84.1	54.0	53.1	1.92	0.55	1127	1126	569	545
September	71.4	64.4	43.9	41.7	1.52	1.84	770	637	322	232
October	56.3	51.6	31.4	28.2	1.20	0.66				
Mean	54.3	51.8	30.5	28.1						
Total					16.79	13.44	4998	5020	2159	2205

[1] Small grains GDD, is growing degree days calculated with 95°F as the maximum temperature and 32°F as the base temperature.

[2] Corn GDD, is growing degree days calculated with 86°F as the maxium temperature and 50°F as the base temperature.

Source: Dickinson Research Extension Center. Data compiled by Garry Ottmar, Ranch Manager; Ryan Buetow, Area Extension Specialist/ Cropping System; and Sheri Schneider, Information Processing Specialist.

Trials Not Published

The following trials were not published in this report because of very poor yields and significant plot variation. Trial average yields are reported below.

Trial	Average Yield
Hettinger Carinata Planting Date	48 lb/ac
Hettinger Carinata Seeding Rate	83 lb/ac
Mandan Barley VT	Not harvested due to wildlife damage

North Dakota hard red spring wheat variety descriptions, agronomic traits, 2018.

Variety	Agent or Origin[1]	Year Released	Height (inches)	Reaction to Disease[4]							
				Straw Strength[2]	Days to Head[3]	Stem Rust[5]	Leaf Rust	Stripe Rust	Tan Spot	Bact. Leaf Streak	Head Scab
AAC Brandon	AAC	2014	31	5	47	NA	2	NA	NA	4	5
AAC Goodwin	**AAC**	**2018**	**32**	**5**	**48**	**NA**	**2**	**NA**	**NA**	**7**	**5**
AAC Penhold	AAC	2015	30	3	49	NA	3	NA	NA	6	6
Ambush	DynaGro	2016	30	5	46	1	4	3	NA	8	5
Barlow	ND	2009	32	6	47	1	6	4	6	7	5
Bolles	MN	2015	32	4	52	2	3	5	4	8	5
Boost	SD	2016	33	5	51	1	4	3	8	5	4
Caliber	DynaGro	2016	28	2	48	1	3	5	NA	7	8
Elgin-ND	ND	2012	34	5	48	1	6	5	6	7	5
Faller	ND	2007	32	5	50	1	7	8	7	7	5
Glenn	ND	2005	33	4	47	1	6	4	6	7	3
HRS 3100	Croplan	2016	30	4	48	1	4	6	8	7	6
HRS 3419	Croplan	2014	31	2	53	1	3	4	7	8	5
HRS 3504	Croplan	2015	30	3	50	1	1	6	8	7	7
HRS 3530	Croplan	2015	33	4	51	1	2	8	6	8	5
HRS 3616	Croplan	2016	31	4	49	1	5	5	4	8	7
HRS 3888	**Croplan**	**2017**	**31**	**4**	**49**	**NA**	**1**	**NA**	**NA**	**8**	**4**
Lang-MN	MN	2017	33	5	51	1	2	1	7	6	5
Lanning	**MT**	**2017**	**29**	**3**	**51**	**NA**	**NA**	**NA**	**NA**	**8**	**5**
LCS Breakaway	Limagrain	2011	30	5	45	1	3	6	4	8	5
LCS Cannon	**Limagrain**	**2018**	**30**	**4**	**44**	**NA**	**7**	**NA**	**NA**	**8**	**5**
LCS Rebel	Limagrain	2017	33	5	48	1	7	4	8	7	4
LCS Trigger	Limagrain	2016	33	5	53	1	1	2	6	5	4
Linkert	MN	2013	28	2	49	1	3	1	4	7	5
Mott[6]	ND	2009	34	3	51	1	6	6	6	8	6
MS Barracuda	**Meridian**	**2018**	**29**	**3**	**46**	**NA**	**2**	**NA**	**NA**	**NA**	**NA**
MS Camaro	Meridian	2016	28	5	48	1	1	2	8	9	6
MS Chevelle	Meridian	2014	31	5	46	1	4	3	6	7	5
ND VitPro	ND	2016	31	3	48	1	4	3	7	7	4
Prosper	ND	2011	32	5	51	1	6	8	6	7	5
Rollag	MN	2011	30	3	49	1	4	2	3	7	3
Shelly	MN	2016	30	5	51	2	6	5	3	8	5
Surpass	SD	2016	31	5	46	1	4	6	8	7	5
SY Ingmar	Syngenta/AgriPro	2014	29	3	49	1	3	6	6	6	5
SY Rockford	**Syngenta/AgriPro**	**2017**	**30**	**3**	**53**	**NA**	**NA**	**NA**	**NA**	**8**	**5**
SY Soren	Syngenta/AgriPro	2011	28	3	48	1	2	7	2	7	5
SY Valda	Syngenta/AgriPro	2015	29	4	49	1	2	7	6	8	4
TCG-Climax	21st Century Genetics	2017	32	2	53	1	6	3	8	8	6
TCG-Glenville	**21st Century Genetics**	**2018**	**28**	**3**	**46**	**NA**	**1**	**NA**	**NA**	**7**	**6**
TCG-Spitfire	21st Century Genetics	2015	30	4	52	1	5	4	8	7	6
WB9479	WestBred	2017	28	4	49	1	1	1	6	9	6
WB9590	WestBred	2017	28	4	48	1	3	8	8	9	6
WB9653	WestBred	2015	28	4	48	2	3	8	6	8	6
WB9719	WestBred	2017	30	4	50	1	5	2	NA	7	6

[1]Refers to agent or developer: AAC = Agriculture & Agri-Food Canada; MN = University of Minnesota; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University. Bold varieties are those recently released, so data is limited and rating values may change.

[2]Straw Strength = 1 to 9 scale, with 1 the strongest and 9 the weakest. These values are based on recent data and may change as more data become available.

[3]Days to Head = the number of days from planting to head emergence from the boot averaged based on data from several locations in 2018.

[4]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.

[5]Fargo stem rust nursery inoculated with Puccinia graminis f. sp. Tritici races TPMK, TMLK, RTQQ, QFCQ and QTHJ.

[6]Solid stemmed or semisolid stem, imparting resistance to sawfly.

Quality data from 2017 western locations.

Variety	Test Weight[1]	Vitreous Kernels[2]	1,000 KWT[3]	Falling Number[4]	Wheat Protein[5]	Flour Extraction[6]	Farinograph Absorption[7]	Farinograph Stability[8]	Loaf Volume[9]
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	60.6	81	31.2	459	15.0	65.2	61.3	41.0	965
Barlow	61.5	98	29.9	458	15.6	67.8	67.2	16.0	995
Bolles	58.8	77	30.3	453	16.2	65.1	62.2	42.1	983
Boost	59.5	92	30.4	489	15.9	66.3	64.8	15.1	1,003
Caliber	61.2	86	31.6	487	15.4	64.2	66.8	18.9	890
Elgin-ND	59.1	96	28.5	460	15.0	65.3	65.2	22.0	1,003
Faller	57.5	86	27.4	432	15.3	67.5	63.9	17.1	990
Glenn	61.6	91	30.3	427	15.1	67.2	64.8	35.8	980
HRS 3100	58.7	85	28.8	436	15.1	68.2	61.7	43.1	923
HRS 3419	56.6	76	22.5	476	15.1	64.3	62.2	29.8	990
HRS 3504	59.9	86	29.9	489	14.5	68.7	61.1	21.2	920
HRS 3530	58.6	93	29.2	433	15.2	64.7	63.9	17.9	965
HRS 3616	59.0	83	27.8	454	15.1	64.9	63.3	29.6	913
Lang-MN	60.0	89	30.3	460	14.9	66.7	63.9	33.8	898
LCS Breakaway	61.1	91	28.6	452	15.2	66.8	64.5	9.5	885
LCS Rebel	61.2	90	33.0	450	15.0	70.1	64.3	25.2	908
LCS Trigger	56.4	91	23.5	484	14.9	66.3	63.4	18.0	838
Linkert	60.9	86	34.1	481	16.1	66.6	65.6	38.3	928
MS Camaro	60.4	75	29.9	463	15.2	65.3	65.5	9.6	910
MS Chevelle	60.6	67	29.3	416	14.1	66.3	63.4	31.8	918
ND VitPro	61.8	96	32.1	450	15.8	67.5	65.6	12.9	945
Prosper	58.5	78	29.0	430	14.5	68.4	62.5	13.6	968
Rollag	59.8	68	30.9	530	15.7	67.1	68.0	9.7	893
Shelly	59.3	59	27.9	466	14.3	67.8	58.9	42.6	875
Surpass	60.3	56	27.0	434	14.3	67.6	59.4	29.2	880
SY Ingmar	59.7	85	27.1	471	15.0	67.7	61.2	15.7	945
SY Rockford	57.5	67	30.5	448	15.1	66.2	64.3	13.9	958
SY Soren	59.9	71	27.2	488	15.2	66.5	62.1	15.1	983
SY Valda	59.7	83	28.8	450	14.5	66.8	61.3	13.1	880
TCG-Climax	59.8	75	23.0	392	16.2	64.3	63.3	12.8	930
TCG-Spitfire	59.5	78	29.7	475	14.1	65.2	62.7	39.9	945
WB 9479	60.5	74	33.3	460	15.6	66.3	63.9	30.3	895
WB 9590	60.2	69	34.7	446	15.0	65.8	64.3	27.1	873
WB 9653	59.3	69	30.3	505	14.7	68.9	62.2	28.6	885
WB 9719	62.5	94	32.8	457	14.2	65.9	64.4	20.5	863

[1]Test weight - Expressed in pounds (lbs) per bushel. A high test weight is desirable. A 58 lb test weight is required for a grade of U.S. No. 1.

[2]Vitreous kernels - Expressed as a percentage of seeds having a vitreous colored endosperm. A high percentage is desirable. US No. 1 DNS requires greater than 75 percent vitreous kernels.

[3]1,000 KWT- estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

[4]Falling Number- Expressed in seconds at a 14 percent moisture basis. It is used as an indicator of sprouting based on elevated enzyme activity. A high falling number is desirable, preferably greater than 400 seconds.

[5]Wheat Protein- measured by NIR at a 12 percent moisture basis. A high protein is desirable for baking quality.

[6]Flour Extraction- Percentage of milled flour recovered from cleaned and tempered wheat. A high flour extraction percentage is desirable.

[7]Farinograph Absorption- measured by NIR at a 14 percent moisture basis. A measure of dough water absorption, expressed as percent. A high absorption is desirable.

[8]Farinograph Stability- A measure of dough strength. It is expressed in minutes above the 500 Brabender unit line during mixing. A high stability is desirable.

[9]Loaf volume- The volume of the pup loaf of bread, expressed in cubic centimeters. A high volume is desirable.

Hard Red Spring Wheat - 2018 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Brandon	53	26	0	57.6	17.3	--	--	55.5	--	--
AAC Goodwin	53	26	0	57.8	16.6	--	--	54.5	--	--
AAC Penhold	54	21	0	57.6	17.0	--	--	49.0	--	--
Barlow	50	24	0	58.4	16	48.4	40.1	55.6	47.9	48.0
Bolles	54	26	0	54.4	19.0	44.0	32.8	36.0	34.4	37.6
Boost	54	25	0	56.8	17.3	50.6	31.2	38.3	34.8	40.0
Dyna-Gro Ambush	51	27	0	57.5	16.4	--	36.3	55.0	45.7	--
Dyna-Gro Caliber	53	20	0	55.9	17.1	--	32.5	44.4	38.5	--
Elgin ND	54	28	0	57.8	16.8	48.5	38.4	60.8	49.6	49.2
Faller	54	25	0	56.7	15.8	43.4	41.5	53.0	47.3	46.0
Glenn	51	23	0	57.8	16.6	49.1	32.1	54.0	43.1	45.1
HRS 3100	52	23	0	55.8	17.3	--	36.3	39.9	38.1	--
HRS 3419	55	22	0	54.1	17.3	54.7	41.2	34.8	38.0	43.6
HRS 3504	53	22	0	57.7	16.3	48.3	32.7	52.9	42.8	44.6
HRS 3530	54	26	0	56.9	17.1	43.7	35.9	52.4	44.2	44.0
HRS 3616	52	25	0	56.1	17.2	48.6	38.7	51.0	44.9	46.1
HRS 3888	53	23	0	56.5	16.9	--	--	50.0	--	--
Lang MN	54	25	0	57.2	17.0	49.9	36.3	53.3	44.8	46.5
Lanning	53	24	0	56.7	16.6	--	--	63.5	--	--
LCS Breakaway	50	22	0	57.5	17.9	48.4	34.8	41.6	38.2	41.6
LCS Cannon	49	24	0	58.7	17.1	--	--	51.3	--	--
LCS Rebel	51	25	0	57.8	16.7	--	36.8	55.5	46.2	--
LCS Trigger	57	25	0	58.6	14.9	55.7	44.5	69.9	57.2	56.7
Linkert	51	21	0	57.2	17.2	43.6	34.0	42.0	38.0	39.9
Mott	53	25	0	56.6	17.2	46.4	36.6	43.8	40.2	42.3
MS Camaro	51	20	0	55.1	17.5	--	31.4	33.4	32.4	--
MS Chevelle	51	21	0	57.7	15.4	47.8	37.5	59.1	48.3	48.1
MS Barracuda	49	22	0	55.8	17.5	--	--	48.6		
ND VitPro	52	25	0	56.9	16.8	48.1	31.9	52.6	42.3	44.2
Prestige	50	24	0	55.7	16.2	45.8	32.6	55.6	44.1	44.7
Prosper	55	26	0	56.7	15.9	36.0	39.5	53.0	46.3	42.8
Redstone	56	25	0	56.1	16.9	47.0	38.3	46.8	42.6	44.0
Rollag	51	23	0	57.5	17.3	47.3	31.6	46.3	39.0	41.7
Shelly	55	24	0	57.6	16.8	50.9	43.9	53.1	48.5	49.3
Surpass	51	20	0	56.6	16.9	49.7	36.7	40.4	38.6	42.3
SY Ingmar	54	22	0	57.1	17.6	48.1	39.9	40.3	40.1	42.8

Table continued on next page

Hard Red Spring Wheat - 2018 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page										
SY Rockford	53	25	0	55.5	16.9	48.7	39.3	54.0	46.7	47.3
SY Soren	53	22	0	56.9	17.6	50.1	36.5	43.7	40.1	43.4
SY Valda	52	22	0	56.8	16.6	49.6	35.1	51.0	43.1	45.2
TCG Climax	56	22	0	57.7	18.3	--	34.5	52.7	43.6	--
TCG Glenville	52	19	0	55.7	17.5	--	--	35.9	--	--
TCG Spitfire	55	25	0	57.0	16.4	52.0	37.6	54.0	45.8	47.9
WB9479	52	21	0	56.9	17.2	--	34.4	51.4	42.9	--
WB9590	52	20	0	56.6	17.2	--	37.6	50.7	44.2	--
WB9653	52	20	0	57.1	16.5	45.8	39.4	50.2	44.8	45.1
WB9719	53	24	0	57.5	16.7	--	43.4	52.2	47.8	--
Trial Mean	53	24	0	57.0	17.0	47.3	35.8	49.4	43.0	44.8
C.V. %	1.2	9.6	--	1.2	2.1	7.1	11.4	12.2	--	--
LSD 5%	0.9	3.2	NS	0.9	0.5	4.7	5.7	8.4	--	--
LSD 10%	0.7	2.7	NS	0.8	0.4	4.0	4.8	7.1	--	--

[1] Days to Head = the number of days from planting to head emergence from the boot.

[2] 0 = no lodging, 9 = 100% lodged.

Planting Date: April 27

Harvest Date: August 22

Previous Crop: Carinata

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2018 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Barlow	32	0	60.4	17.4	41.1	15.2	45.1	30.2	33.8
Bolles	33	0	58.7	15.9	--	12.5	44.0	28.3	--
DynaGro Ambush	28	0	58.5	15.6	--	--	33.9	--	--
Elgin-ND	29	0	58.1	16.0	41.7	16.4	35.4	25.9	31.2
Glenn	31	0	57.0	15.6	42.4	16.1	41.1	28.6	33.2
HRS 3419	28	0	59.6	15.9	48.5	16.2	38.6	27.4	34.4
HRS 3530	28	0	57.7	15.7	42.8	14.8	36.3	25.6	31.3
HRS 3616	28	0	57.4	16.1	--	--	35.4	--	--
Lang-MN	31	0	59.3	13.1	--	16.4	57.0	36.7	--
LCS Rebel	29	0	58.8	14.8	--	--	44.2	--	--
LCS Trigger	28	0	58.0	15.4	--	13.8	29.8	21.8	--
Linkert	30	0	58.9	15.5	--	--	46.7	--	--
Mott	27	0	58.3	15.1	36.6	15.4	43.3	29.4	31.8
MS Chevelle	27	0	58.5	15.7	--	13.5	35.5	24.5	--
ND-VitPro	30	0	56.7	17.3	--	13.7	34.4	24.1	--
Redstone	30	0	57.1	15.7	--	13.9	37.0	25.5	--
Shelly	33	0	57.9	14.5	--	18.9	53.7	36.3	--
Surpass	29	0	59.3	16.6	--	17.9	37.0	27.5	--
SY Ingmar	33	0	57.6	15.1	38.2	14.1	54.1	34.1	35.5
SY Rockford	28	0	57.8	14.8	--	--	37.1	--	--
SY Soren	27	0	58.6	17.1	38.3	18.1	36.1	27.1	30.8
SY Valda	31	0	58.9	15.4	--	13.8	44.0	28.9	--
TCG Climax	25	0	59.3	15.7	--	--	37.2	--	--
TCG Spitfire	29	0	59.4	15.0	--	17.8	33.0	25.4	--
WB9653	32	0	57.4	16.0	41.2	16.9	37.2	27.1	31.8
WB9719	28	0	58.0	14.7	--	--	33.7	--	--
Trial Mean	29	0	58.3	15.6	40.7	15.6	39.9	28.1	32.6
C.V. %	4.9	--	0.8	2.6	9.7	16.5	5.3	--	--
LSD 5%	2.0	NS	0.7	0.6	5.6	3.6	3.0	--	--
LSD 10%	1.7	NS	0.6	0.5	4.6	3.0	2.5	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 7

Harvest Date: September 1

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2018 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Barlow	33	0	60.3	14.9	31.5	17.7	45.1	31.4	31.4
Bolles	32	0	58.8	15.4	--	15.5	45.2	30.4	--
DynaGro Ambush	32	0	59.7	15.3	--	--	45.4	--	--
Elgin-ND	36	0	58.7	14.2	35.3	18.8	48.6	33.7	34.2
Glenn	36	0	60.9	14.4	29.0	17.2	46.3	31.8	30.8
HRS 3419	33	0	57.8	14.7	24.2	15.9	50.0	33.0	30.0
HRS 3530	33	0	58.6	14.6	36.9	14.5	49.9	32.2	33.8
HRS 3616	31	0	58.4	15.1	--	--	49.2	--	--
Lang-MN	36	0	60.9	14.6	--	19.4	53.4	36.4	--
LCS Rebel	35	0	60.2	15.6	--	--	48.8	--	--
LCS Trigger	34	0	58.1	13.6	--	20.7	52.9	36.8	--
Linkert	31	0	59.1	15.5	--	--	44.0	--	--
Mott	38	0	59.1	15.1	32.7	16.7	46.8	31.8	32.1
MS Chevelle	32	0	58.7	13.4	--	21.3	46.3	33.8	--
ND-VitPro	33	0	58.9	14.9	--	16.9	48.3	32.6	--
Redstone	33	0	58.8	14.2	--	15.4	48.4	31.9	--
Shelly	33	0	60.3	13.9	--	18.9	51.6	35.3	--
Surpass	33	4	59.7	14.4	--	19.0	45.9	32.5	--
SY Ingmar	30	0	59.8	15.0	35.2	19.8	44.3	32.1	33.1
SY Rockford	32	0	58.7	14.3	--	--	51.3	--	--
SY Soren	30	0	60.1	15.2	32.9	15.4	47.3	31.4	31.9
SY Valda	30	0	59.4	14.5	--	18.7	51.4	35.1	--
TCG Climax	33	0	62.0	15.6	--	--	44.8	--	--
TCG-Spitfire	32	0	58.6	14.9	--	16.7	48.9	32.8	--
WB9653	30	0	56.5	14.5	38.1	20.1	49.2	34.7	35.8
WB9719	32	0	60.8	14.9	--	--	47.4	--	--
Trial Mean	33	0	59.4	14.7	32.3	17.7	48.1	33.1	32.6
C.V. %	6.5	69.2	1.4	4.2	7.6	13.5	6.3	--	--
LSD 5%	3.0	0.1	1.2	0.9	3.5	3.4	4.3	--	--
LSD 10%	2.5	0.1	1.0	0.7	2.9	2.8	3.6	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 7

Harvest Date: August 17

Hard Red Spring Wheat - 2018 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Brandon	28	0	54.4	12.4	--	--	41.7	--	--
AAC Goodwin	31	0	55.4	12.6	--	--	50.9	--	--
AAC Penhold	30	0	54.6	12.4	--	--	49.0	--	--
Barlow	28	0	54.7	13.1	60.9	16	46.2	31.1	41.0
Bolles	27	0	55.3	13.2	--	7.5	48.6	28.1	--
Boost	28	0	54.5	12.8	--	16.0	50.5	33.3	--
DynaGro Ambush	26	0	56.1	12.1	--	--	50.5	--	--
DynaGro Caliber	29	0	55.9	14.2	--	--	52.7	--	--
Elgin-ND	27	0	55.8	12.7	65.3	17.4	48.9	33.2	43.9
Faller	29	0	55.6	11.3	--	--	45.6	--	--
Glenn	30	0	54.9	13.1	62.6	11.1	56.0	33.6	43.2
HRS 3100	29	0	54.5	12.5	--	--	52.4	--	--
HRS 3419	30	0	54.9	10.5	73.5	18.3	51.2	34.75	47.7
HRS 3504	27	0	53.4	11.7	--	--	46.2	--	--
HRS 3530	25	0	55.3	12.9	70.6	18.3	48.2	33.3	45.7
HRS 3616	27	0	55.9	13.0	--	--	46.5	--	--
HRS 3888	30	0	54.5	12.5	--	--	51.5	--	--
Lang-MN	28	0	55.3	12.0	--	21.1	51.3	36.2	--
Lanning	28	0	55.1	12.8	--	--	46.3	--	--
LCS Breakaway	28	0	54.3	13.1	--	--	49.6	--	--
LCS Cannon	30	0	54.1	13.1	--	--	50.0	--	--
LCS Rebel	27	0	55.4	12.9	--	--	52.0	--	--
LCS Trigger	29	0	54.0	10.2	--	28.7	43.5	36.1	--
Linkert	29	0	54.9	13.1	--	--	45.9	--	--
Mott	28	0	54.1	12.9	61.3	18.2	45.1	31.65	41.5
MS Camaro	26	0	55.0	13.7	--	--	51.6	--	--
MS Chevelle	29	0	54.0	12.0	--	22.6	49.8	36.2	--
MS Barracuda	29	0	55.3	12.3	--	--	50.2	--	--
ND VitPro	29	0	55.2	13.7	--	16.2	47.1	31.7	--
Prestige	29	0	55.5	12.6	--	--	46.5	--	--
Prosper	31	0	54.3	11.2	--	--	53.0	--	--
Redstone	26	0	55.4	10.9	--	22.3	44.7	33.5	--
Rollag	29	0	54.6	13.7	--	--	48.6	--	--
Shelly	28	0	54.7	11.0	--	15	51.8	33.4	--
Surpass	30	0	54.8	11.8	--	17.4	51.4	34.4	--
SY Ingmar	29	0	55.2	12.5	58.8	20.5	55.4	38.0	44.9

Table continued on next page

Hard Red Spring Wheat - 2018 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page									
SY Rockford	27	0	54.6	11.9	--	--	46.0	--	--
SY Soren	30	0	54.6	12.7	59.4	18.3	48.0	33.2	41.9
SY Valda	31	0	56.0	11.6	--	19.1	46.0	32.6	--
TCG Climax	29	0	54.6	12.7	--	--	54.8	--	--
TCG Glenville	30	0	55.2	13.6	--	--	53.3	--	--
TCG Sptifire	29	0	55.2	11.4	--	23.2	49.2	36.2	--
WB9479	30	0	55.8	13.1	--	--	51.9	--	--
WB9590	27	0	54.1	12.8	--	--	52.2	--	--
WB9653	29	0	54.2	11.1	70.1	23.7	45.3	34.5	46.4
WB9719	31	0	54.7	11.3	--	--	49.9	--	--
Trial Mean	29	0	54.9	12.5	64.2	18.5	49.3	33.1	43.8
C.V. %	7.6	--	2.2	6.0	7.6	15.7	12.2	--	--
LSD 5%	3.0	NS	1.7	1.0	6.9	4.1	8.4	--	--
LSD 10%	2.6	NS	1.4	0.9	5.7	3.4	7.0	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 9

Harvest Date: September 6

Previous Crop: Spring Wheat

2018 Hard Red Spring Wheat - Recrop — Dickinson, ND

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Brandon	53	11,201	30	61.1	14.2	--	--	65.1	--	--
AAC Penhold	54	9,711	26	62.1	13.6	--	--	62.7	--	--
AC Goodwin	55	10,661	31	62.1	13.9	--	--	67.4	--	--
Barlow	53	11,737	31	60.4	14.2	48.5	38.1	60.2	49.1	48.9
Bolles	58	11,207	31	60.8	15.6	47.5	34.4	65.0	49.7	48.9
Boost	56	11,170	31	59.6	14.4	52.3	34.7	57.5	46.1	48.2
DynaGro Ambush	52	10,891	30	61.7	14.0	--	34.1	61.6	47.8	--
DynaGro Caliber	54	11,869	26	60.4	15.7	--	31.6	58.1	44.8	--
Elgin ND	55	11,800	36	60.3	13.5	48.5	36.2	60.1	48.2	48.3
Faller	56	10,772	33	61.5	13.6	47.1	34.5	72.1	53.3	51.2
Glenn	52	11,850	33	62.5	15.2	51.2	34.9	63.5	49.2	49.9
HRS 3100	54	11,558	28	60.5	13.7	--	34.3	62.3	48.3	--
HRS 3419	57	12,734	31	60.2	12.7	60.5	30.7	74.8	52.7	55.3
HRS 3504	55	11,473	28	61.0	13.5	65.0	34.8	70.3	52.6	56.7
HRS 3530	55	11,126	31	60.4	14.9	59.1	33.1	63.1	48.1	51.7
HRS 3616	54	10,642	30	61.2	15.5	48.9	32.7	69.1	50.9	50.3
HRS 3888	54	11,480	29	61.5	14.0	--	--	65.5	--	--
Lang MN	55	12,149	31	61.7	14.4	--	35.7	61.3	48.5	--
Lanning	52	10,968	29	59.1	14.1	--	--	69.5	--	--
LCS Breakaway	50	11,403	27	61.9	14.6	51.2	32.7	49.6	41.1	44.5
LCS Cannon	50	12,206	29	62.9	12.7	--	--	56.6	--	--
LCS Rebel	52	11,100	32	62.4	14.8	--	33.3	60.4	46.8	--
LCS Trigger	59	11,679	33	60.7	12.6	--	34.0	76.0	55.0	--
Linkert	54	10,729	28	61.1	15.6	52.9	32.8	58.8	45.8	48.2
Mott	56	12,617	36	60.8	14.3	45.1	29.8	60.1	45.0	45.0
MS Camaro	52	12,604	26	62.2	14.9	--	33.5	54.0	43.7	--
MS Chevelle	51	11,880	28	61.9	13.0	57.7	35.3	67.3	51.3	53.4
MS Barracuda	50	11,070	26	61.1	14.9	--	--	51.1	--	--
ND VitPro	53	11,828	30	61.2	15.0	49.8	28.8	59.6	44.2	46.1
Prosper	56	10,619	33	61.0	13.2	55.0	33.6	59.5	46.5	49.4
Rollag	53	11,118	29	61.8	15.0	52.6	37.1	60.2	48.7	50.0
Shelly	56	11,225	29	62.6	13.1	48.7	39.3	70.4	54.9	52.8

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Surpass	49	12,854	31	61.2	13.9	56.2	35.6	65.1	50.3	52.3
SY Ingmar	55	12,149	27	62.1	13.6	56.7	37.0	61.8	49.4	51.8
SY Rockford	55	11,048	31	59.5	14.0	--	38.6	64.9	51.7	--
SY Soren	54	12,344	28	62.1	14.4	50.1	32.4	61.9	47.2	48.1
SY Valda	53	11,171	28	60.9	14.1	63.5	38.7	62.9	50.8	55.0
TCG-Climax	59	12,947	31	61.4	15.7	--	33.9	62.3	48.1	--
TCG Glenville	51	11,709	25	62.0	15.3	--	--	56.0	--	--
TCG Spitfire	57	11,033	30	60.1	14.1	59.7	35.0	66.1	50.6	53.6
WB9479	52	11,107	26	61.8	14.7	--	28.4	62.7	45.5	--
WB9590	52	10,980	26	60.7	14.0	--	34.3	67.5	50.9	--
WB9653	54	11,410	28	60.7	12.7	61.8	37.3	69.2	53.3	56.1
WB9719	54	11,818	27	63.4	13.6	--	38.7	71.3	55.0	--
Trial Mean	54	11,478	30	61.3	14.2	52.7	34.4	63.1	--	--
CV %	1.4	4.1	3.7	1.6	4.6	10.4	11.2	8.5	--	--
LSD 0.05	1	653	2	1.3	1.1	7.6	5.4	7.5	--	--
LSD 0.10	1	547	1	1.1	0.9	6.4	4.5	6.2	--	--

Planting Date: May 2, 2018
Harvest Date: May 14, 2018
Previous Crop: Cover Crop
Seeding Rate: 1.2 million live seeds/ac

2018 Glen Ullin Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
		lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Barlow	12,453	61.4	14.8	33.6	33.9	72.8	53.3	46.8
Boost	12,246	60.3	14.9	--	42.3	75.2	58.8	--
Elgin-ND	12,588	60.9	14.8	31.6	32.5	75.9	54.2	46.6
HRS3100	13,208	59.8	14.5	--	--	76.7	--	--
LCS Rebel	12,061	61.3	15.3	--	--	72.9	--	--
Lang-MN	13,433	61.8	15.3	--	--	70.5	--	--
Mott	12,971	61.1	14.9	34.0	35.4	78.4	56.9	49.3
ND-Vitpro	11,963	62.4	15.4	--	35.3	71.5	53.4	--
Sy Ingmar	14,288	60.8	15.0	--	--	74.5	--	--
Sy Soren	13,947	60.9	15.4	30.1	37.5	70.9	54.2	46.1
Sy Valda	12,422	60.8	14.0	35.3	39.8	77.5	58.6	50.9
WB9590	12,633	60.1	14.8	--	--	81.4	--	--
WB9653	12,359	59.5	14.1	40.3	43.2	76.6	59.9	53.4
Trial Mean	12,813	60.9	14.9	36.2	37.2	75.0	--	--
CV %	6.6	0.8	1.9	7.2	16.4	6.6	--	--
LSD 0.05	1,217	0.7	0.5	3.8	NS	7.1	--	--
LSD 0.10	1,013	0.6	0.4	3.1	NS	5.9	--	--

Planting Date: May 14, 2018
Harvest Date: August 30, 2018
Previous Crop: wheat
Seeding Rate: 1.2 million live seeds/ac

North Dakota hard winter wheat variety descriptions and agromomic traits.

Variety	Agent or Origin[2]	Year	Reaction to Disease[1]					Days to Heading[3]	Straw Strength[4]	Height[5] (inches)	Winter[6] Hardiness
			Stripe Rust	Leaf Rust	Stem Rust	Scab	Tan Spot				
AAC Gateway	A.Can.	2012	2	4	1	6	7	0	2	25	3
AAC Goldrush	**A.Can.**	**2017**	**2**	**1**	**3**	**3**	**6**	**1**	**2**	**25**	**2**
AAC Wildfire	A.Can.	2015	2	6	5	4	NA	2	3	25	2
Accipiter	CDC	2008	2	6	1	8	8	1	5	25	2
Broadview	A.Can.	2008	4	1	1	8	NA	0	5	24	4
CDC Chase	CDC	2013	1	1	1	6	NA	1	5	25	4
Decade	MT/ND	2010	8	9	1	9	4	-1	3	25	2
Emerson	A.Can.	2011	1	6	1	3	5	0	2	25	3
Ideal	SD	2011	4	1	3	8	4	-1	4	25	5
Jerry	ND	2001	8	3	1	8	8	0	5	26	3
Keldin	WB	2011	2	3	3	5	3	1	3	25	3
Loma	MT	2016	1	NA	1	8	NA	2	4	23	3
Lyman	SD	2008	4	1	1	3	6	-2	6	25	5
Moats	CDC	2010	1	1	1	3	7	1	5	27	2
Northern	MT	2015	1	8	1	8	6	1	4	24	6
Oahe	SD	2016	2	3	6	NA	NA	-1	5	25	3
Overland	NE	2006	3	2	3	8	4	-2	5	24	5
Peregrine	CDC	2008	1	3	1	6	6	1	5	28	2
Redfield	SD	2013	4	6	8	3	NA	-2	5	23	5
SY Monument	Agripro	2014	3	3	NA	6	NA	-2	3	22	4
SY Sunrise	Agripro	2015	3	NA	NA	6	NA	-2	3	20	5
SY Wolf	Agripro	2010	3	3	1	6	1	-2	3	23	6
Thompson	**SD**	**2017**	**5**	**3**	**3**	**3**	**NA**	**-1**	**3**	**26**	**NA**
WB-Matlock	WB	2010	6	6	1	6	NA	0	5	25	2
WB4462	WB	2016	7	3	NA	8	6	-2	4	23	3

[1]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.

[2]A.Can. = Agriculture and Agri-Food Canada; CDC = Crop Development Centre, University of Saskatchewan; MT = Montana State University; NE = University of Nebraska; ND = North Dakota State University; SD = South Dakota State University; WB = WestBred.
Bold varieties are those recently released, so data are limited and rating values may change.

[3]Days to heading relative to Jerry.

[4]Straw strength: 1 = strongest, 9 = weakest. Based on field observations in 2018 only.

[5]Based on the average of several environments, and should be used for comparing varieties. The environment can impact the height of varieties.

[6]Relative winter hardiness rating: 1 = excellent, 10 = very poor. These values are subject to change as additional information becomes available.

Analytical milling and baking characteristics of selected varieties evaluated at Carrington and Dickinson Research Extension Centers in 2017.

	Kernel						Flour					Farinograph				Loaf		
	Test Weight	1,000 KWT	Hard-ness	Whole Wheat Ash	Whole Wheat Protein 12 MB	Falling Number	Flour Protein 14 MB	Flour Ash 14 MB	Milling Extraction	Wet Gluten	Gluten Index	Abs	Peak Time	Stab	MTI	Loaf Volume	Crumb Structure	Crumb Color
	(lb/bu)	(gram)	(score)	(%)	(%)	(seconds)	(%)	(%)	(%)	(%)		(%)	(min)	(min)	(BU)	(cc)	(1-10)[1]	(1-10)[1]
AC Gateway	61.8	32.3	69	1.36	15.5	445	14.4	0.48	71.3	41.3	84	62.2	8.5	11.2	24	1,013	7	9
Accipiter	61.0	30.1	71	1.44	13.8	454	13.2	0.50	69.0	35.5	90	61.1	6.4	20.1	13	1,050	8	7
Broadview	60.3	33.8	60	1.37	14.3	464	13.5	0.47	67.2	55.0	52	61.2	4.5	4.4	50	948	6	8
CDC Chase	62.4	31.5	72	1.36	13.7	404	12.7	0.46	68.4	33.2	96	60.0	8.9	15.8	17	980	6	7
Decade	60.9	30.3	70	1.50	15.5	439	13.7	0.56	68.0	36.0	95	62.5	10.7	17.7	21	1,030	7	9
Emerson	61.3	27.3	63	1.41	15.4	435	14.2	0.48	66.5	38.4	91	59.7	10.6	16.3	13	1,080	7	8
Ideal	61.1	31.8	71	1.32	14.4	437	13.4	0.49	68.0	34.5	96	61.7	13.4	19.5	14	1,020	7	8
Jerry	59.7	33.5	65	1.34	15.1	480	13.7	0.48	68.6	37.9	84	62.2	7.4	11.9	20	958	7	7
Keldin	61.3	39.4	68	1.38	14.1	469	13.0	0.50	67.4	35.6	79	61.7	7.4	14.4	21	940	7	7
Loma	59.0	32.3	73	1.31	15.6	428	14.4	0.47	67.6	40.4	86	62.6	10.3	15.1	15	1,100	8	7
Lyman	60.3	34.2	72	1.29	16.1	417	14.6	0.49	68.5	42.9	65	64.2	7.1	8.1	30	1,010	7	7
Moats	60.5	31.2	79	1.37	14.3	440	13.7	0.48	68.1	35.9	90	61.2	8.7	15.7	15	1,055	7	7
Northern	61.5	33.5	81	1.35	15.0	527	14.0	0.50	68.1	38.6	76	65.2	7.6	7.9	37	983	7	8
Oahe	61.2	33.9	73	1.26	14.2	471	13.2	0.50	68.4	41.5	62	66.0	4.6	4.0	58	890	6	7
Overland	60.4	31.9	71	1.24	15.0	506	13.8	0.50	66.1	45.3	60	64.2	5.3	4.9	55	860	6	7
Peregrine	61.7	31.3	80	1.39	13.5	433	12.8	0.48	66.8	33.7	92	61.5	9.5	14.6	20	938	7	7
Redfield	61.9	34.3	63	1.47	14.3	448	13.3	0.50	68.5	35.7	87	61.6	9.3	14.7	25	1,018	7	8
SY Monument	61.1	32.6	80	1.28	13.4	444	12.6	0.48	68.4	28.0	99	61.5	13.9	29.9	14	835	7	7
SY Sunrise	61.5	33.6	66	1.24	14.7	484	13.0	0.48	64.7	38.2	69	62.3	6.1	8.2	29	860	7	7
SY Wolf	62.4	32.5	77	1.23	14.5	396	13.3	0.48	68.2	37.4	62	62.5	7.3	6.8	33	940	7	7
WB-Matlock	61.4	31.2	71	1.41	15.4	433	14.0	0.50	68.3	39.8	74	62.5	7.7	9.5	26	963	8	7
MEAN	61.0	32.5	71	1.35	14.7	453	13.6	0.49	67.7	39.0	79	62.4	8.1	12.3	27	967	6.7	7.5
LSD 5%	2.9	3.3	7	0.26	2.9	41	1.9	0.08	3.5	10.6	13	2.6	4.8	8.4	18	149	1	1

[1]Scale 1-10, with 1 being low and 10 being superior.

Hard Red Winter Wheat - 2018 **Hettinger, ND**

Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	Grain Protein	---- Grain Yield ---- 2016	2017	2018	Average Yield 2 yr	3 yr
	Julian	inches	0-9[1]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Goldrush	164	25	0	57.7	17.0	--	--	32.7	--	--
AAC Wildfire	164	21	0	58.9	15.6	--	--	40.2	--	--
AC Broadview	163	24	0	58.6	15.4	58.4	81.6	36.7	59.2	58.9
AC Emerson	164	21	0	57.6	18.4	63.0	70.6	30.6	50.6	54.7
AC Gateway	164	24	0	59.2	16.3	64.1	76.5	35.9	56.2	58.8
Accipiter	164	23	0	59.9	15.0	56.1	72.4	35.2	53.8	54.6
CDC Chase	164	22	0	58.9	15.9	56.3	81.3	33.9	57.6	57.2
Decade	162	23	0	55.6	17.7	58.0	76.2	19.5	47.9	51.2
Ideal	163	29	0	57.5	16.7	57.3	88.2	26.6	57.4	57.4
Jerry	163	24	0	56.8	16.9	51.9	76.1	29.7	52.9	52.6
Keldin	164	25	0	57.4	15.5	--	101.2	37.2	69.2	--
Loma	165	24	0	58.3	15.9	69.7	71.5	36.5	54.0	59.2
Lyman	162	24	0	56.6	17.0	64.9	84.2	27.3	55.8	58.8
Moats	164	27	0	57.0	16.5	60.7	80.2	29.5	54.9	56.8
Northern	165	22	0	58.8	16.1	68.3	78.9	33.7	56.3	60.3
Oahe	162	26	0	54.9	16.6	--	83.1	28.2	55.7	--
Overland	162	21	0	57.5	16.8	72.4	91.7	29.5	60.6	64.5
Overland-FHB1	160	23	0	56.7	16.8	--	90.9	26.9	58.9	--
Peregrine	164	21	0	59.4	14.9	63.1	81.1	38.0	59.6	60.7
Redfield	162	21	0	58.1	16.6	60.2	79.2	24.7	52.0	54.7
SY Monument	160	19	0	56.9	15.6	69.1	99.6	27.6	63.6	65.4
SY Sunrise	162	22	0	57.3	15.9	80.2	85.6	20.4	53.0	62.1
SY Wolf	160	22	0	54.6	16.1	69.0	93.9	24.3	59.1	62.4
Thompson	163	25	0	55.2	16.6	--	--	33.0	--	--
WB Matlock	163	22	0	58.8	16.3	55.7	71.1	33.8	52.5	53.5
WB4462	159	23	0	55.8	16.1	--	--	20.1	--	--
Trial Mean	162	23	0.0	57.4	16.3	61.2	82.2	30.3	56.4	58.1
C.V. %	0.5	8.8	--	2.3	2.4	4.3	9.4	18.3	--	--
LSD 0.05	1.2	2.9	NS	1.9	0.5	4.8	10.8	7.8	--	--
LSD 0.10	1.0	2.4	NS	1.5	0.5	4.0	9.1	6.5	--	--

[1] 0 = no lodging, 9 = 100% lodged.

Planting Date: September 29

Harvest Date: August 3

Previous Crop: Oats

2018 Winter Wheat - Recrop **Dickinson, ND**

Variety	Winter Survival	Heading Date	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
		from 1/1		in	lbs/bu	%		-----bu/ac-----		bu/ac	bu/ac
AAC Goldrush	100	162	13,871	28	61.4	13.9	--	--	89.9	--	--
AAC Wildfire	100	163	12,251	30	61.3	13.4	--	--	92.8	--	--
AC Broadview	100	161	13,960	26	61.3	12.7	37.2	54.3	89.7	72.0	60.4
AC Emerson	100	161	15,384	27	61.4	14.6	31.7	52.5	83.1	67.8	55.8
AC Gateway	100	160	13,207	25	62.3	13.9	32.0	48.3	85.8	67.0	55.3
Accipiter	100	162	15,804	27	61.6	13.2	37.8	53.8	91.2	72.5	60.9
CDC Chase	100	160	13,810	28	62.3	13.7	35.1	56.4	85.5	70.9	59.0
Decade	100	160	13,288	25	61.4	14.6	34.0	59.1	85.1	72.1	59.4
Ideal	100	160	12,989	25	62.8	13.2	40.3	52.1	90.6	71.3	61.0
Jerry	100	160	11,995	29	61.1	13.7	28.9	58.4	84.6	71.5	57.3
Keldin	100	162	10,962	26	61.5	13.7	--	59.9	99.0	79.5	--
Loma	100	162	16,334	26	58.3	13.5	31.6	45.2	80.2	62.7	52.3
Lyman	100	159	12,467	27	61.4	14.5	35.6	54.7	80.7	67.7	57.0
Moats	100	161	13,650	29	62.4	13.3	31.8	57.6	91.5	74.6	60.3
Northern	100	162	14,005	27	60.8	13.2	36.5	51.5	85.2	68.4	57.7
Oahe	100	160	12,627	26	60.5	13.8	--	54.5	74.7	64.6	--
Overland	100	158	13,445	27	61.0	14.3	31.7	58.2	75.3	66.8	55.1
Overland-FHB1	100	158	13,705	26	60.6	14.6	--	55.8	71.0	63.4	--
Peregrine	100	161	13,817	32	61.9	12.6	37.9	58.6	90.6	74.6	62.4
Redfield	100	159	12,186	25	62.0	14.2	33.9	53.3	86.4	69.9	57.9
SY Monument	100	158	12,990	22	59.8	14.1	48.7	62.0	76.2	69.1	62.3
SY Sunrise	100	158	13,751	20	60.8	13.6	38.7	60.2	64.1	62.1	54.3
SY Wolf	100	159	14,003	25	59.0	14.5	44.7	57.9	80.5	69.2	61.0
Thompson	100	160	15,261	27	60.6	14.0	--	--	84.4	--	--
WB Matlock	100	161	13,309	27	61.1	14.7	40.2	60.9	82.9	71.9	61.3
WB4462	100	156	10,774	24	61.8	13.5	38.6	56.2	68.7	62.4	54.5
Trial Mean	100	160	13,443	26	61.1	13.8	34.4	55.2	83.3	--	--
CV %	0	0.6	6.0	5.1	1.6	3.4	16.5	9.0	8.8	--	--
LSD 0.05	0	1	1,140	2	1.4	0.8	9.3	7.0	10.3	--	--
LSD 0.10	0	1	953	2	1.2	0.6	7.7	5.9	8.6	--	--

Planting Date: September 20, 2017
Harvest Date: August 2, 2018
Previous Crop: Cover Crop
Seeding Rate: 1 million live seeds/ac

Hard Red Winter Wheat - 2018 — Bison, SD

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 yr	Average Yield 3 yr
	inches	1-5	lbs/bu	%	Bushels per acre				
Alice	22	NR	57.0	14.0	34.2	8.2	38.7	23.5	27.1
Avery	26	-	54.3	13.3	40.6	13.8	41.0	27.4	31.8
Cowboy	29	-	58.8	13.0	35.7	9.7	62.0	35.8	35.8
Dyna-Gro Long Branch	26	-	54.1	13.1	-	14.3	41.7	28.0	-
Expedition	25	-	54.9	14.4	36.4	14.4	40.2	27.3	30.3
Ideal	29	-	57.9	13.3	40.1	17.8	59.1	38.4	39.0
Keldin	20	-	56.3	13.8	-	9.0	55.8	32.4	-
Langin	30	-	56.5	13.9	-	11.0	37.9	24.4	-
LCS Chrome	26	-	56.6	14.3	-	-	46.6	-	-
LCS Link	27	-	58.3	15.1	-	-	42.0	-	-
LCS Mint	24	-	55.6	14.4	48.7	9.2	44.6	26.9	34.2
Lyman	27	-	58.7	14.9	37.6	9.9	54.2	32.0	33.9
NHH144913-3	30	-	51.8	14.9	-	-	37.1	-	-
Oahe	29	-	56.1	13.5	45.0	10.7	46.7	28.7	34.1
Overland	29	-	57.5	13.5	30.6	14.6	50.9	32.8	32.1
PSB13NEDH-7-140	29	-	57.4	14.8	41.4	14.5	51.3	32.9	35.7
Redfield	25	-	56.4	14.0	38.3	11.1	50.0	30.5	33.1
SY 517 CL2	25	-	52.9	15.1	-	17.9	38.2	28.0	-
SY Benefit	27	-	55.5	14.1	-	-	47.2	-	-
SY Monument	27	-	55.3	13.5	39.6	15.6	49.6	32.6	34.9
SY Sunrise	22	-	53.4	13.5	39.8	13.2	41.5	27.3	31.5
SY Wolf	23	-	52.2	14.4	43.9	13.3	43.3	28.3	33.5
Thompson	32	-	57.8	13.4	33.2	12.7	53.4	33.0	33.1
WB4418	26	-	56.1	13.2	-	-	40.4	-	-
WB4462	28	-	56.9	13.4	-	-	43.4	-	-
WB4623CLP	29	-	48.9	15.6	-	-	35.5	-	-
WB-Grainfield	24	-	56.8	14.2	41.1	14.8	33.4	24.1	29.8
Wesley	24	-	57.1	14.9	45.6	17.0	39.5	28.3	34.0
Trial Average#	27	-	56.1	14.0	38.3	12.4	46.4	29.9	33.4
C.V.%	-	-	4.2	1.1	15.9	33.7	11.9	-	
LSD 0.05	-	-	3.3	0.8	8.5	5.8	7.7	-	-

Lodging score: 1, perfectly standing; to 5, completely flat.
Planting Date: September 28
Harvest Date: August 1

Winter Rye - 2018 **Hettinger, ND**

Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
		inches	0-9[1]	lbs/bu	---------- Bushels per acre ----------				
Aroostok	5/28	38	0	48.1	45.6	53.2	27.6	40.4	42.1
Brasetto	6/2	31	0	50.3	--	97.8	58.6	78.2	--
Dacold	6/4	33	0	45.1	72.9	76.6	37.6	57.1	62.4
ND Dylan	6/2	37	0	45.8	64.6	74.5	21.6	48.1	53.6
Hancock	6/1	35	0	44.6	59.9	66.1	29.7	47.9	51.9
Hazlet	6/3	33	0	47.7	--	84.9	40.2	62.6	--
Rymin	6/3	33	0	48.4	62.1	85.4	39.6	62.5	62.4
Spooner	6/2	35	0	46.7	57.3	61.4	32.6	47.0	50.4
Wheeler	6/3	37	0	47.8	--	50.8	25.6	38.2	--
Trial Mean	6/1	34	0	47.1	60.5	70.0	34.2	53.5	53.8
C.V. %	0.4	6.5	--	3.2	9.0	6.7	15.3	--	--
LSD 0.05	0.9	3.3	--	1.8	8.0	6.8	7.6	--	--
LSD 0.10	0.8	2.7	--	1.5	6.7	5.6	6.3	--	--

[1] 0 = no lodging, 9 = 100% lodged.

Planting Date: September 29

Harvest Date: August 6

Previous Crop: Oats

Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2018.

	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Heading[4]	Reaction to Disease[5]				
						Stem Rust	Leaf Rust	Foliar Disease	Bact. Leaf Streak	Head Scab
AC Commander	Can.	2002	30	5	54	1	1	6	NA	NA
Alkabo	ND	2005	34	2	56	1	1	5	7	6
Alzada[6]	WB	2004	28	6	52	1	1	8	NA	9
Ben	ND	1996	34	3	55	1	1	4	7	8
Carpio	ND	2012	34	5	57	1	1	5	8	5
CDC Verona	Can.	2010	34	4	56	1	1	4	NA	8
Divide	ND	2005	35	5	56	1	1	5	8	5
Grenora	ND	2005	32	5	54	1	1	5	8	6
Joppa	ND	2013	34	5	56	1	1	5	7	5
Lebsock	ND	1999	33	3	54	1	1	5	7	6
Maier	ND	1998	31	5	55	1	1	5	NA	8
Mountrail	ND	1998	34	5	55	1	1	5	7	8
ND Grano[7]	ND	2017	34	5	56	1	1	NA	NA	6
ND Riveland[7]	ND	2017	36	4	55	1	1	NA	NA	5
Pierce	ND	2001	33	5	54	1	1	6	7	8
Rugby	ND	1973	37	5	55	1	1	4	NA	8
Strongfield[7]	Can.	2004	33	6	55	1	1	6	NA	8
Tioga	ND	2010	35	4	56	1	1	5	7	6
VT Peak	Viterra	2010	33	6	55	NA	NA	NA	NA	NA

[1]Refers to agent or developer: Can. = Agriculture Canada, WB = Westbred, ND = North Dakota State University.

[2]Plant height was obtained from the average of six variety trials in 2018.

[3]Straw Strength = 1-9 scale, with 1 the strongest and 9 the weakest. Based on recent data. These values may change as more data become available.

[4]Days to Heading = the number of days from planting to head emergence from the boot. Averaged from several locations in 2018.

[5]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible. NA = Not adequately tested. Foliar Disease = reaction to tan spot and septoria leaf spot complex.

[6]Alzada has a disease-resistance package that makes it more adapted to drier growing conditions (for example, western North Dakota).

[7]Low cadmium accumulating variety.

Durum wheat variety quality descriptions, milling and processing data averaged for five years (2013-2017) from drill strips (32 locations/year).

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein[1]	Gluten Index[2]	Pasta Color[3]	Spaghetti Firmness	Overall Quality[4]
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
AC Commander	60.3	90	58	492	13.5	90	8.9	4.4	Good
AC Navigator	61.0	91	55	499	13.7	69	8.8	4.4	Good
Alkabo	61.7	82	56	394	13.4	49	8.9	3.9	Good
Alzada[5]	59.9	88	67	471	13.8	89	8.5	4.4	Good
Carpio	61.5	78	62	452	13.5	93	8.9	4.2	Good
Divide	61.2	85	54	435	13.6	77	8.7	4.0	Good
Joppa[5]	61.5	85	48	413	13.1	85	9.1	4.0	Good
Maier	61.1	88	53	399	14.2	56	8.7	4.4	Good
Mountrail	60.9	89	47	424	13.6	24	8.4	3.8	Fair
ND Grano[6]	61.9	85	50	455	13.7	68	9.1	4.2	Good
ND Riveland[6]	61.6	88	60	439	13.7	84	9.0	4.2	Good
Strongfield	60.7	87	56	423	14.1	66	8.5	4.2	Good
Tioga	61.1	84	60	394	13.4	78	8.7	4.2	Good
Average	61.1	86	56	438	13.6	71	8.8	4.2	

For all numbered footnotes, refer to bottom of Table 3.

Durum wheat variety quality descriptions, milling and processing data for 2017 at all locations in the drill strips.

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein[1]	Gluten Index[2]	Pasta Color[3]	Spaghetti Firmness	Overall Quality[4]
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
AC Commander	59.6	86	46	498	14.7	92	8.8	5.1	Good
AC Navigator	60.6	88	46	533	14.7	75	8.7	4.7	Good
Alkabo	60.5	76	49	381	14.2	63	8.5	4.2	Good
Alzada[5]	59.1	84	61	485	14.6	95	8.5	4.7	Good
Carpio	60.5	77	57	448	14.4	95	8.6	4.5	Good
Divide	60.3	84	50	445	14.8	83	8.2	4.4	Good
Joppa	60.5	83	40	462	14.1	92	8.7	4.5	Good
Maier	59.7	83	43	404	15.3	72	8.4	4.6	Good
Mountrail	59.7	88	36	467	14.5	38	8.1	4.2	Fair
ND Grano[6]	60.4	73	40	470	14.7	80	8.6	4.4	Good
ND Riveland[6]	59.9	77	54	441	14.8	91	8.6	4.4	Good
Strongfield	59.9	85	46	452	14.7	79	8.4	4.4	Good
Tioga	60.2	80	53	392	14.6	85	8.4	4.5	Good
Average	60.1	82	48	452	14.6	80	8.5	4.5	

[1]Wheat protein is reported on a 12 percent moisture basis.

[2]Gluten index is unitless. Numbers less than 15 = very weak and greater than 80 = very strong gluten proteins.

[3]Pasta Color Score: Higher number indicates better color, with 8.5+ typically considered good.

[4]Overall Quality is determined based on agronomic, milling and spaghetti processing performance.

[5]Alzada has good quality when grown in environments where it is adapted. Low test weight can affect quality in some environments.

[6]Low cadmium accumulating variety.

Durum Wheat - 2018 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AC Commander	55	26	0	55.3	16.1	35.0	38.0	37.3	37.7	36.8
AC Navigator	56	27	0	56.0	15.7	36.3	37.3	35.2	36.3	36.3
Alkabo	56	29	0	56.0	15.5	33.3	32.6	38.1	35.4	34.7
Alzada	53	29	0	54.4	16.0	34.4	34.0	35.6	34.8	34.7
Ben	54	30	0	55.3	16.2	31.6	35.1	31.9	33.5	32.9
Carpio	56	29	0	55.6	15.0	32.2	36.5	41.9	39.2	36.9
CDC Verona	56	28	0	55.5	16.8	33.7	36.0	36.2	36.1	35.3
Divide	56	28	0	55.1	16.3	33.4	33.5	34.1	33.8	33.7
Grenora	54	28	0	56.0	15.6	33.4	33.3	38.3	35.8	35.0
Joppa	56	27	0	54.9	15.6	41.1	35.7	34.6	35.2	37.1
Lebsock	54	29	0	56.1	16.4	35.6	37.8	33.2	35.5	35.5
Maier	55	29	0	56.0	17.0	30.4	33.5	35.9	34.7	33.3
Mountrail	55	29	0	56.1	16.0	31.8	38.9	37.7	38.3	36.1
ND Grano	56	28	0	56.1	15.7	33.8	35.7	34.6	35.2	34.7
ND Riveland	56	31	0	54.9	15.6	37.4	37.3	36.3	36.8	37.0
Pierce	54	29	0	56.0	15.7	35.1	34.7	32.2	33.5	34.0
Rugby	54	31	0	55.8	16.3	25.5	34.1	31.5	32.8	30.4
Strongfield	56	29	0	54.7	16.9	35.5	38.9	38.8	38.9	37.7
Tioga	56	29	0	55.4	16.7	34.3	33.8	32.1	33.0	33.4
VT Peak	54	28	0	56.7	16.1	35.1	37.2	39.5	38.4	37.3
Trial Mean	56	29	0	55.7	16.0	35.1	36.1	36.7	35.7	35.1
C.V. %	0.9	6.1	--	1.0	2.4	17.2	9.7	8.1	--	--
LSD 5%	0.7	2.5	NS	0.8	0.5	8.4	4.9	4.1	--	--
LSD 10%	0.6	2.1	NS	0.7	0.4	7.1	4.1	3.5	--	--

[1] Days to Head = the number of days from planting to head emergence from the boot.

[2] 0 = no lodging, 9 = 100% lodged.

Planting Date: April 27

Harvest Date: August 22

Previous Crop: Carinata

Durum Wheat - 2018 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Alkabo	27	0	57.9	12.8	62.5	20.2	33.6	26.9	38.8
Carpio	31	0	57.2	11.6	70.2	21.6	36.4	29.0	42.7
Joppa	31	0	57.8	12.2	69.8	24.9	34.9	29.9	43.2
ND Grano	31	0	58.1	11.3	--	23.7	32.1	27.9	--
ND Riveland	32	0	58.6	11.0	--	18.8	36.4	27.6	--
Tioga	34	0	58.2	12.0	72.9	19.9	34.0	27.0	42.3
Trial Mean	31	0	57.9	11.8	70.0	21.3	34.6	28.0	41.7
C.V. %	8.0	--	1.1	7.0	4.8	12.3	7.7	--	--
LSD 5%	2.7	NS	0.9	1.2	5.1	3.9	4.0	--	--
LSD 10%	2.3	NS	0.8	1.0	4.2	3.2	3.3	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 7

Harvest Date: September 1

Durum Wheat - 2018 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Alkabo	36	0	59.7	13.7	26.6	9.8	52.4	31.1	29.6
Carpio	38	0	58.6	14.0	29.3	12.3	49.3	30.8	30.3
Joppa	38	0	57.7	13.5	29.9	12.9	53.8	33.4	32.2
ND Grano	38	0	59.3	14.3	--	14.0	50.2	32.1	--
ND Riveland	38	0	58.9	14.5	--	14.2	52.0	33.1	--
Tioga	37	0	59.5	13.8	31.1	13.1	52.3	32.7	32.2
Trial Mean	37	0	59.0	14.0	86.3	13.3	51.7	32.2	31.1
C.V. %	2.7	--	1.7	4.9	2.6	16.5	5.4	--	--
LSD 5%	1.5	NS	1.5	1.0	3.4	3.2	4.2	--	--
LSD 10%	1.2	NS	1.2	0.9	2.8	2.7	3.4	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 7

Harvest Date: August 17

NDSU Hettinger Research Extension Center

Durum Wheat - 2018 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Alkabo	27	0	57.9	12.8	62.5	20.2	33.6	26.9	38.8
Carpio	31	0	57.2	11.6	70.2	21.6	36.4	29.0	42.7
Joppa	31	0	57.8	12.2	69.8	24.9	34.9	29.9	43.2
ND Grano	31	0	58.1	11.3	--	23.7	32.1	27.9	--
ND Riveland	32	0	58.6	11.0	--	18.8	36.4	27.6	--
Tioga	34	0	58.2	12.0	72.9	19.9	34.0	27.0	42.3
Trial Mean	31	0	57.9	11.8	70.0	21.3	34.6	28.0	41.7
C.V. %	8.0	--	1.1	7.0	4.8	12.3	7.7	--	--
LSD 5%	2.7	NS	0.9	1.2	5.1	3.9	4.0	--	--
LSD 10%	2.3	NS	0.8	1.0	4.2	3.2	3.3	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: May 9

Harvest Date: September 6

NDSU Dickinson Research Extension Center

2018 Durum - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AC Commander	59	10,416	29	60.8	15.3	47.6	31.1	48.1	39.6	42.3
Alkabo	59	10,477	31	61.6	14.7	53.1	32.0	63.2	47.6	49.4
Alzada	55	10,784	25	59.0	15.0	39.9	35.0	38.4	36.7	37.8
Ben	59	9,636	34	61.4	15.4	43.7	33.0	56.5	44.7	44.4
CDC Verona	63	10,046	36	61.1	15.1	47.7	29.8	64.1	47.0	47.2
Carpio	61	10,618	34	61.5	14.3	52.5	33.2	57.9	45.5	47.8
Divide	60	9,966	34	61.5	15.1	54.2	33.2	62.4	47.8	49.9
Grenora	58	10,770	31	60.4	15.2	51.5	35.2	55.9	45.5	47.5
Joppa	59	10,526	35	62.0	14.2	56.7	34.0	65.8	49.9	52.2
Lebsock	58	11,070	33	62.4	14.5	52.8	31.8	59.1	45.5	47.9
Maier	60	11,292	30	61.3	15.5	45.1	32.4	57.5	44.9	45.0
Mountrail	60	11,003	35	61.6	14.6	50.3	35.9	64.8	50.3	50.3
ND Grano	61	10,607	33	62.1	14.8	48.5	32.9	64.5	48.7	48.6
ND Riveland	60	10,179	35	61.0	14.6	52.1	32.4	60.1	46.3	48.2
Pierce	58	11,197	34	62.5	14.4	48.2	32.5	56.8	44.7	45.8
Rugby	60	11,254	39	61.6	14.8	45.8	31.8	63.2	47.5	46.9
Strongfield	61	10,784	34	61.1	15.8	51.2	33.8	60.3	47.1	48.5
Tioga	60	10,026	35	61.8	14.5	51.5	32.8	63.3	48.1	49.2
VT Peak	59	10,217	34	62.5	15.0	51.7	30.0	60.3	45.2	47.3
Trial Mean	60	10,418	34	61.7	14.8	50.2	31.9	61.6	--	--
CV %	1.4	8.6	5.4	0.7	3.2	9.6	9.9	9.0	--	--
LSD 0.05	1	1,252	3	0.6	0.8	6.8	4.4	7.8	--	--
LSD 0.10	1	1,048	2	0.5	0.7	5.7	3.7	6.5	--	--

Planting Date: May 1, 2018
Harvest Date: August 20, 2018
Previous Crop: Cover Crop
Seeding Rate: 1.2 million live seeds/ac

2018 North Dakota barley variety descriptions.

Variety	Use[1]	Origin[2]	Year Released	Awn Type[3]	Rachilla Hair Length[4]	Aleurone Color	Height (inch)	Days to Head	Straw Strength	Reaction to Disease[5]			
										Stem Rust	Spot-form Net Blotch	Spot Blotch	Net Blotch
Six-rowed													
Celebration	M/F	BARI	2008	S	S	White	27	62	Strg.	8	6	3	7
Innovation	MT	BARI	2010	S	L	White	26	62	Strg.	8	6	3	7
Lacey	M/F	MN	2000	S	S	White	26	61	Strg.	8	4	3	7
Quest[6]	M/F	MN	2010	S	L	White	27	61	V.strg.	8	4	3	7
Stellar-ND	M/F	ND	2005	S	L	White	26	61	V.strg.	8	6	3	7
Tradition	M/F	BARI	2003	S	L	White	27	62	V.strg.	8	6	3	7
Two-rowed													
AAC Synergy	M/F	Syngenta	2015	R	L	White	25	64	Strg.	4	3	4	4
ABI Balster	M/F	BARI	2015	R	L	White	25	64	Med.	NA	4	8	NA
ABI Growler	M/F	BARI	2014	R	L	White	25	68	M.strg.	NA	7	8	NA
Conlon[7]	M/F	ND	1996	S	L	White	25	60	Med.	8	4	6	3
Explorer	M	Secobra	NA	R	L	White	22	64	M.strg.	NA	NA	8	4
LCS Genie	M	Limagrain	NA	S	S	White	23	65	V.strg.	NA	6	8	6
ND Genesis	M/F	ND	2015	S	L	White	25	65	M.strg.	8	4	4	6
Pinnacle	M/F	ND	2006	S	L	White	25	63	Strg.	8	8	4	6
Sirish	M	Syngenta	NA	R	L	White	23	63	M.strg.	NA	NA	8	6

[1]M = malting; MT = being tested in plant-scale tests for malting and brewing quality; F = feed.

[2]BARI = Busch Agricultural Resources Inc.; MN = University of Minnesota; ND = North Dakota State University.

[3]R = rough; S = smooth.

[4]S = short; L = long.

[5]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA – not available.

[6]Moderately resistant to Fusarium head blight.

[7]Lower DON accumulations than other varieties tested.

NDSU Hettinger Research Extension Center

Barley - 2018 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW											
AAC Synergy	54	25	0	92	47.1	14.0	75.7	41.8	88.6	65.2	68.7
ABI Balster	54	23	0	88	46.9	14.2	73.2	53.0	85.1	69.1	70.4
ABI Growler	52	22	0	88	45.8	14.6	68.0	34.7	85.4	60.1	62.7
Conlon	48	23	0	93	46.8	13.9	60.4	24.2	75.5	49.9	53.4
Explorer	53	20	0	89	46.6	13.7	--	57.8	95.5	76.7	--
LCS Genie	56	23	0	87	47.3	13.2	67.0	53.7	89.0	71.4	69.9
ND Genesis	52	24	0	92	46.2	12.5	69.0	40.0	90.3	65.2	66.4
Pinnacle	51	24	0	93	47.7	12.0	64.6	49.4	90.4	69.9	68.1
Sirish	54	20	0	91	47.8	13.2	71.4	48.6	88.6	68.6	69.5
SIX ROW											
Celebration	52	24	0	87	43.8	16.4	61.4	47.9	77.0	62.5	62.1
Innovation	50	22	0	89	44.8	15.5	62.1	40.4	76.4	58.4	59.6
Lacey	49	22	0	87	44.3	15.0	59.5	49.9	70.3	60.1	59.9
Quest	51	25	0	86	43.5	15.2	64.4	52.1	70.4	61.3	62.3
Stellar-ND	50	22	0	90	43.3	15.1	62.5	47.5	66.7	57.1	58.9
Tradition	52	22	0	88	44.8	14.8	63.3	46.3	76.4	61.4	62.0
Trial Mean	51	23	0	89	45.6	14.0	67.7	45.4	82.9	64.8	64.9
C.V. %	1.7	7.3	--	1.8	1.1	3.6	7.5	15.0	5.7	--	--
LSD 5%	1.2	2.4	NS	2.3	0.7	0.7	7.2	9.6	6.7	--	--
LSD 10%	1.0	2.0	NS	1.9	0.6	0.6	6.0	8.0	5.6	--	--

[1] Days to Head = the number of days from planting to head emergence from the boot.

[2] 0 = no lodging, 9 = 100% lodged.

Planting Date: May 2

Harvest Date: August 24

Previous Crop: Soybean

Barley - 2018 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW										
ND Genesis	27	0	89	46.0	12.7	66.5	11.3	52.7	32.0	43.5
Pinnacle	25	0	93	48.1	12.4	56.7	11.0	73.0	42.0	46.9
CDC Meredith	29	0	93	48.1	11.9	57.5	9.5	62.3	35.9	43.1
SIX ROW										
Innovation	23	0	82	43.6	14.7	60.8	12.1	32.7	22.4	35.2
Tradition	25	0	85	44.4	15.3	59.8	12.1	32.9	22.5	34.9
Trial Mean	26	0	89	46.0	13.4	60.3	11.2	50.7	35.7	51.3
C.V. %	8.7	--	5.5	1.2	4.3	10.2	23.1	6.8	--	--
LSD 5%	3.5	NS	7.4	0.8	0.9	9.4	4.0	10.5	--	--
LSD 10%	2.8	NS	6.0	0.7	0.7	7.7	3.3	8.6	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: April 27

Harvest Date: August 11

Barley - 2018 **Regent, ND**

Variety	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	inches	0-9*	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW										
ND Genesis	33	0	87	48.0	12.8	39.7	19.3	87.0	53.2	48.7
Pinnacle	27	0	80	45.3	14.2	24.5	17.4	82.2	49.8	41.4
CDC Meredith	33	0	83	46.9	13.5	44.1	19.1	82.5	50.8	48.6
SIX ROW										
Innovation	32	0	72	45.6	15.6	27.4	19.5	81.6	50.6	42.8
Tradition	33	0	81	46.7	14.3	30.8	21.1	85.4	53.3	45.8
Trial Mean	32	0	81	46.5	14.1	33.3	19.3	83.7	26.3	50.1
C.V. %	7.1	--	9.1	2.1	4.7	18.8	27.4	6.7	--	--
LSD 5%	3.5	NS	11.2	1.5	1.0	9.6	8.1	8.6	--	--
LSD 10%	2.8	NS	9.2	1.2	0.8	7.9	6.6	7.0	--	--

* 0 = no lodging, 9 = 100% lodged.

Planting Date: April 27

Harvest Date: August 11

Mandan location was abandoned due to wildlife damage.

2018 Barley - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	% Plump	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	>6/64	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Six Row											
Celebration	62	11,315	30	52.0	16.3	92.1	74.3	49.2	119.9	84.5	81.1
Innovation	59	10,400	30	52.5	14.3	94.0	77.8	50.0	127.1	88.6	85.0
Lacey	60	10,663	29	52.5	15.0	93.3	75.2	45.6	126.3	85.9	82.3
Quest	61	11,315	31	52.0	13.7	87.5	74.5	47.3	124.0	85.7	82.0
Stellar-ND	60	10,028	30	51.6	13.8	95.1	75.2	46.7	137.9	92.3	86.6
Tradition	61	10,408	30	53.3	14.6	93.8	69.5	45.6	124.9	85.3	80.0
Two Row											
AAC Synergy	62	8,949	30	52.8	13.9	95.5	90.3	47.4	141.3	94.3	93.0
ABI Balster	62	9,826	29	52.0	14.4	91.1	92.4	47.8	134.6	91.2	91.6
ABI Growler	63	9,662	29	50.5	14.6	92.0	86.9	46.3	132.7	89.5	88.6
ND Genesis	57	8,987	31	51.3	12.5	93.6	88.7	49.3	134.4	91.8	90.8
Conlon	56	9,124	30	53.4	14.3	96.0	54.2	45.8	79.9	62.8	59.9
Explorer	60	8,804	25	52.9	14.1	94.9	--	54.1	134.5	94.3	--
LCS Genie	64	9,647	26	51.4	13.7	92.1	97.1	46.2	128.2	87.2	90.5
Pinnacle	60	8,580	31	53.0	13.6	96.4	80.3	45.7	133.9	89.8	86.6
Sirish	63	9,541	25	52.3	14.2	95.7	91.4	45.3	132.6	88.9	89.7
Trial Mean	60	9,769	29	52.1	14.0	94	81.3	48.8	127.8	--	--
CV %	1.6	4.4	4.0	1.4	3.9	1.4	9.2	9.7	7.2	--	--
LSD 0.05	1	613	2	1.0	0.9	2	10.6	6.7	13.0	--	--
LSD 0.10	1	512	1	0.8	0.7	2	8.8	5.6	10.8	--	--

Planting Date: April 27, 2018
Harvest Date: August 9, 2018
Previous Crop: Cover Crop
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis

2018 Glen Ullin Barley - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	% Plump	Protein	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
		lbs/bu	>6/64	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Six Row									
AAC Synergy	7,679	50.4	98	16.5	--	--	132.4	--	--
Innovation	10,565	51.5	93	15.7	60.7	63.3	111.4	87.4	78.5
Tradition	10,446	51.5	93	15.7	--	65.6	106.3	85.9	--
Two Row									
ND Genesis	8,272	50.3	97	15.0	72.5	65.8	115.8	90.8	84.7
Pinnacle	7,892	51.0	98	16.2	60.8	58.5	117.6	88.1	79.0
Sirish	8,594	50.6	97	15.8	--	67.3	123.6	95.5	--
Trial Mean	8,908	50.9	96	15.8	61.2	64.6	117.9	--	--
CV %	5.6	1.5	0.8	2.6	6.3	11.3	9.2	--	--
LSD 0.05	755	1.2	1	0.7	5.8	NS	16.3	--	--
LSD 0.10	621	1.0	1	0.6	4.7	NS	13.4	--	--

Planting Date: May 14, 2018
Harvest Date: August 16, 2018
Previous Crop: Wheat
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis

2018 North Dakota oat variety descriptions.

Variety	Origin[1]	Year Released	Grain Color	Height	Straw Strength	Maturity[2]	Reaction to Diseases: Stem Rust[3]	Reaction to Diseases: Crown Rust[3]	Reaction to Diseases: Barley Y.Dwf[4]	Bu/Wt.	Protein[5]
AC Pinnacle	AAFC	1999	White	Tall	Med.	L	8	8	8	V.good	L
Beach	ND	2004	White	Tall	M.strg.	M/L	8	4	6	V.good	M
CDC Dancer	Sask.	2000	White	Tall	Strong	L	8	6	8	V.good	M
CDC Minstrel	Sask.	2006	White	Tall	M.strg.	L	8	8	8	Good	M
CS Camden	Canterra	2016	White	Med.	Strong	M	8	6	NA	Good	NA
Deon	MN	2013	Yellow	Tall	Strong	L	8	1	2	V.good	NA
Hayden	SD	2014	White	Tall	Med.	L	8	7	NA	V.good	NA
HiFi	ND	2001	White	Tall	Strong	L	4	8	2	Good	M
Hytest	SD	1986	White	Tall	M.strg.	E	8	6	8	V.good	H
Jury	ND	2012	White	Tall	M.strg.	M	1	8	4	V.good	M
Killdeer	ND	2000	White	Med.	Strong	M	8	6	4	Good	M
Leggett	AAFC	2005	White	Tall	Strong	L	3	1	8	Good	M
Newburg	ND	2011	White	Tall	Med.	L	1	8	4	Good	M
Otana	MT	1977	White	M.tall	M.weak	L	8	8	8	V.good	M/L
Paul[6]	ND	1994	Hull-less	V.tall	Strong	L	1	4	2	Good	H
Rockford	ND	2008	White	Tall	Strong	L	8	8	4	V.good	M
Souris	ND	2006	White	Med.	Strong	M	6	8	6	V.good	M
Stallion	SD	2006	White	Tall	Med.	L	8	3	NA	V.good	M

[1]AAFC = Agriculture & Agri-Food Canada; MN = University of Minnesota; ND = North Dakota State University; SD = South Dakota State University; Sask. = University of Saskatchewan; MT = Montana State University.

[2]E = early; M = medium; L = late.

[3]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible.

[4]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA – not available.

[5]H = high; M = medium; L = low; NA = not available.

[6]Hull-less variety.

NDSU Hettinger Research Extension Center

Oat - 2018 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2016	2017	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	---------- Bushels per acre ----------				
Beach	54	32	0	37.3	59.6	50.9	90.9	70.9	67.1
CS Camden	55	30	0	34.3	--	73.3	114.1	93.7	--
CDC Dancer	55	33	0	34.6	62.4	72.4	98.9	85.7	77.9
Deon	56	31	0	35.6	64.0	70.9	89.8	80.4	74.9
Hayden	54	30	0	36.0	68.9	75.4	105.2	90.3	83.2
HiFi	55	31	0	35.3	61.6	57.5	94.1	75.8	71.1
Hytest	51	33	0	37.1	53.7	63.5	84.3	73.9	67.2
Jury	53	33	0	36.2	55.5	58.0	92.3	75.2	68.6
Killdeer	52	30	0	36.0	61.6	58.2	108.3	83.3	76.0
Leggett	55	30	0	34.3	61.5	65.6	99.7	82.7	75.6
CDC Minstrel	54	30	0	34.9	65.9	66.6	99.6	83.1	77.4
Newburg	54	33	0	34.1	63.9	57.5	95.6	76.6	72.3
Otana	55	34	0	36.6	63.8	67.2	97.1	82.2	76.0
AC Pinnacle	56	31	0	34.6	77.4	79.5	95.5	87.5	84.1
Rockford	56	32	0	37.1	65.3	76.2	112.3	94.3	84.6
Souris	54	30	0	36.2	64.0	74.2	103.6	88.9	80.6
Stallion	54	32	0	37.3	59.6	58.2	96.5	77.4	71.4
Paul (hull-less)	57	32	0	40.7	46.2	39.3	72.7	56.0	52.7
Trial Mean	54	31	0	35.8	62.8	62.3	97.3	81.0	74.2
C.V. %	1.0	5.4	--	1.2	9.1	26.0	6.0	--	--
LSD 5%	0.8	2.4	NS	0.6	8.0	22.7	8.2	--	--
LSD 10%	0.6	2.0	NS	0.5	6.7	19.0	6.9	--	--

[1] Days to Head = the number of days from planting to head emergence from the boot.

[2] 0 = no lodging, 9 = 100% lodged.

Planting Date: May 2

Harvest Date: August 14

Previous Crop: Oat No-till Green Fallow

2018 Oat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AC Pinnacle	61	14,105	33	35.6	150.3	83.4	116.2	99.8	116.6
Beach	59	17,026	33	37.1	130.9	70.3	83.5	76.9	94.9
CDC Dancer	58	15,339	33	37.0	135.3	74.4	95.3	84.8	101.6
CDC Minstrel	60	14,524	32	34.5	133.9	70.2	106.0	88.1	103.4
Cs Camden	59	14,365	33	33.6	--	72.4	111.4	91.9	--
Deon	59	13,986	33	36.8	126.9	76.1	95.5	85.8	99.5
Hayden	58	13,696	33	39.1	140.7	80.9	117.4	99.2	113.0
HiFi	58	14,833	35	37.9	123.3	69.7	109.4	89.5	100.8
Hytest	58	13,868	37	39.9	108.3	66.0	101.6	83.8	92.0
Jury	58	15,633	37	36.9	111.2	73.2	95.2	84.2	93.2
Killdeer	58	15,866	29	35.9	125.3	81.8	109.3	95.5	105.5
Leggett	60	14,385	32	36.4	133.4	70.9	95.4	83.2	99.9
Newburg	57	15,580	36	34.9	115.9	73.2	82.1	77.6	90.4
Otana	59	16,380	36	35.0	126.1	76.5	97.7	87.1	100.1
Paul*	60	17,060	33	40.9	91.8	43.3	82.2	62.8	72.5
Rockford	59	16,522	32	38.5	133.2	71.2	99.1	85.1	101.2
Souris	58	15,776	31	36.6	111.5	78.2	94.5	86.3	94.7
Stallion	58	17,635	31	33.5	118.4	83.2	103.6	93.4	101.7
Trial Mean	58	14,937	34	36.6	122.8	72.9	100.7	--	--
CV%	1.1	5.1	7.9	2.5	9.0	9.6	13.7	--	--
LSD 0.05	1	1,077	4	1.3	15.5	9.8	19.3	--	--
LSD 0.10	1	901	3	1.1	12.9	8.2	16.1	--	--

Planting Date: May 3, 2018
Harvest Date: August 7, 2018
* Hulless
Previous Crop: Cover Crop
Seeding Rate: 1 million live seeds/ac
Trial receive hail at @ 5 leaf stage

Safflower - 2018 **Hettinger, ND**

Variety	Days to Flower	Plant Height	Test Weight	Oil Content	Grain Yield 2015	Grain Yield 2016	Grain Yield 2018	Average Yield 2-Yr	Average Yield 3-Yr
	DAP[1]	inches	lbs/bu	%	lbs per acre				
Linoleic Types									
Cardinal	71	24	40.5	33.4	2497	1805	1825	1815	2042
Chickadee	72	23	38.9	34.5	--	--	1497	--	--
Finch	72	24	41.1	33.8	2672	1669	1335	1502	1892
NutraSaff	69	25	33.3	43.8	2162	1223	1425	1324	1603
Rubis Red	70	24	43.0	29.0	--	--	1393	--	--
Oleic Types									
Hybrid 200	72	25	40.4	29.9	3412	1723	1397	1560	2177
Hybrid 446	72	25	41.2	29.5	--	--	1297	--	--
Hybrid 1601	71	24	37.7	33.7	3750	2095	1929	2012	2591
MonDak	72	25	37.8	33.8	3050	1559	1680	1620	2096
Montola 2003	70	25	37.5	35.4	3346	1555	1830	1693	2244
Trial Mean	71	24	39.1	33.7	3011	1661	1561	1646	2092
C.V. %	2.2	4.0	1.6	1.5	7.7	13.6	9.5	--	--
LSD 5%	2.3	1.4	0.9	0.8	337	333	215	--	--
LSD 10%	1.9	1.2	0.8	0.6	279	276	179	--	--

[1] Days after planting.

Planting Date: May 16

Harvest Date: October 2

Previous Crop: Oats

Safflower Trial was not harvested in 2017

NDSU Hettinger Research Extension Center

Oil Type Sunflower - 2018 **Hettinger, ND**

Company/ Brand	Hybrid	Oil Type & Traits[1]	Days to Bloom[2]	Plant Height	Lodging	Test Weight	Oil Content	Grain Yield 2018	Grain Yield 2-Year	Grain Yield 3-Year
				inches	%	lbs/bu	%	--------lbs/ac--------		
Croplan	3732	NS	67	57	0	28.2	37.1	3410	2496	--
Croplan	3845 HO	HO	66	61	0	28.7	37.5	3421	2683	--
Croplan	432 E	NS, EX, DM	64	65	0	26.4	33.4	2370	2132	2124
Croplan	455 E HO	HO, EX, DM	66	65	0	27.9	37.2	3715	2639	2284
Croplan	545 CL	NS, CL, DM	68	62	0	25.9	36.2	3172	2525	2460
Croplan	549 CL	HO, CL, DM	63	69	0	28.4	37.5	2892	2384	2278
Croplan	557 CL HO	HO, CL, DM	69	66	0	25.7	36.9	3407	--	--
Croplan	568 CL HO	HO, CL, DM	70	64	0	26.5	36.6	3466	2643	--
Mycogen	8H449CLDM	HO, CL, DM	67	61	0	29.6	39.1	3571	2791	2558
Mycogen	MY8H456CL	HO, CL, DM	69	69	0	26.2	38.3	3617	2875	--
Mycogen	MY8H460CP	HO, CLP	68	73	0	27.0	36.8	3246	--	--
Nuseed	Badger DMR	NS, CL, DM	64	70	0	25.8	36.1	2899	2536	2269
Nuseed	Camaro II	NS, CL, DM	67	71	0	29.0	37.2	2905	2485	2321
Nuseed	Falcon	NS, EX	67	61	0	27.8	35.5	3014	2505	2264
Nuseed	Hornet	HO, CL, DM	68	68	0	26.1	37.0	3417	2839	2789
Nuseed	N4H302 E	HO, EX	66	63	0	25.8	37.7	2539	--	--
Nuseed	N4HM354	NS, CL, DM	64	57	0	28.0	36.2	2769	2440	2367
Nuseed	N4H521 CL	NS, CL, DM	69	65	0	25.6	35.9	3359	--	--
Nuseed	N4H470 CL Plus	HO, CLP, DM	68	63	0	28.1	39.1	3566	3051	--
Nuseed	N5LM307	NS, CL	64	64	0	24.8	34.4	2514	2159	2058
NuTech	63C4 CL	NS, CL	64	59	0	27.6	38.1	2769	--	--
NuTech	64H6	H0, EX	66	70	0	26.9	36.1	3444	--	--
NuTech	68H7	HO, EX	68	71	0	27.6	35.4	2862	--	--
NuTech	68M5	NS, EX	68	66	0	27.2	36.1	2851	--	--
NuTech	69M2	NS, EX	68	74	0	27.4	36.5	3617	--	--
Proseed	E-21 CL	NS, CL, DM	67	74	0	25.7	36.1	2105	1854	--
Proseed	E-31 CL	NS, CL, DM	67	72	0	25.0	34.9	2551	2259	2207
Proseed	E-362436	NS, CL, DM	66	73	0	28.5	35.1	2638	2279	--
Proseed	E 50016 CL	NS, CL	68	65	0	26.0	36.1	2973	2260	--
Proseed	E-71 CL	NS, CL, DM	68	70	0	24.0	34.5	2582	2084	--
Proseed	E-72	NS	69	72	0	27.2	35.9	3138	2510	--
Proseed	E-73 CL	NS, CL, DM	69	70	0	23.7	35.2	2519	2141	--
SunOpta	4415 HO/CLP/DM	HO, CLP, DM	67	71	0	25.8	36.0	2990	--	--
SunOpta	4425 CL	NS, CL	67	74	0	26.7	35.4	3007	--	--
SunOpta	EX721	HO, CL	67	68	0	24.7	35.6	2994	--	--
SunOpta	EX725	NS, CL	67	72	0	25.1	35.6	2950	--	--
SunOpta	EX72468	NS, CL	70	68	0	25.8	36.9	3582	--	--

Table continued on next page

NDSU Hettinger Research Extension Center

Oil Type Sunflower - 2018 **Hettinger, ND**

Company/ Brand	Hybrid	Oil Type & Traits[1]	Days to Bloom[2]	Plant Height	Lodging	Test Weight	Oil Content	Grain Yield 2018	Grain Yield 2-Year	Grain Yield 3-Year
Table continues from previous page										
Limagrain	LCSADVX18-001HO	HO	69	72	0	25.4	37.1	2951	--	--
Limagrain	LCSADVX18-002HO	HO	67	73	0	27.5	35.5	2966	--	--
Limagrain	LCSADVX18-003HOCL	HO, CLP	69	72	0	24.6	35.2	2830	--	--
Limagrain	LCSADVX18-004HO	HO	67	75	0	26.2	34.0	3009	--	--
Limagrain	LCSADVX18-005LN	Conv	72	76	0	28.6	36.6	2697	--	--
Limagrain	LCSADVX18-006HO	HO	67	72	0	25.1	34.5	2393	--	--
Limagrain	LCSADVX18-007LN	Conv	67	75	0	25.4	34.6	2833	--	--
Limagrain	LCSADVX18-008HOCL	HO, CL	67	71	0	25.6	34.4	2384	--	--
Limagrain	LCSADVX18-009LN	Conv	65	74	0	27.7	35.8	2923	--	--
Limagrain	LCSADVX18-010LNCL	Conv, CLP	68	74	0	29.5	37.0	3212	--	--
Limagrain	LCSADVX18-011LN	Conv	65	73	0	26.6	35.5	2825	--	--
Limagrain	LCSADVX18-012LNCL	Conv, CLP	67	68	0	25.4	36.7	2675	--	--
Limagrain	LCSADVX18-013LN	Conv	67	72	0	29.1	37.2	2793	--	--
Mycogen (C	8N270CLDM	NS, CL, DM	62	62	0	27.8	38.3	2260	1960	1925
USDA (CK	Honeycomb NS	NS	60	61	0	22.1	32.3	958	875	1061
USDA (CK	894	TR	65	67	0	27.9	37.1	2808	2353	2173
USDA (CK	Hybird 924	TR	67	67	0	26.4	35.9	2931	--	--
Trial Mean			67	68	0	26.6	36.2	2931	2373	2209
C.V. %			1.0	5.5	--	3.2	3.5	9.7	--	--
LSD 5%			1.0	5.3	NS	1.2	1.8	397	--	--
LSD 10%			0.9	4.4	NS	1.0	1.5	333	--	--

[1] Type: TR-Traditonal, NS-NuSun, HO-High Oleic, CL=Clearfield, EX=ExpressSun, DM=Downy Mildew Resistan

[2] Days after planting.

Planting Date: May 31

Harvest Date: November 1

Previous Crop: Wheat

Canola - Conventional - 2018 **Hettinger, ND**

Brand	Variety	Oil Type[1]	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Oil Content	Seed Yield
			DAP[2]	days	DAP[2]	inches	0 - 9[3]	%	lbs/a
Photosyntech	NCC101S		43	16	76	29	0	32.8	188
Photosyntech	NCC1825/8-S		43	17	77	32	0	36.3	359
Rubisco Seeds	Atomic		45	16	79	27	0	32.9	54
Rubisco Seeds	Trapper		43	17	78	32	0	36.0	240
BrettYoung	6090 RR (RR Check)		47	17	82	34	0	37.6	399
Croplan	HyClass 930 (RR Check)		42	17	77	31	0	39.3	436
Trial Mean			44	16	78	32	0	35.8	248
C.V. %			2.7	3.2	1.7	9.7	--	3.0	17.3
LSD 5%			1.7	0.8	1.9	4.5	--	1.6	62
LSD 10%			1.4	0.6	1.6	3.7	--	1.3	51

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

[2] Days after planting.

[3] Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 16

Harvest Date: August 23

This trial has a high coeffient of variation (CV) due dry conditions and hail in June. Therefore yield comparisons should not be made.

NDSU Hettinger Reserch Extension Center

Canola - Roundup Ready - 2018 **Hettinger, ND**

Brand	Variety	Oil Type[1]	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Oil Content	Seed Yield	
									2018	2-Yr. Avg.
			DAP[2]	days	DAP[2]	inches	0 - 9[3]	%	----------lbs/a----------	
BrettYoung	4187 RR	TR	44	18	80	40	0	40.8	749	--
BrettYoung	6074 RR	TR	43	18	79	34	0	39.2	627	740
BrettYoung	6090 RR	TR	44	18	80	43	0	38.9	503	--
Canterra Seeds	CS2100	TR	43	18	79	38	0	38.0	522	716
Canterra Seeds	CS2300	TR	43	18	79	36	0	39.6	685	--
Cargill Inc.	11H430	TR	41	18	77	32	0	37.7	588	--
Croplan	HyCLASS 730	TR	41	18	77	34	0	40.3	530	--
Croplan	HyCLASS 930	TR	42	19	78	35	0	40.4	546	793
Croplan	HyCLASS 955	TR	42	19	78	33	0	39.8	513	703
Proseed	300 MAG	TR	43	18	79	37	0	41.4	701	751
Proseed	PS 5000	TR	43	18	79	37	0	38.2	415	604
Star Specialty Seed	Star 402	TR	43	18	79	33	0	41.6	416	628
Trial Mean			43	18	79	36	0	39.4	550	705
C.V. %			1.0	3.4	0.7	9.6	--	3.2	**26.2**	--
LSD 5%			0.6	0.9	0.8	4.9	--	1.8	206	--
LSD 10%			0.5	0.7	0.7	4.0	--	1.5	171	--

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

[2] Days after planting.

[3] Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 16

Harvest Date: August 23

This trial has a high coeffient of variation (CV) due dry conditions and hail in June. Therefore yield comparisons should not be made.

NDSU Hettinger Research Extension Center

Flax - 2018 **Hettinger, ND**

Variety	Days to Bloom	Plant Height	Test Weight	Oil Content	-------Grain Yield-------- 2015	2016	2018	Average Yield 2-Yr	3-Yr
	DAP[1]	inches	lbs/bu	%	---------- bu per acre ----------				
Bison	44	26	55.9	44.2	--	18.7	21.6	20.2	--
Carter*	45	25	55.2	44.1	35.5	18.2	24.5	21.4	26.1
CDC Bethume	45	28	56.1	43.9	32.5	19.1	23.6	21.4	25.1
CDC Glas	47	25	54.7	44.7	35.4	21.1	24.1	22.6	26.9
CDC Neela	45	26	55.6	44.1	36.2	21.6	25.1	23.4	27.6
CDC Sanctuary	45	25	55.5	44.4	35.1	22.5	23.0	22.8	26.9
CDC Sorel	47	29	56.1	44.5	32.8	21.4	24.3	22.9	26.2
Gold ND*	47	30	55.8	44.4	33.1	19.4	22.0	20.7	24.8
ND Hammond	45	28	53.4	42.5	--	--	22.0	--	--
Nekoma	46	27	55.5	44.0	--	19.3	20.6	20.0	--
Omega*	46	25	56.1	43.6	27.2	19.4	18.9	19.2	21.8
Pembina	44	27	55.4	44.3	30.5	17.6	23.5	20.6	23.9
Prairie Blue	45	26	56.3	44.6	33.8	19.2	21.7	20.5	24.9
Prairie Sapphire	45	26	54.8	45.6	30.5	19.9	22.0	21.0	24.1
Prairie Thunder	45	28	55.7	44.5	28.2	18.9	27.0	23.0	24.7
Rahab 94	46	24	55.0	44.3	33.1	17.8	23.1	20.5	24.7
Webster	46	29	56.4	44.4	30.8	20.1	23.9	22.0	24.9
York	44	28	55.5	43.9	33.8	19.4	24.0	21.7	25.7
Trial Mean	45	27	55.5	44.6	32.4	19.5	23.0	22.1	26.2
C.V. %	2.6	5.9	1.3	1.5	6.9	9.6	11.6	--	--
LSD 5%	1.6	2.2	1.0	0.9	3.2	2.7	3.7	--	--
LSD 10%	1.4	1.8	0.9	0.8	2.6	2.2	3.1	--	--

* Yellow seed type.

[1] Days after planting.

Lodging notes were taken at harvest, however no lodging was observed.

Planting Date: May 16

Harvest Date: September 26

Previous Crop: Oats

Dry Bean - 2018 **Hettinger, ND**

Variety	Type	Plant Height	Plant Lodge	Test Weight	Grain Yield 2016	Grain Yield 2017	Grain Yield 2018	Average Yield 2 yr	Average Yield 3 yr
		inches	0-9[1]	lbs/bu	lbs per acre	lbs per acre	lbs per acre	lbs per acre	lbs per acre
LaPaz	Pinto	18	5	56.8	1318	1507	1691	1599	1505
Lariat	Pinto	17	7	52.9	1252	1140	1375	1258	1256
Monterrey	Pinto	21	4	56.5	1454	1496	1653	1575	1534
Palomino	Pinto	18	5	55.0	1099	1282	1536	1409	1306
Stampede	Pinto	19	5	54.0	1382	1415	1609	1512	1469
Windbreaker	Pinto	16	5	53.0	1069	1110	1534	1322	1238
HMS Medalist	Navy	18	2	56.2	1282	1466	937	1202	1228
Ensign	Navy	17	3	56.3	--	--	1130	--	--
T9905	Navy	18	3	56.7	1438	1652	1243	1448	1444
Merlot	Sm Red	19	4	50.4	1230	1449	1011	1230	1230
Rosetta	Pink	18	3	51.9	1261	1597	1060	1329	1306
Eclipse	Black	17	2	53.0	1429	1451	1162	1307	1347
Loreto	Black	18	3	57.8	1284	1298	1006	1152	1196
Zorro	Black	18	2	53.6	1333	1391	1071	1231	1265
Powderhorn	Great Northern	20	2	51.1	--	1900	1303	1602	--
Trial Mean		18	4	54.4	1226	1427	1288	1369	1333
C.V. %		7.4	19.8	3.8	9.8	13.1	13.0	--	--
LSD 5%		1.9	2.0	2.9	170	266	240	--	--
LSD 10%		1.6	1.7	2.4	142	222	200	--	--

[1] 0 = no lodging, 9 = lying flat on ground.

Planting Date: May 23

Harvest Date: September 18

Previous Crop: HRSW

NDSU Hettinger Research Extension Center

Chickpea - 2018 **Hettinger, ND**

Variety	Days to Flower	Height	Lodging	-----Seed Size (mm)----- <8	8-9	9-10	>10	Test Weight	Grain Yield ---- 2015	2016	2018	Average Yield 2 yr	3 yr
	DAP[1]	inches	0 - 9[2]	----------%----------				lb/bu	----------lbs/ac----------				
Kabuli Type													
CDC Frontier	47	15	0	7	43	17	1	56.0	3891	2119	1802	1961	2604
CDC Luna	47	14	0	8	36	15	2	55.0	3761	2054	1589	1822	2468
Sawyer	47	17	0	5	37	25	10	60.0	3107	1387	1439	1413	1978
Sierra	49	14	0	3	15	21	12	56.0	3021	879	1066	973	1655
CDC Orion	43	13	0	4	31	25	8	56.0	--	--	1456	--	--
Desi Type													
CDC Anna	47	15	0	36	4	0	0	56.0	3378	2136	1687	1912	2400
Mean	47	15	0	10	28	17	6	56.0	3032	1736	1507	1616	2221
C.V. %	2.0	7.4	--	19.1	16.4	25.2	44.2	1.5	8.2	12.7	11.1	--	--
LSD 5%	1.4	1.7	NS	3.0	6.9	6.5	3.7	1.2	351	324	253	--	--
LSD 10%	1.1	1.4	NS	2.5	5.6	5.3	3.1	1.0	294	268	208	--	--

[1] Days after planting.

[2] Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 3

Harvest Date: september 18

Previous Crop: Oats

Field Pea - 2018 **Hettinger, ND**

Variety	Days to Flower	Days to Mature	Canopy Height	Lodging	Seed Protein	1,000 Seed Wt.	Seeds Lb	Test Weight	Seed Yield 2018	Seed Yield 2-Yr. Avg.	Seed Yield 3-Yr. Avg.
	DAP[1]	DAP[1]	inches	0 - 9[2]	%	gm	seeds	lb/bu	bu/a	bu/a	bu/a
Yellow Cotyledon Type											
DS Admiral	46	82	13	7		239	1898	*	19.6	16.3	17.2
Agassiz	46	82	15	7		226	2013		25.2	18.7	19.3
LG Amigo	46	82	14	5		221	2057		17.8	15.8	--
Bridger	44	82	13	5		217	2103		12.9	12.8	14.7
Durwood	47	82	17	7		208	2191		21.2	17.6	19.1
Hyline	47	83	12	6		236	1923		15.4	13.7	14.9
LGPN4249	46	82	14	6		274	1660		20.4	--	--
LGPN4906	44	82	14	6		260	1750		19.0	15.9	16.8
LGPN4908	41	80	11	4		251	1809		11.1	11.4	--
LGPN4909	42	81	10	5		257	1769		14.2	14.1	--
LGPN4912	46	81	11	5		231	1966		13.3	--	--
LGPN4913	45	82	12	7		233	1954		15.8	--	--
LGPN4915	44	82	16	7		229	1987		24.4	--	--
SW Midas	46	82	13	5		211	2156		12.0	13.3	14.1
Navarro	41	76	11	5		264	1719		11.6	13.1	15.4
Nette 2010	46	82	14	6		220	2069		18.1	16.3	17.4
Pro 133-6243	42	81	11	4		267	1700		12.3	--	--
AAC Profit	48	83	17	8		237	1919		30.0	--	--
Salamanca	46	81	15	7		226	2012		20.1	17.4	18.5
Spider	47	82	16	8		237	1917		26.7	18.7	17.9
LG Sunrise	46	81	15	6		241	1883		19.1	--	--
Green Cotyledon Type										9.1	11.9
Arcadia	46	82	12	1		202	2255		5.7	--	--
Banner	42	76	10	2		230	1973		7.0	13.4	13.9
Cruiser	44	81	13	4		192	2363		13.6	11.6	--
Ginny	46	81	13	5		207	2197		12.6	11.8	--
Greenwood	45	81	11	4		218	2082		11.6	16.6	--
LG Koda	48	82	12	6		235	1937		20.4	17.6	--
LGPN1125	47	82	14	7		271	1675		22.8	--	--
LGPN1131	46	81	14	5		246	1844		18.7	--	--
Pro 121-7126	46	81	15	6		212	2146		19.3	15.0	--
Shamrock	49	83	15	7		222	2049		18.6	11.2	12.8
CDC Striker	46	82	10	3		194	2345		9.3	12.9	14.5
Viper	44	82	14	6		229	1986		12.6	--	--
Trial Mean	45	81	13	5		231	1979		16.7	14.5	15.9
C.V. %	1.4	0.9	17.4	20.4		3.3	3.5		25.9	--	--
LSD 5%	0.9	1.1	3	2		11	98		6.1	--	--
LSD 10%	0.7	0.9	3	1		9	82		5.1	--	--

[1] Days after planting.

[2] Lodging: 0 = none, 9 = lying flat on ground.

* Not enough sample for a test weight.

Planting Date: May 3

Harvest Date: August 7

Previous Crop: Oats

NDSU Dickinson Research Extension Center

2018 Field Pea - Recrop **Dickinson, ND**

Variety	Days to Flower	Days to Mature	1000 Seed Weight	Seeds per Pound	Plant Height	Test Weight	Protein	--Grain Yield-- 2016	2017	2018*	Average Yield 2 Year	3 Year
			gm		in	lbs/bu	%	--------bu/ac--------			--bu/ac--	
Yellow Types												
Agassiz	53	86	223	2,038	23	62.6	30.1	31.2	21.6	23.1	22.4	25.3
Bridger	48	86	221	2,052	21	63.2	28.2	--	--	23.1	--	--
DS Admiral	52	85	258	1,765	22	62.8	28.2	29.7	23.1	25.7	24.4	26.2
Durwood	53	89	271	1,697	28	64.3	27.7	--	22.8	25.5	24.1	--
Hyline	51	86	271	1,676	22	63.1	28.6	--	--	25.3	--	--
Navarro	49	86	247	1,844	23	63.0	27.8	--	--	23.4	--	--
Nette 2010	48	83	218	2,080	21	63.3	29.6	27.9	25.4	21.7	23.6	25.0
Salamanca	50	87	281	1,613	23	62.1	29.4	--	--	26.5	--	--
Spider	51	87	231	1,969	23	63.0	29.2	22.6	18.5	28.8	23.6	23.3
Green Types												
Arcadia	49	82	199	2,318	18	62.2	29.1	30.3	25.8	27.9	26.8	28.0
CDC Striker	49	81	209	2,178	20	62.6	28.8	28.4	24.8	25.7	25.3	26.3
Cruiser	48	84	203	2,233	20	61.4	30.5	26.7	22.7	21.0	21.8	23.4
Trial Mean	50	85	236	1,955	22	62.8	28.9	28.1	22.8	24.8	--	--
CV %	1.2	2.0	7.6	7.6	10.0	1.6	2.5	7.4	8.5	17.2	--	--
LSD 0.05	1	3	30	253	4	1.7	1.2	3.1	2.8	NS	--	--
LSD 0.10	1	2	25	210	3	1.4	1.0	2.6	2.3	NS	--	--

Planting Date: May 3, 2018
Harvest Date: August 8, 2018
Previous Crop: Cover Crop
Seeding Rate: 325,000 live seeds/ac
*Trial Received Hail June 16
Grain protein percentages reported on 0% moisture basis

NDSU Hettinger Reserach Extension Center

Lentil - 2018 **Hettinger, ND**

Variety	Days to Flower	Height	Lodging	1,000 Seed Wt.	Seeds Lb	Test Weight	Grain Yield 2015	Grain Yield 2016	Grain Yield 2018	Average Yield 2 yr	Average Yield 3 yr
	DAP[1]	inches	0 - 9[2]	gm	seeds	lb/bu	lbs/acre	lbs/acre	lbs/acre	lbs/acre	lbs/acre
Large Green Type											
CDC Greenland	48	13	2	66	6921	*	2823	1219	1028	1124	1690
Pennell	47	13	1	65	6955		2527	1079	1268	1174	1625
Riveland	46	15	2	72	6330		2374	1118	951	1034	1481
Medium Green Type											
CDC Richlea	48	13	1	53	8542		2804	1299	1233	1266	1779
Small Green Type											
CDC Viceroy	47	12	0	38	11899		2951	1352	1634	1493	1979
ND Eagle	46	13	1	42	10974		3409	890	1455	1172	1918
French Green Type											
CDC Lemay	55	12	1	35	12999		3005	598	1334	966	1646
Small Red Type											
CDC Red Rider	50	14	1	48	9465		2974	1359	1466	1413	1933
CDC Redberry	51	15	0	45	10103		3295	902	1258	1080	1818
CDC Rosetown	56	13	0	34	13442		2768	1304	1557	1431	1876
CDC Rouleau	54	13	0	41	11150		3154	1157	1180	1169	1830
Trial Mean	50	13	1	49	9889		2687	1043	1306	1932	2128
C.V. %	2.4	8.5	105.5	5.1	5.5		7.0	11.8	18.9	--	--
LSD 5%	1.7	1.6	1.3	3.6	780		264	174	357	--	--
LSD 10%	1.4	1.4	1.1	3.0	648		221	145	297	--	--

[1] Days after planting.

[2] Lodging: 0 = none, 9 = lying flat on ground.

* Not enough sample for weigh system to obtain a test weight.

Planting Date: May 3

Harvest Date: August 13

2017 results not used for milti-year averages because of very low yields.

Soybean - Roundup Ready - 2018 **Hettinger, ND**

Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield	Average Yield 2-Yr	Average Yield 3-Yr
				inches	lbs/bu	%	%	------ Bushels per acre ------		
NDSU	17009GT	00.9	9/17	23	55.1	15.6	34.6	26.2	--	--
Proseed	30-20	0.2	9/20	23	52.8	16.2	33.8	31.0	28.7	28.1
Legacy Seeds	LS-0334 RR2	0.3	9/28	22	53.5	15.4	34.0	30.1	--	--
Legend Seeds	LS 03X852N	0.3	9/27	22	54.3	15.1	33.0	28.9	--	--
Legacy Seeds	LS-0438 RR2X	0.4	9/28	21	53.3	15.7	34.1	28.9	--	--
Legend Seeds	LS 05X865N	0.5	9/29	21	52.8	15.7	34.3	29.2	--	--
REA Hybrids	RX0516	0.5	9/29	23	53.9	15.2	33.3	30.5	--	--
REA Hybrids	RX0628	0.6	10/2	20	53.4	15.5	33.5	29.0	26.2	--
Legacy Seeds	LS-0738N RR2X	0.7	10/2	21	53.7	15.2	34.5	30.6	--	--
REA Hybrids	RX0719	0.7	10/2	20	53.6	15.5	34.1	29.8	--	--
Legend Seeds	LS 09R23N	0.9	10/3	21	54.3	15.3	33.7	31.7	--	--
Legend Seeds	LS 09X960N	0.9	10/4	20	53.8	14.9	35.4	30.3	--	--
REA Hybrids	RX0929	0.9	10/3	21	53.4	14.7	35.3	31.0		
Trial Mean			9/29	21	53.7	15.4	34.1	29.8	27.4	28.1
C.V. %			1.2	8.5	1.1	2.0	1.4	11.0	--	--
LSD 5%			2.2	2.6	0.8	0.4	0.7	4.7	--	--
LSD 10%			1.8	2.2	0.7	0.4	0.6	3.9	--	--

Planting Date: May 23
Harvest Date: October 15
Previous Crop: Barley

Soybean - Conventional - 2018 **Hettinger, ND**

Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield	Average Yield 2-Yr	Average Yield 3-Yr
				inches	lbs/bu	%	%	------ Bushels per acre ------		
NDSU	ND Benson	0.4	9/30	24	13.2	15.4	35.4	30.3	28	--
NDSU	ND Bison	0.7	10/5	24	13.1	15.7	33.5	33.9	30.6	34.3
NDSU	ND Stutsman	0.7	9/27	27	12.3	15.6	33.6	36.8	32.4	--
RR Check		0.8	10/6	26	13.4	15.8	33.0	36.6	--	--
Trial Mean			10/2	25	13.0	15.6	33.9	34.0	30.3	34.3
C.V. %			0.3	5.4	0.7	3.0	3.4	12.2	4.1	12.2
LSD 5%			0.7	2.2	0.6	0.7	1.9	6.7	1.7	6.7
LSD 10%			0.5	1.8	0.5	0.6	1.5	5.5	1.4	5.5

Planting Date: May 23
Harvest Date: October 16
Previous Crop: HRSW

NDSU Hettinger Research Extension Center

Corn - 2018 **Hettinger, ND**

Company	Hybrid	Traits[1]	Relavtive Maturity[1]	Plant Height	Ear Height	Stalk Lodge	Moisture Content	Test Weight	Grain Yield 2018	Grain Yield 2-Yr
			days	inches	inches	%	%	lbs/bu	------bu/ac------	
Integra	3282	RR2, VT2P	83	105	46	0	17.7	53.1	111.4	--
Integra	3325	RR2, AV-3010A	84	91	36	0	18.7	54.0	110.9	84.8
Integra	3537	RR2, VT2P	86	105	43	0	17.7	52.1	110.8	83.4
Integra	3718	RR2, VT2P	90	104	46	0	20.9	52.6	113.4	--
Legend Seeds	LR 9583	RR2, VT2P	83	100	43	0	17.3	51.9	110.8	--
Legend Seeds	40J684	RR2	87	108	43	1	20.8	55.0	114.5	--
Legend Seeds	LR 9986	RR2, VT2P	85	99	39	1	18.0	52.0	90.1	--
Legend Seeds	LR 9990	RR2, VT2P	83	110	46	0	22.6	50.7	114.0	--
Legacy	L-2516	RR2, VT2P	82	99	39	0	17.2	51.9	97.9	81.7
Legacy	L-2847	RR2, VT2P	83	105	45	1	19.0	51.8	112.6	85.1
Legacy Seeds	L-2546	RR2	85	109	43	2	20.0	56.3	116.8	--
Legacy Seeds	L-2314	RR2, VT2P	87	102	45	1	17.2	53.6	110.9	--
Proseed	1480	RR2, VT2P	80	103	43	0	17.1	54.1	112.5	79.8
Proseed	1483	RR2, VT2P	83	102	42	1	16.4	53.4	117.5	88.2
Proseed	1384	RR2, VT2P	84	103	40	1	18.2	54.8	89.5	71.6
Proseed	1787	RR2, VT2P	87	107	42	0	17.6	53.4	115.4	--
Proseed	1487	RR2, VT2P	87	107	44	0	18.3	53.1	114.0	--
Trial Mean				104	42	0	18.5	53.2	109.6	82.1
C.V. %				3.8	8.3	265.1	7.8	2.2	12.1	--
LSD 5%				5.6	5.0	1.8	2.1	1.9	19.1	--
LSD 10%				4.6	4.2	1.5	1.7	1.6	15.9	--

[1] Traits and relavtive maturity provided by company.

Planting Date: May 22

Harvest Date: October 30

Previous Crop: Spring Wheat

Broadleaf weed control using pyridate (Tough) herbicide in chickpea

Chickpea 'Leader,' a medium-sized Kabuli-type, was planted at a rate of 150 lb/A at a depth of 3 inches on May 9, 2018 using a John Deere 1590 no-till drill. Chickpea inoculant was applied in-furrow during planting. Prior to planting, the entire field was treated with glyphosate (32 oz/A, 1.0 lb ai/A) to control winter annual weeds. Chickpea emerged on May 23. Herbicide treatments were applied on June 5 using a tractor-mounted research plot sprayer at a spray volume of 20 gallons per acre. This trial was designed to evaluate pyridate application rate without adjuvant and to compare methylated seed oil (MSO) verses crop oil concentrate (COC) adjuvants for broadleaf weed control. Additionally, treatments were included to determine if clethodim (Select) could be safely tank-mixed with pyridate. Also, we evaluated a single versus sequential applications of pyridate. Weeds present at time of application included kochia (2 to 5 inches), common lambsquarters (2 to 4 inches), Russian thistle (1 to 3 inches), and green foxtail (1 to 2 inches). Chickpea were evaluated for injury 8 days after treatment and no injury was observed for any of the herbicide treatments applied. The sequential treatments were applied on June 14, 9 days after the initial application. Chickpea were again evaluated for injury 7 days after the sequential application and no injury was observed for any herbicide treatment. At this same time, kochia, common lambsquarters, and green foxtail were visually evaluated for control (0-100 with 0 being no control, similar to the untreated and 100 being complete control or death of plants). At two weeks after the initial treatment application, kochia control increased from 44 to 59 to 68% when Tough herbicide was applied at 0.75, 1, and 1.5 pt/A, respectively. When Tough was applied at 1.5 pt/A with MSO or COC adjuvants, kochia control increased to 75 and81%, respectively. Tank-mixing Tough with Select did not antagonize kochia control. When Tough was applied sequentially using 1.5 pt/A twice, kochia control increased to 89%, this was similar to sequential applications of 1.5 pt/A followed by 0.75 pt/A that resulted in 90% control of kochia. Sequential applications of 0.75 pt/A resulted in only 73% kochia control and was similar to a single application at 1.5 pt/A. Control of common lambsquarters followed similar trends to that of kochia with the best control occurring with sequential applications of either 1.5 pt/A twice or 1.5 pt/A followed by 0.75 pt/A that resulted in 95% control of common lambsquarters. When Select was tank-mixed with Tough, green foxtail was controlled 94 to 98% 16 days after treatment, indicating that there was no antagonism for this tank-mix. Tough alone did not control green foxtail. At 30 days after the first application, similar trends occurred for weed control with one exceptions. There was no apparent advantage to use of either MSO or COC adjuvants as control of both kochia and common lambsquarters was similar with and without these adjuvants. This was also true for Russian thistle that was evaluated at this timing. Results from this trial indicate that pyridate (Tough herbicide) has potential use for broadleaf weed control in chickpea. Pyridate is a contact herbicide with no residual effect on weed control that will only control weeds present at time of application and with smaller weeds being controlled better than larger ones. It will best be utilized with other management options, such as following PRE herbicide application or possibly being tank-mixed with other PRE herbicides labelled for use in chickpea. Pyridate does offer potential POST control of broadleaf weeds in chickpea with is not currently an option with current registered herbicides. Further evaluations of PRE/POST combinations with pyridate as well as tank-mixes need to be considered.

Table. Chickpea response and weed control following application of pyridate (Tough) herbicide treatments at Hettinger, ND.

			chickpea			kochia			common lambsquarters			Russian thistle	
			8 DAT	16 DAT	30 DAT	16 DAT	30 DAT	49 DAT	16 DAT	30 DAT	49 DAT	30 DAT	49 DAT
Treatment	Rate	Timing	————% injury————			——————————————————— % control ———————————————————							
1Untreated	—	—	0	0	0	0	0	0	0	0	0	0	0
2Tough	0.75pt/a	A	0	0	0	44g	42f	54d	34e	41d	50e	49f	53e
3Tough	1pt/a	A	0	0	0	59f	58e	66c	58d	76bc	78cd	66e	76d
4Tough	1.5pt/a	A	0	0	0	68e	71cd	75b	77c	90a	89ab	80cd	81cd
5Tough	1.5pt/a	A	0	0	0	81c	79bc	79b	85b	88ab	81bcd	78cde	80cd
COC	2pt/a	A											
6Tough	1.5pt/a	A	0	0	0	75cd	79bc	81b	88ab	89a	91a	85bc	90b
MSO	2pt/a	A											
7Tough	1.5pt/a	A	0	0	0	81bc	75c	80b	86b	87ab	85abc	82bcd	85bc
Select	6oz/a	A											
COC	2pt/a	A											
8Tough	1.5pt/a	A	0	0	0	77cd	77bc	76b	84b	87ab	89ab	81cd	84c
Select	6oz/a	A											
MSO	2pt/a	A											
9Tough	1.5pt/a	A	0	0	0	89ab	88a	91a	95a	95a	92a	98a	100a
Select	6oz/a	A											
COC	2pt/a	A											
Tough	1.5pt/a	B											
COC	2pt/a	B											
10Tough	0.75pt/a	A	0	0	0	73de	66d	79b	72c	70c	72d	71de	81cd
Select	6oz/a	A											
COC	2pt/a	A											
Tough	0.75pt/a	B											
COC	2pt/a	B											
11Tough	1.5pt/a	A	0	0	0	90a	85ab	92a	95a	89a	94a	93a	100a
Select	6oz/a	A											
COC	2pt/a	A											
Tough	0.75pt/a	B											
COC	2pt/a	B											
LSD P=.05			.	.	.	7.27	8.14	7.88	7.12	12.72	9.46	3.90	5.52
Treatment F			0.000	0.000	0.000	31.249	23.794	16.725	58.371	13.033	16.394	1418.604	50.055
Treatment Prob(F)			1.0000	1.0000	1.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Treatment timing ‘A’ was applied on June 5, 2018; timing ‘B’ was applied on June 14, 2018

Comparison of spray volume and adjuvant use for broadleaf weed control using pyridate (Tough) herbicide in chickpea

Chickpea 'Leader,' a medium-sized Kabuli-type, were planted at a rate of 150 lb/A at a depth of 3 inches on May 9, 2018 using a John Deere 1590 no-till drill. Chickpea inoculant was applied in-furrow during planting. Prior to planting, the entire field was treated with glyphosate (32 oz/A, 1.0 lb ai/A) to control winter annual weeds. Chickpea emerged on May 23. Herbicide treatments were applied on June 5 using a tractor-mounted research plot sprayer. Spray volumes of 10, 20, and 30 gallons per acre were compared with and without crop oil concentrate (COC) adjuvant. Weeds present at time of application included kochia (2 to 5 inches) and Russian thistle (1 to 3 inches). Chickpea was evaluated for injury 8, 16, and 31 days after treatment (DAT) and there was no injury observed with any treatment. At 16 DAT, kochia control was less (69%) when Tough plus COC was applied at a spray volume of 10 gallons per acre compared with spray volumes of 20 and 30 gallons per acre, 81 and 88% control, respectively. However, when evaluated at 31 and 49 DAT, no differences in kochia control was observed when comparing spray volumes, although there appeared to be a small advantage when using COC adjuvant verses no adjuvant. Russian thistle was controlled equally well regardless of spray volume or COC adjuvant. While initially it appear that a higher spray volume may increase weed control, the impact did not carry through at later evaluations.

Table. Chickpea response and weed control following application of pyridate (Tough) herbicide treatments at spray volumes of 10, 20, and 30 gallons per acre.

			chickpea			kochia			Russian thistle		
			8 DAT	16 DAT	31 DAT	16 DAT	31 DAT	49 DAT	8 DAT	31 DAT	49 DAT
Treatment	Rate	Volume	———% injury———			——————————— % control ———————————					
1Untreated	—	—	0	0	0	0	0	0	0	0	0
2Tough	1.5pt/a	10	0	0	0	69bc	73bc	77	84	85	88
3Tough	1.5pt/a	10	0	0	0	69bc	75abc	79	95	83	92
COC	1.25pt/a		0	0	0						
4Tough	1.5pt/a	20	0	0	0	65c	64bc	74	79	81	85
5Tough	1.5pt/a	20				81ab	77ab	78	90	81	92
COC	1.25pt/a		0	0	0						
6Tough	1.5pt/a	30				64c	63c	73	90	86	93
7Tough	1.5pt/a	30	0	0	0	74abc	71bc	76	86	87	70
COC	1.25pt/a										
8Tough	1.5pt/a	30				88a	87a	85	100	89	90
COC	2.5pt/a		0	0	0						
LSD P=.05			.	.	.	14.05	13.27	9.67	16.45	12.95	24.72
Treatment F			0.000	0.000	0.000	3.364	3.344	1.588	1.622	0.494	0.926
Treatment Prob(F)			1.0000	1.0000	1.0000	0.0211	0.0216	0.2076	0.1984	0.8048	0.4998

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Response of Oats to Preemergence and Postemergence applied Herbicides at Hettinger, ND

A trial was conducted to evaluate herbicide with potential use in oats for preemergence and postemergence applications. Oats 'Hytest' were planted on May 23, 2018 at a rate of 60 lbs/A at a depth of 2 inches using a John Deere 1590 no-till drill. Starter fertilizer (18-46-0) was applied in furrow during planting at a rate of 40 lb/A (7 lb N and 18 lb P2O5/A). Immediately after planting paraquat (Gramoxone @ 32 oz/A) was applied to control emerged weeds. Prior to planting, urea fertilizer (46-0-0) was applied at a rate of 150 lbs/A (69 lb N/A) and glyphosate was applied (Cornerstone 5 Plus @ 32 oz/A) to control winter annual weeds. Preemergence herbicide treatments were applied on May 24 using a tractor-mounted research plot sprayer at a spray volume of 10 gallons per acre. Oats emerged on May 30. Early postemergence treatments were applied on June 4 (at the 1-leaf oat stage) and late postemergence treatments were applied on June 14 (at the 4-leaf oat stage). Oats were evaluated for injury at 18, 26, 36, and 50 days after the PRE application timing. The only injury observed to oats was with the postemergence application of Armezon, with bleaching injury being greater at the late POST application timing. Oats were harvested on August 31. Even with significant injury, there were no significant differences in oat yield or test weight. Oat yield ranged from 67 to 83 bushel per acre. The numerically lowest yield occurred following the late POST application of Armezon and the POST application of Zidua. Further evaluation of these herbicides is needed to verify safety for use in oats, but there appears to be potential for additional herbicides that could be utilized in oats.

Table. Oat response to preemergence and postemergence herbicide application at Hettinger, ND

			18 DAT	26 DAT	36 DAT	50 DAT	Yield	Test
Treatment	Rate	Timing	% control				Bu/A	Lb/Bu
1Untreated			0b	0c	0b	0b	74	36
2Zidua	3oz/a	PRE	0b	0c	0b	0b	82	35
3Warrant	1.5qt/a	PRE	0b	0c	0b	0b	82	37
4Dual II Magnum	1.67pt/a	PRE	0b	0c	0b	0b	78	35
5Prowl	3pt/a	PRE	0b	0c	0b	0b	76	37
6Outlook	18oz/a	PRE	0b	0c	3b	0b	78	35
7Zidua	3oz/a	EPOST	0b	0c	0b	0b	67	35
8Warrant	1.5qt/a	EPOST	0b	0c	0b	0b	76	34
9Dual II Magnum	1.67pt/a	EPOST	0b	0c	0b	0b	83	35
10Prowl	3pt/a	EPOST	0b	0c	0b	0b	83	35
11Outlook	18oz/a	EPOST	0b	0c	0b	0b	79	36
12Armezon COC	1oz/a 1% v/v	EPOST	14a	9b	0b	3b	77	37
13Armezon COC	1oz/a 1% v/v	LPOST	—	28a	46a	30a	67-	36
LSD P=.05			0.60	1.24	2.89	3.46	16.6	2.359
Treatment F			361.000	329.379	160.611	47.254	0.852	1.248
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.5995	0.2903

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
Oats were planted on May 23, 2018 at Hettinger, ND.
Abbreviations: PRE, preemergence; EPOST, early postemergence; LPOST, late postemergence
Herbicides were applied on May 24 (PRE), June 4 (EPOST, 1-leaf oats), and June 14 (LPOST, 4-leaf oats)

Fall and Spring Applications of Sulfentrazone and Metolachlor for Weed Control in Dry Field Peas.

A trial was conducted to evaluate fall and spring applications of sulfentrazone and metolachlor for weed control in dry field peas. Fall treatments were applied on October 17, 2017 to a no-till field site previously planted to spring wheat. Treatments were applied using a tractor-mounted research plot spray at a spray volume of 10 gallons per acre. Downy brome had emerged prior to this application timing and was mostly in the 1-leaf stage. Winter weather prevented evaluation of plots until spring. In the spring, prior to planting, fall applications were 100% effective in controlling downy brome shepherd's purse and prickly lettuce. Field peas 'Nettes' were planted on May 3, 2018 using a John Deere 1590 no-till drill. On May 5, spring preemergence treatments were applied using the same equipment as fall treatments. All preemergence treatments included glyphosate plus AMS to control emerged weeds. Spring treatments were also nearly 100% effective at controlling downy brome and shepherd's purse. Residual control of green foxtail was generally better with spring application than fall, but control of kochia and common lambsquarters was very similar for both application timings. Evaluations taken on June 26th, 250 days after fall application of sulfentrazone resulted in 88 to 95% control of common lambsquarters and 87 to 91% control of kochia. Unfortunately, a severe hailstorm on the night of June 26 resulted in total defoliation of the peas and weeds making further evaluation of weed control impossible and prevented collection of yield data as well. It was impressive how well spring weeds were controlled with fall preemergence applications. Further research looking at fall herbicide applications for weed control prior to planting peas should be pursued.

Table. Effect of fall and spring preemergence herbicide treatments for weed control in field peas at Hettinger, ND

Treatment	Rate oz/A	Timing	Pea	Downy brome		Shepherd's purse		Kochia			Green foxtail		Common lambsquarters	
			18 DAE	-11 DAE	7 DAE	-11 DAE	7 DAE	7 DAE	18 DAE	43 DAE	18 DAE	43 DAE	18 DAE	43 DAE
			% injury	% control										
1Untreated		Fall	0	0b	0c	0c	0d	0c	0.0d	0f	0g	0c	0c	0e
2Glyphosate Broadaxe XC	32 25	Fall	0	100a	100a	100a	99a	100a	91.3a	91ab	70e	63a	94a	92a
3Glyphosate Broadaxe XC	32 19	Fall	0	100a	100a	100a	100a	95a	80.0c	90ab	58f	36b	86b	93a
4Glyphosate Broadaxe XC Dual II	32 19 10	Fall	0	100a	100a	100a	100a	98a	85.0bc	88b	78cd	73a	90ab	95a
5Glyphosate Broadaxe XC Dual II	32 19 16	Fall	0	100a	100a	100a	100a	96a	85.0bc	91ab	80bcd	74a	93a	88a
6Glyphosate Dual II	32 32	Fall	0	100a	100a	100a	100a	44b	0.0d	13e	75de	66a	0c	0e
7Glyphosate	32	Fall	0	100a	96b	97ab	90bc	0c	0.0d	0f	0g	0c	0c	0e
8Glyphosate	32	Fall + Spring	0	100a	100a	95b	99a	95a	0.0d	0f	0g	0c	0c	0e
9Glyphosate Broadaxe XC	32 25	Spring	0	0b	100a	0c	98a	100a	91.0a	93ab	85a	78a	94a	87ab
10Glyphosate Broadaxe XC	32 19	Spring	0	0b	100a	0c	96ab	100a	89.1ab	96a	83abc	74a	90ab	90a
11Glyphosate Broadaxe XC Dual II	32 10 16	Spring	0	0b	100a	0c	99a	98a	86.3ab	80c	77d	75a	86b	75c
12Glyphosate Broadaxe XC Dual II	32 10 23	Spring	0	0b	100a	0c	94abc	96a	90.0ab	93ab	83ab	78a	86b	78bc
13Glyphosate Dual II	32 32	Spring	0	0b	99a	0c	98a	95a	0.0d	25d	79bcd	76a	0c	0e
14Glyphosate	32	Spring	0	0b	100a	0c	89c	98a	0.0d	0f	0g	0c	0c	0e
LSD P=.05			.	.	2.13	3.25	6.69	8.32	5.8	6.7	5.0	17.4	4.0	9.4
Treatment F			0.000	0.000	1283.6	2036.3	125.2	157.6	475.7	340.1	425.1	31.0	1053.4	161.9
Treatment Prob(F)			1.0000	1.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Fall treatments were applied on October 19. Spring treatments were applied on May 5. Peas were planted on May 3

All treatments included AMS at 8.5 lbs/100 gallons

Flax Tolerance to Preemergence Herbicides at Hettinger, ND

Flax 'York' was planted on May 15, 2018 at 38 lb/A at a depth of 1.5 inches using a John Deere 1590 no-till drill. Prior to planting, on May 4, the entire field was treated with glyphosate (Cornerstone 5 Plus @ 32 oz/A) to control winter annual weeds. Urea fertilizer (46-0-0) was applied on May 2 at a rate of 45 lb/A. Preemergence herbicide treatments were applied on May 16 using a tractor mounted research spray using a spray volume of 10 gallons per acre. Flax emerged on May 24. Flax was evaluated for injury on June 12 (27 days after treatment (DAT)) and Jul 13 (58 DAT). The only treatment causing visual injury was the herbicide acetochlor (Warrant) resulting in 8% and 19% injury at 27 and 58 DAT, respectively. Stand and height counts were measured on June 19 and while there were no significant differences in stand or height, flax height following acetochlor was lowest of all treatments. Common mallow control 27 DAT was greatest (81%) following application of sulfentrazone plus metolachlor (Broadaxe plus Dual II Magnum), and similar to sulfentrazone plus pyroxasulfone (Spartan plus Zidua), flumioxazin plus pyroxasulfone (Fierce) and pendimethalin (Prowl H2O) with control ranging from 74 to 76%. All other treatments resulted in poor control of common mallow. Baryard control was best following application of metolachlor (Dual II Magnum) sulfentrazone plus metolachlor, pendimethalin, and dimethenamid (Outlook). Control of barnyardgrass with these treatments was only fair (74 to 79%). All other treatments provided poor control of barnyardgrass. Plots were impacted by a severe hailstorm on the night of June 26 resulting in nearly complete defoliation. Further evaluations were not taken do to the damage to the plots. However, plot yields were measured on September 28. While yields showed no statistically significant differences, yields were lowest following application of acetochlor and second lowest in the untreated control. Yields ranged from 787 to 1015 LB/A. Test weight of flax was lowest following application of acetochlor. From these results, it appears that there are several options that could be pursued for preemergence weed control in flax. Although, the herbicide acetochlor may be too injurious to flax.

Table. Flax response and weed control following preemergence herbicide application.

		Flax			Common mallow	Barnyardgrass	Kochia	Flax	
		Injury	Stand	height	27 DAT	27 DAT	27 DAT	Yield	Test
Treatment	Rate	%	plants/m	cm	——————% control——————			LB/A	LB/BU
1 Untreated		0b	187	20	0c	0f	0e	836-	53c
2 Zidua	3oz/a	0b	216	21	0c	71bcd	70b	1012-	56abc
3 Spartan Zidua	4oz/a 1.5oz/a	0b	221	21	76a	68cd	78ab	1016-	58a
4 Warrant	1.5qt/a	8a	213	19	5c	63d	66b	787-	49d
5 Dual II Magnum	1.5pt/a	0b	196	20	0c	75abc	74ab	873-	55abc
6 BroadAxe Dual II Magnum	22.8oz/a 5.2oz/a	0b	206	21	81a	78ab	84a	908-	57ab
7 Fierce	3oz/a	0b	195	21	74a	74abc	74ab	870-	56abc
8 Prowl H2O	3pt/a	0b	221	20	76a	79a	67b	967-	55abc
9 Valor	2oz/a	0b	228	21	30b	45e	46c	872-	54c
10 Outlook	18oz/a	0b	229	20	23b	74abc	21d	967-	55bc
LSD P=.05		2.3	43.3	1.8	7.8	8.7	11.3	204.6	2.9
Treatment F		9.000	0.940	0.846	179.594	63.687	48.965	1.188	5.741
Treatment Prob(F)		0.0001	0.5082	0.5821	0.0001	0.0001	0.0001	0.3417	0.0002

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Flax Tolerance to Preemergence and Postemergence Herbicides

Flax 'York' was planted on May 15, 2018 at 38 lb/A at a depth of 1.5 inches using a John Deere 1590 no-till drill. Prior to planting, on May 4, the entire field was treated with glyphosate (Cornerstone 5 Plus @ 32 oz/A) to control winter annual weeds. Urea fertilizer (46-0-0) was applied on May 2 at a rate of 45 lb/A. Preemergence herbicide treatments were applied on May 16 using a tractor mounted research spray using a spray volume of 10 gallons per acre. Flax emerged on May 24. Postemergence treatments were applied on June 5. Flax was evaluated visually for injury at 7, 15, and 38 days after postemergence treatments were applied. Injury from POST application of Talinor was severe (61 to 81%), whereas PRE application of Talinor caused little or no injury. However, Talinor acts primarily as a POST herbicide and resulted in little control of either common mallow or kochia. POST applications of Talinor provided fair control of both common mallow and kochia. Armezon caused injury (bleaching) to flax with the injury being greater when applied at 0.75 oz/A compared with 0.5 oz/A at 15 DAT. Armezon in this trial provided only fair control of common mallow or kochia. Bison (bromoxynil plus MCPA) also caused minor injury to flax and provided fair to poor control of common mallow and kochia. Basagran caused very little injury to flax and fair control of common mallow but poor control of kochia. Raptor caused moderate injury to flax (29% 15 DAT) but provided excellent control of common mallow and fair control of kochia. The tank-mix of Basagran plus Raptor showed less injury to flax 15 DAT and also provided excellent common mallow control and fair control of kochia. Flax was harvested on September 28. Flax yield was reduced by POST Talinor treatments and in the untreated control. Even though moderate injury occurred following Raptor application, flax yield was not reduced and was second highest numerically or all treatments. Note: trial was impacted by a severe hailstorm on the night of June 26 that completely defoliated flax and weeds in this trial. This may have impacted both weed control and yield potential in this trial.

Table. Flax response and weed control following preemergence and postemergence herbicide application.

			Flax			Common mallow		Kochia	Flax	
			7 DAT	15 DAT	38 DAT	15 DAT	38 DAT	15 DAT	Yield	Test
Treatment	Rate	Timing	—— % Injury ——			———% control———			LB/A	LB/BU
1 Untreated			0	0	0	0	0	0	937bc	49.33bc
2 Coact+	2.75oz/a	PRE	0e	0f	0c	5d	28e	0d	1067ab	51.53ab
Talinor	13.7oz/a									
COC	1% v/v									
3 Coact+	3.6oz/a	PRE	9d	0f	4c	0d	45d	23c	989ab	51.75a
Talinor	18.2oz/a									
COC	1% v/v									
4 Coact+	2.75oz/a	POST	73b	61b	70a	65b	56bcd	55ab	731cd	47.40c
Talinor	13.7oz/a									
COC	1% v/v									
5 Coact+	3.6oz/a	POST	81a	78a	74a	74a	70b	65ab	651d	49.85ab
Talinor	18.2oz/a									
COC	1% v/v									
6 Armezon	0.5oz/a	POST	14cd	0f	0c	64bc	60bc	63ab	1174a	51.55ab
COC	1% v/v									
7 Armezon	0.75oz/a	POST	12d	13de	4c	65b	69b	49b	1038ab	50.43ab
COC	1% v/v									
8 Bison	1pt/a	POST	10d	14d	5c	55c	53cd	50ab	947abc	51.10ab
9 Basagran	1pt/a	POST	3e	6ef	3c	63bc	64bc	48b	1061ab	50.58ab
COC	1% v/v									
10 Raptor	4oz/a	POST	18c	29c	15b	80a	100a	70a	1118ab	51.15ab
NIS	0.25% v/v									
28% N	2.5% v/v									
11 Basagran	1pt/a	POST	11d	18d	14b	80a	92a	66ab	1094ab	51.90a
Raptor	4oz/a									
MSO	1% v/v									
LSD P=.05			4.94	6.89	8.05	8.45	14.92	17.75	229.1	4.94
Treatment F			267.731	121.505	98.073	112.363	28.870	13.547	4.072	267.731
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0017	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
PRE, preemergence treatments were applied on May 16; POST, postemergence treatments were applied on June 5.

Sunflower response and weed control from herbicides applied pre-plant and post-plant preemergence near Hettinger, ND

A trial was established on May 22, 2018 to determine sunflower response and weed control following early pre-plant (EPP) and preemergence (PRE) herbicide treatments. On May 31, sunflower were planted in 30-inch rows using a John Deere planter at a rate of 20,000 seeds/A at a depth of 1.5 inches. Nine days prior to planting, and EPP treatments were applied using a hand-held back-pack sprayer with a 76-inch spray boom. PRE treatments were applied on June 4 using the same procedures. All EPP and PRE treatments were tank-mixed with glyphosate (Cornerstone 5 Plus @ 32 oz/A plus AMS at 8.5 lbs/100 Gal). The delay between planting and PRE application was due to persistent winds that prevented application. Sunflower emerged on June 7. Weeds emerging in trial included green foxtail and wild buckwheat. Green foxtail was controlled equally well when treatments were applied preplant or PRE. Wild buckwheat control was almost always greater following preplant application compared with PRE application. This may be due to greater amounts of rainfall after preplant vs PRE application which allowed for greater emergence of wild buckwheat following the PRE application timing. Sunflower yield was not affected by herbicide treatment or timing of herbicide treatment. Although yield in untreated plots was numerically the lowest, the difference was not significant. Weed populations in this trial were low, which was likely the reason for lack of yield response to herbicide treatments.

Table. Sunflower response and weed control following early pre-plant and preemergence herbicide treatments.

				Green foxtail		Wild buckwheat		
	Rate		Sunflower	28 DAT	42 DAT	28 DAT	42 DAT	Sunflower yield
Treatment	oz/A	Timing	% injury	% control				lb/A
1Untreatead			0	0	0	0	0	3280
2Authority Supreme	8.5	EPP	0	87ab	88b	90a	91ab	3580
3Spartan Charge	5.75	EPP	0	71d	66d	90a	94a	3637
4Spartan Elite	26	EPP	0	98a	96a	90ab	91ab	3893
5Zidua SC	4	EPP	0	89ab	91ab	75bc	820bc	3625
6Authority Supreme	5.8	PRE	0	88ab	93ab	68c	75c	3985
7Authority Supreme	8.5	PRE	0	94ab	94ab	68c	74c	4110
8Spartan Charge	3.75	PRE	0	74cd	79c	71c	79bc	3856
9Spartan Elite	19	PRE	0	85bc	92ab	73c	78c	3823
10Zidua SC	3	PRE	0	88ab	95a	78abc	86abc	3679
LSD P=.05			.	10.76	7.01	13.89	11.74	602.05
Treatment F			0.000	4.439	15.797	3.672	3.086	0.926
Treatment Prob(F)			1.0000	0.0029	0.0001	0.0079	0.0183	0.5213

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
EPP, early pre plant treatments, applied on May 22 (9 days before planting; PRE, preemergence treatments, applied on June 4 (4 days after planting)

Spring wheat response to the herbicide pyroxasulfone at Hettinger, ND

A trial was established to evaluate spring wheat response to the herbicide pyroxasulfone (Zidua SC) when applied PRE (after planting), DPRE (after wheat germination, but before emergence), and EPOST (soon after wheat has emerged). Wheat 'Elgin' was planted on May 21, 2018 at 100 lb/A at a depth of 1.5 inches using a John Deere 1590 no-till drill. Starter fertilizer (18-46-0) was applied in furrow at planting at a rate of 40 lb/A. Prior to planting, urea fertilizer (46-0-0) was broadcast applied at a rate of 150 lb/A (69 lb nitrogen per acre). The field was treated with glyphosate (Cornerstone 5 Plus @ 32 oz/A plus AMS @ 17 lb/100 gal) prior to planting to control emerged annual weeds. Plots were maintained weed free for the entire growing season. Herbicide treatments were applied using a research plot sprayer at an application volume of 10 gallons per acre. PRE treatments were applied the day after wheat was planted. The DPRE treatments were applied on May 24, three days after planting when wheat coleoptiles were 0.5 inches in length and had not yet emerged. Wheat emerged on May 27. EPOST treatments were applied on June 4 to wheat in the 1-leaf growth stage. In between planting and wheat emergence, 0.19 inches of rainfall occurred. An additional 0.4 inches of rainfall occurred after crop emergence, but prior to the EPOST application. Wheat was evaluated for injury on June 21 and no injury was observed for any herbicide treatment regardless of application timing. Wheat height (the longest extended leaf) was measured on June 28 and no differences in wheat height were found regardless of herbicide treatment or treatment timing. Wheat was harvest on August 30. No differences in wheat yield were found regardless of herbicide treatment or treatment timing. The herbicide Zidua is currently registered for use at rates of 1.25 to 4 oz/A when applied DPRE or EPOST to spring wheat in North Dakota.

Table. Spring wheat response to pyroxasulfone (Zidua SC) applied preemergence, delayed preemergence, and early-postemergence at Hettinger, ND

	Rate		injury 31 DAP	height 37 DAP	Yield	Test
Treatment	—oz/A—	Timing	%	cm	bu/A	lb/bu
1Zidua SC	1.75	PRE	0	44	26.6	55
2Zidua SC	2.5	PRE	0	46	28.8	55
3Zidua SC	3.25	PRE	0	46	29.8	55
4Zidua SC	4.0	PRE	0	45	28.7	55
5Zidua SC	1.75	DPRE	0	46	28.8	55
6Zidua SC	2.5	DPRE	0	45	28.3	55
7Zidua SC	3.25	DPRE	0	46	25.2	54
8Zidua SC	4.0	DPRE	0	44	26.8	55
9Zidua SC	1.75	EPOST	0	45	26.2	54
10Zidua SC	2.5	EPOST	0	46	28.9	55
11Zidua SC	3.25	EPOST	0	44	25.2	55
12Zidua SC	4.0	EPOST	0	44	26.1	54
13Untreated			0	46	26.0	55
LSD P=.05			.	2.5	4.64	1.5
Treatment F			0.000	0.836	0.956	0.622
Treatment Prob(F)			1.0000	0.6144	0.5057	0.8092

Abbreviations: DAP, days after planting; PRE, preemergence treatments were applied on May 22 (the day after planting); DPRE, delayed preemergence treatments were applied on May 24 (3 days after planting),;EPOST, early-postemergence treatments were applied on June 4 (14 days after planting).

Nitrogen Relationships in Soybean in Southwest North Dakota

Best management practices are needed to achieve optimal crop yields. Soybean has the ability to form a symbiotic relationship with nitrogen (N)-fixing bacteria; however, it may be possible to increase yield through addition of synthetic N fertilizer, however addition of N reduces the plants need to form a relationship with N-fixing bacteria. It may be possible that with a dryer environment in southwest North Dakota that the N-fixing bacteria are less productive. The Dickinson Research Extension Center worked with the Hettinger Research Extension Center to observe the effects of different agronomic management strategies on soybean growth and yield. Objectives of the research were to evaluate yield and growth differences between five N management strategies applied to two soybean cultivars with different maturities grown at two populations. The research was conducted at two locations in 2017 and 2018, however only data from the Hettinger location was recorded due to herbicide damage in 2017 in Dickinson. In 2018 we dealt with early frost in the region. The Dickinson site was a little further behind the Hettinger site in maturity at first frost and there was frost damage during pod fill that caused issues with maturity. Due to this issue only data from Hettinger is included in 2018 as well.

In 2017 even with drought conditions throughout most of the season rainfall in August aligned with reproductive growth of soybeans allowing the plants to attain decent average yields considering the poor conditions during vegetative growth. Although there were no significant differences among N treatments alone, there were differences in yield with the interaction between populations of 80,000 and 160,000 plants per acre and the N treatments (Table 1), this interaction needs to be further investigated before making any conclusions. In 2017, no significant yield differences were found between populations, 80,000 plants/acre averaged 23.3 bu/ac while 160,000 plants/acre averaged 24.2 bu/ac. In 2018, 160,000 plants/ acre yielded significantly higher at 27.1 bu/ac compared to 25.4 bu/ac in 80,000 plants/acre however depending on seed input costs and soybean price this may not necessarily result in higher profits.

Table 1. 2017 and 2018 soybean yields in Hettinger, ND across plants per acre and nitrogen treatments. Soybeans were planted May 18th 2017 and May 24th 2018.

Nitrogen Management	Yield bu/acre			
	2017		2018	
	80,000	160,000	80,000	160,000
No inoculant/no N added	24.0ab	20.9b	25.0	27.1
No inoculant/30 lbs N added	21.3b	26.8a	24.7	25.5
Inoculant/no N added	23.4ab	24.5ab	24.9	28.4
Inoculant/30 lbs N added	24.4ab	24.5ab	26.6	26.9
Double inoculant	NA	NA	26.0	27.8
LSD (0.05)	3.9		ns	

A yield difference was found among the two maturities with the 0.3 maturity out yielding the 0.6 maturity (Table 2). This is consistent with the recommended maturity for the region.

Table 2. 2018 soybean yields in Hettinger, ND across maturities.

	Yield (bu/ac)
0.3	27.8a
0.6	24.8b
LSD (0.05)	1.4

Drought conditions in 2017 reduced yield capacity for soybeans. Under drought conditions a plant population half of the recommended seeding rate was able to yield just as well as the full rate. While it may be possible that with higher rainfall a larger yield is possible, more work should be conducted before changing recommendations. Under drought conditions with a reduced yield potential, it could be possible to reduce seed input costs without losing bushels and depending on the economic environment it may still be profitable to decrease plant population.

Hettinger Soybean Seeding Rate Study

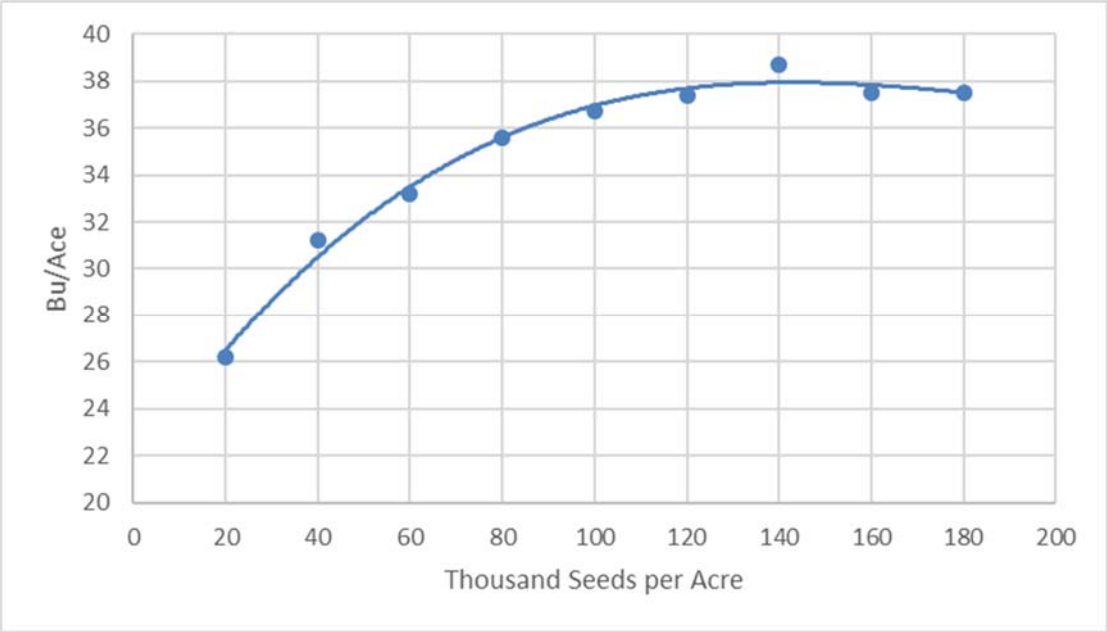
John Rickertsen & Michael Adsero, Hettinger Research Extension Center, 2018

Over the past decade soybean seeding rate recommendations in the corn-soybean belt have been reduced from 180,00 - 240,000 seeds per acre to 125,000 - 170,000. Much of this is due to increasing cost of soybean seed and soybeans tremendous ability to compensate for lower densities with increased branching and pod number. Yield per acre for soybeans remains relatively constant across population. This is because the number of seeds produced per plant is inversely related to the number of plants per acre. In general, numerous studies in the Midwest have shown 100,000 relatively uniformly spaced plants at harvest will produce the maximum economic return under most conditions. There have been many studies on soybean seeding rates in the Midwest, but there is little information on seeding rates for dryland soybeans in the semi-arid high plains.

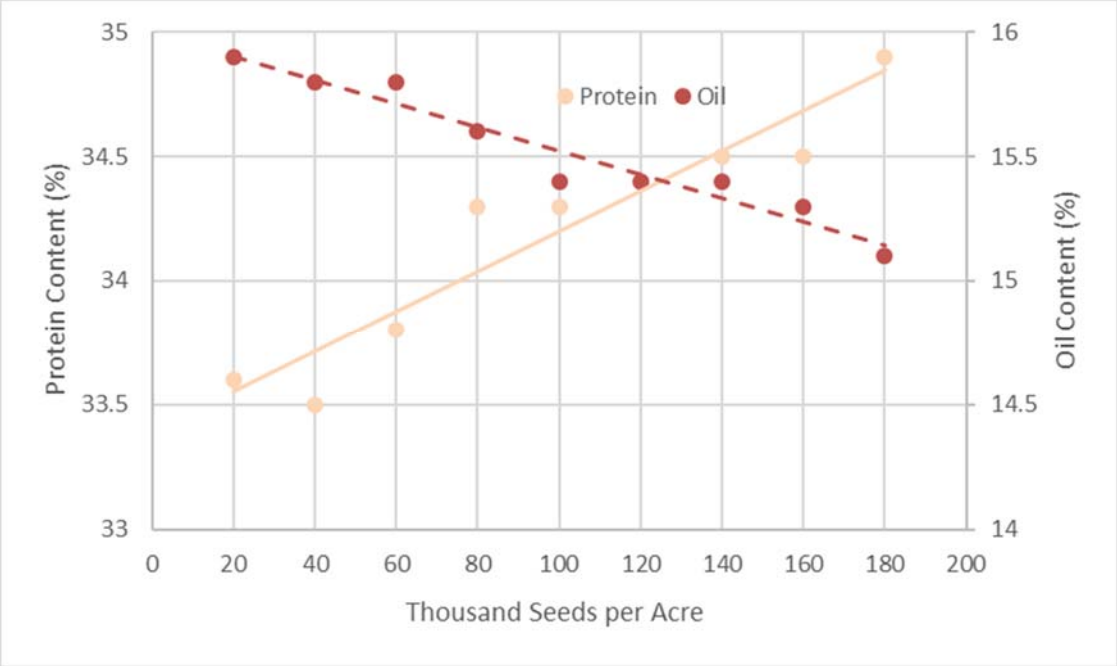
A study was initiated at Hettinger, ND in 2018 with nine seeding rates, 20,000 to 180,000 in 20,000 increments in both drilled (7”) and row (30”) configuration. The soybean variety Proseed 30-20 was no-till planted on May, 23 with a 7 row plot drill equipped with Acra Plant ADU double disk openers and a two row planter equipped with John Deere 1700 row units. Weed control was obtained by a pre-emergence herbicide application of BroadAxe and post-emergence application of glyphosate. The trial was harvested on October 16 with a Kincaid 8XP small plot combine. Data was recorded on flowering, height, maturity date, yield, test weight, seed size, seed protein and seed oil content.

The results in the following graphs and table show that seeding rates of 100,000 – 180,000 were not significantly different in yield and even the extremely low rate of 20,000 yielded 70% of the 100,000 - 180,000 seeding rates. For seed protein and oil content, as seeding rate increased, oil content decreased and protein increased. At the very lowest population, seed size increased and test weight decreased, but there was no significant difference in the 40,000 to 180,000 rates for seed size or test weight. Plant height was not significantly different among any of the treatments. Row spacing showed no difference in yield, test weight or height, but 7” rows had slightly smaller seed size and slightly lower oil content than 30” rows.

Soybean Seeding Rate Study Yields by Seeding Rate.



Soybean Seeding Rate Study Protein and Oil Content by Seeding Rate.

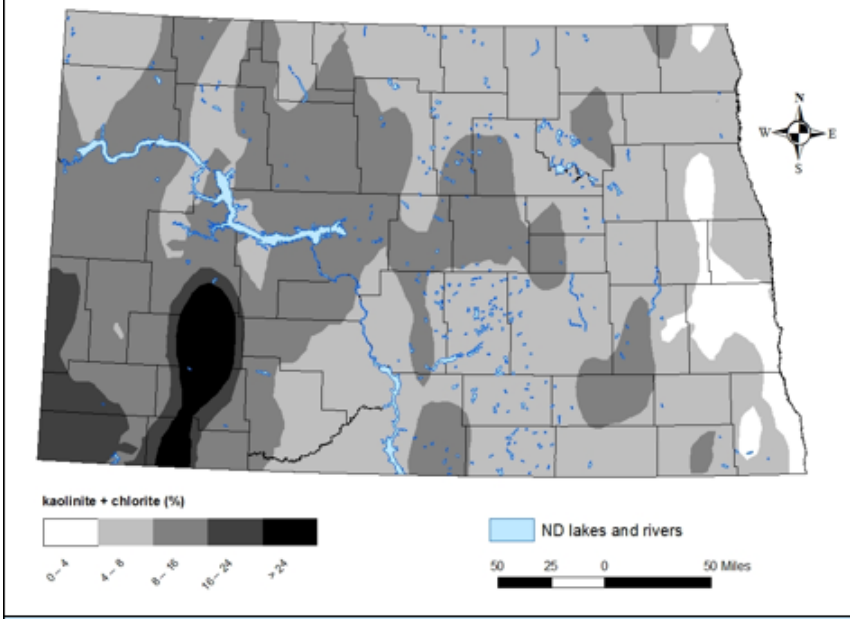


Soybean Seeding Rate Study - 2018 **Hettinger, ND**

Treatment	Mature Date	Plant Height	Seeds Lb	Test Weight	Seed Oil	Seed Protein	Grain Yield
		inches	seeds	lbs/bu	%	%	bu/ac
Row Spacing							
7" Rows	9/30	26	3727	54.4	15.4	34.2	34.6
30" Rows	9/30	25	3535	54.3	15.7	34.1	35.2
LSD 5%	NS	NS	53	NS	0.1	NS	NS
Population							
20,000	10/2	25	3497	53.4	15.9	33.6	26.2
40,000	10/1	25	3603	54.2	15.8	33.5	31.2
60,000	9/30	26	3607	54.1	15.8	33.8	33.2
80,000	9/30	26	3608	54.6	15.6	34.3	35.6
100,000	9/30	26	3757	54.4	15.4	34.3	36.7
120,000	9/30	25	3676	54.4	15.4	34.4	37.4
140,000	9/30	26	3685	54.7	15.4	34.5	38.7
160,000	9/30	26	3655	54.5	15.3	34.5	37.5
180,000	9/30	26	3589	54.6	15.1	34.9	37.5
LSD 5%	0.3	NS	112	0.4	0.3	0.5	3.7
Row Spacing X Population							
7" - 20,000	10/2	25	3470	53.1	15.6	33.6	25.3
7" - 40,000	10/2	26	3742	54.2	15.7	33.7	31.0
7" - 60,000	9/30	27	3743	54.2	15.7	33.8	32.2
7" - 80,000	9/30	27	3705	54.7	15.5	34.3	35.8
7" - 100,000	9/30	26	3919	54.6	15.1	34.5	37.9
7" - 120,000	9/30	25	3758	54.7	15.2	34.5	37.0
7" - 140,000	9/30	26	3751	55.0	15.2	34.5	38.9
7" - 160,000	9/30	26	3797	54.5	15.3	34.4	37.2
7" - 180,000	9/30	26	3656	54.8	14.9	35.0	36.0
30" - 20,000	10/2	25	3524	53.8	16.1	33.5	27.2
30" - 40,000	10/1	25	3463	54.3	15.9	33.4	31.3
30" - 60,000	9/30	25	3471	54.0	15.9	33.8	34.2
30" - 80,000	9/30	25	3511	54.5	15.7	34.3	35.5
30" - 100,000	9/30	26	3595	54.2	15.7	34.1	35.5
30" - 120,000	9/30	25	3594	54.2	15.6	34.2	37.8
30" - 140,000	9/30	26	3619	54.5	15.6	34.4	38.6
30" - 160,000	9/30	27	3512	54.5	15.4	34.6	37.9
30" - 180,000	9/30	26	3522	54.4	15.3	34.8	38.9
Trial Mean	9/30	26	3631	54.3	15.5	34.2	34.9
LSD 5%	0.3	NS	158	0.5	NS	NS	NS
C.V. %	0.1	4.9	3.1	0.7	1.8	1.3	10.6

Acidic soils in southwest, ND

Many soils in southwest North Dakota contain kaolinitic clays (Figure 1), which have a relatively low cation exchange capacity (CEC) of around 10 meq/100 g soil. This clay type in combination with no-till management and nitrogen fertilizers results in a decrease in soil pH.



Map of kaolinite + chlorite percentage of clay portion of soil for North Dakota. From 2017 soil sampling expedition to every North Dakota county (Franzen).

Figure 1 Source:"Growing Problem of Surface Acidity in Long-term No-till" Franzen 2018

To properly test for this issue it is important to soil sample for pH from 0-2” and 2-6”. If the soil pH is less than 5.5 this will impact the availability of certain nutrients along with bacterial activity. This may have implications for rhizobial inoculant for legume crops, how herbicides act on the soil surface, and will effect crop uptake to toxic levels of Aluminum and Manganese. Crop reaction to Aluminum and Manganese toxicity varies between crop species, and even within crop cultivars/varieties within each crop. Liming and variety selection are two potential management tools for dealing with this issue.

Work was conducted by Montana State University and Washington State University (Figure 2.) to find TaAl1, which is a gene for aluminum tolerance in spring wheat. Varieties Lanning and Alum were identified as having this gene and Soren was identified to not have this gene. A variety demonstration was conducted to observe how several varieties performed on low pH soils in southwest, ND to attempt to replicate some of the work conducted in Montana and Washington (Table 1.). Significant differences were found in yield and test weight among the crop varieties demonstrated. Next year our hope is to observe more varieties on low pH and neutral pH soils for comparison. More research is needed to identify all management options.

Table 1. Wheat variety assessment on acidic soil near Dickinson, ND. Soil test results showed pH of 5.7, 4.5, and 4.2 and 0-2", 2-6", and 6-12" respectively. Trial planted May 9th, 2018.

Variety	Yield	Test Weight	Aluminum	Manganese
	(bu/ac)		Tissue samples collected around early flag leaf	
Soren	39.9c	59.3a	91.7	283.5
Alum	49.4b	56.3b	72.4	209.5
Glenn	50.7b	57.0a	54.0	264.5
Bolles	50.8b	57.8ab	118.2	277.8
Lanning	58.7a	55.5b	88.7	255.8
LSD (0.05)	5.2	2.3	ns	ns

Aluminum Tolerance of Spring Wheat Varieties Based on Four Sets of Data

VARIETY	Highwood YIELD (2017) (BU/AC)	Highwood YIELD (2016) (BU/AC)	Marker (TaAl1*)	Washington
FORTUNA	29	29	Minus	Susceptible
REEDER	35	38	Plus	Tolerant
CHOTEAU	36	35	Plus	Susceptible
VIDA	33	34	Minus	Suscpetible
DUCLAIR	31	37	Plus	Tolerant
CORBIN	28	35	Minus	Susceptible
MCNEAL	37	30	Plus	Tolerant
WB9879CLP	34	36	Plus	Susceptible
WB GUNNISON	29	29	Minus	Susceptible
BRENNAN	27	28	Minus	Susceptible
SY SOREN	33	29	Minus	Susceptible
EGAN	36	42	Plus	Tolerant
LANNING	39	41	Plus	Tolerant
NS PRESSER CL+	33	26	?	Susceptible
ALUM	36	46	Plus	Tolerant

*TaAl1 is a gene for aluminum tolerance

Figure 2 Work conducted by Jason Cook, Mike Pumphrey, Luther Talbert and Pat Carr in Montana and Washington state

NOTES

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