

# Thirty-Sixth Annual Western Dakota Crops Day Research Report 2019



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NDSU

HETTINGER  
RESEARCH EXTENSION CENTER



# **36<sup>th</sup> Annual Western Dakota Crops Day**

## **December 19, 2019**

### **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.

- Herbicide and weed research.

Ryan Buetow, Extension Agronomist, NDSU Dickinson Research Extension Center.

- Dickinson REC agronomy update, acidic soil management.

Dr. Chris Graham, Extension Agronomist, SDSU West River Ag Center, Rapid City, SD.

- South Dakota agronomy research update.

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.

- Variety updates, hemp and soybean research.

**1:30 Conservation-Minded Solutions for Profit-Focused Operations.**

Emily Spolyar, Precision Ag & Conservation Specialist, Pheasants Forever.

**2:15 2019 Crop Disease Review of Southwest ND**

Dr. Andrew Friskop, Extension plant pathologist, NDSU Department of Plant Pathology.

**3:00 Conclusion**

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

**3:00 West River Breeders Annual Meeting**

# **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.

## **2019 Western Dakota Crops Day Sponsors**

Hettinger Area Chamber of Commerce  
AGT Foods  
Agripro/Syngenta  
Agtegra  
Cargill  
Central Life Science  
CHS  
Farm Credit Services of Mandan  
Helena Chemical Company  
North Dakota Grain Growers Association  
North Dakota Soybean Council  
Proseed  
Southwest Ag, Inc.  
Southwest Grain

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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Pat Doll, Hannover

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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 2019 Hettinger HRSW variety trial was 7.1% meaning that there was a 7.1 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 Faller averaged 71.8 bu/ac in 2019 compared to Mott at 62.8 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 9.0 bu/ac between the varieties (71.8 – 62.8) to the LSD 5% value of 6.6 bu/ac. Since the 9.0 bu/ac difference is more than the LSD value of 6.6 bu/a, the varieties do differ significantly in yield. If the difference between these two varieties would have been 5.0 bu/ac, their difference would have been less than 6.6 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

	28°F	32°F	50% Probability 32°F
Date of Last Frost	May 9	May 20	May 20
Date of First Frost	September 28	September 28	September 16
<b>Frost Free Days</b>	<b>142</b>	<b>131</b>	<b>119</b>

### Precipitation (inches)

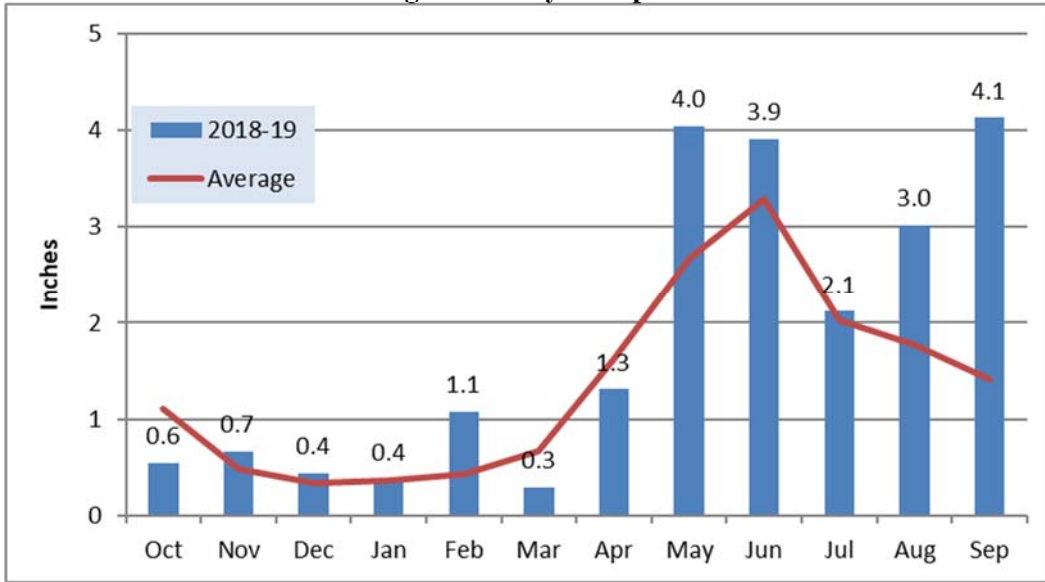
						64 Year
Month	2014-15	2015-16	2016-17	2017-18	2018-19	Average
October	0.1	2.0	0.9	0.0	0.6	1.1
November	1.0	0.0	0.4	0.2	0.7	0.5
December	0.0	0.5	0.1	0.2	0.4	0.3
January	0.1	0.2	0.6	0.3	0.4	0.4
February	0.0	0.4	0.2	0.6	1.1	0.4
March	0.2	0.2	0.9	0.3	0.3	0.7
April	1.0	3.7	1.2	1.6	1.3	1.6
May	4.0	1.0	0.6	1.7	4.0	2.7
June	5.2	0.9	0.3	3.7	3.9	3.3
July	1.0	1.5	1.7	2.7	2.1	2.0
August	1.9	1.7	1.8	0.9	3.0	1.8
September	0.9	2.3	1.9	1.7	4.1	1.4
<b>April-August</b>	<b>13.1</b>	<b>8.9</b>	<b>5.6</b>	<b>10.6</b>	<b>14.4</b>	<b>11.4</b>
<b>Total</b>	<b>15.4</b>	<b>14.4</b>	<b>10.6</b>	<b>13.9</b>	<b>21.9</b>	<b>16.2</b>

### Air Temperature (°F)

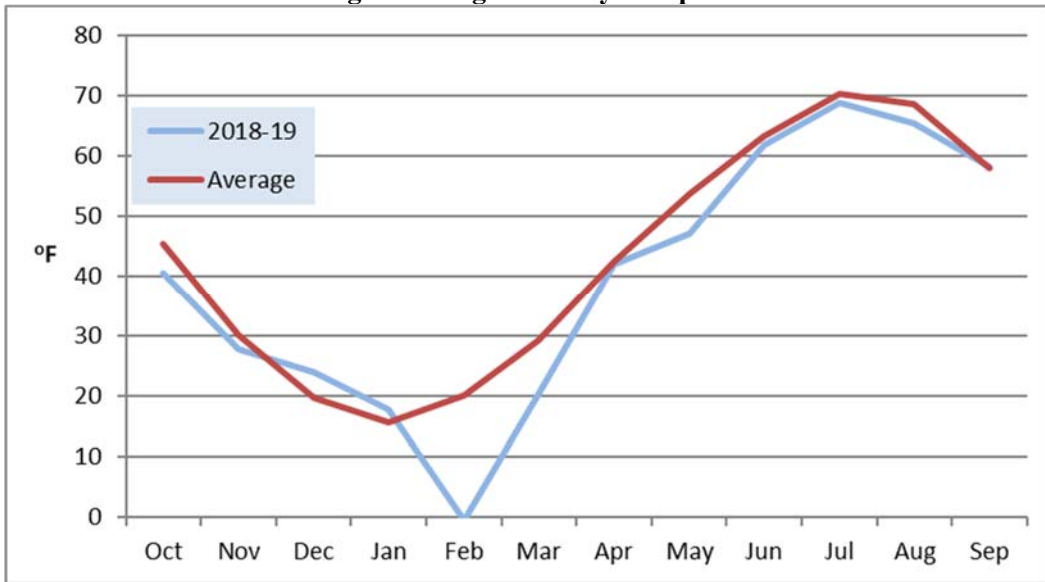
						64 Year
Month	2014-15	2015-16	2016-17	2017-18	2018-19	Average
October	46.6	48.5	48.1	44.9	40.5	45.5
November	21.3	32.4	39.5	32.4	27.7	30.1
December	23.4	23.9	10.1	19.0	24.0	19.6
January	21.6	20.1	11.8	17.1	17.8	15.6
February	19.1	32.0	24.6	6.0	-0.6	20.0
March	38.0	38.8	34.1	27.4	20.3	29.3
April	43.2	44.2	43.6	35.1	42.0	42.4
May	50.2	54.2	55.2	58.7	47.2	53.7
June	64.6	68.7	66.1	65.4	61.9	63.3
July	70.4	72.0	76.3	69.1	68.8	70.2
August	69.3	69.0	66.8	67.8	65.4	68.6
September	64.1	60.7	58.2	56.3	58.3	58.0
<b>Average</b>	<b>44.3</b>	<b>47.0</b>	<b>44.5</b>	<b>41.6</b>	<b>39.4</b>	<b>43.0</b>

Corn Growing Degree Days (GDD)						
Month	2015	2016	2017	2018	2019	47 Year Average
May	185	298	297	371	154	260
June	444	545	519	467	409	422
July	595	626	699	579	556	587
August	578	568	520	511	529	536
September	462	380	339	321	393	327
<b>Total</b>	<b>2264</b>	<b>2417</b>	<b>2374</b>	<b>2249</b>	<b>2041</b>	<b>2132</b>

**Hettinger Monthly Precipitation**



**Hettinger Average Monthly Temperature**





**2019 Weather Summary for the Dickinson Research Extension Center Ranch Headquarters, Manning, ND.**

Month	---Maximum temp.---°F		-----Minimum temp.-----°F		-----Precipitation ----- inches		-----Small grains GDD <sup>1</sup> -----		-----Corn GDD <sup>2</sup> -----	
	Long Term 1983 - 2019	Current Year	Long Term 1983 - 2019	Current Year	Long Term 1983 - 2019	Current year	Long Term 1983 - 2019	Current year	Long Term 1983 - 2019	Current year
November - 18	39.6	34.4	18.9	18.6	0.56	1.13				
December - 18	26.8	33.4	7.7	15.6	0.43	0.20				
January	24.9	24.8	5.7	6.3	0.41	0.23				
February	29.0	5.9	8.6	-11.5	0.44	1.12				
March	40.0	33.1	18.7	13.3	0.75	0.12				
April	54.4	54.0	29.2	31.4	1.43	1.35	333	378		
May	66.3	59.0	40.7	35.9	2.61	2.52	673	505	256	166
June	75.9	74.3	50.6	50.9	3.17	2.60	925	918	401	412
July	83.6	81.1	55.7	55.9	2.30	1.61	1169	1132	611	571
August	82.7	80.3	53.9	53.4	2.00	4.70	1127	1080	569	528
September	71.3	68.8	44.0	46.5	1.72	9.10	770	637	322	232
October	56.1	46.5	31.3	27.0	1.20	1.26				
Mean	54.2	49.6	30.4	28.6						
Total					17.04	25.94	4998	4649	2159	1908

<sup>1</sup> Small grains GDD, is growing degree days calculated with 95°F as the maximum temperature and 32°F as the base temperature.

<sup>2</sup> Corn GDD, is growing degree days calculated with 86°F as the maximum 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.

<b>Trial</b>	<b>Average Yield</b>
Hettinger Flax VT	Not harvested due to poor stands
Scranton Barley VT (Weigh System Problems)	51.4 bu/ac

North Dakota hard red spring wheat variety descriptions, agronomic traits, 2019.

Variety	Agent or Origin <sup>1</sup>	Year Released	Height (inches)	Reaction to Disease <sup>4</sup>							
				Straw Strength <sup>2</sup>	Days to Head <sup>3</sup>	Stem Rust <sup>5</sup>	Leaf Rust	Stripe Rust	Tan Spot	Bact. Leaf Streak	Head Scab
Ambush	DynaGro	2016	29	5	58	1	4	3	NA	6	5
Barlow	ND	2009	30	6	58	1	6	4	6	4	4
Bolles	MN	2015	29	4	62	2	3	5	4	7	5
Boost	SD	2016	30	5	62	1	4	3	8	2	5
<b>Commander</b>	<b>DynaGro</b>	<b>2019</b>	<b>28</b>	<b>6</b>	<b>59</b>	<b>NA</b>	<b>4</b>	<b>NA</b>	<b>NA</b>	<b>4</b>	<b>5</b>
CP3504	Croplan	2015	27	3	61	1	1	6	8	4	6
CP3530	Croplan	2015	31	5	61	1	2	8	6	5	5
CP3616	Croplan	2016	29	4	60	1	5	5	4	6	6
CP3888	Croplan	2017	28	4	60	NA	1	NA	NA	6	6
<b>CP3910</b>	<b>Croplan</b>	<b>2019</b>	<b>27</b>	<b>5</b>	<b>58</b>	<b>NA</b>	<b>1</b>	<b>NA</b>	<b>NA</b>	<b>8</b>	<b>6</b>
<b>CP3915</b>	<b>Croplan</b>	<b>2019</b>	<b>28</b>	<b>4</b>	<b>59</b>	<b>NA</b>	<b>1</b>	<b>NA</b>	<b>NA</b>	<b>4</b>	<b>5</b>
<b>CP3939</b>	<b>Croplan</b>	<b>2019</b>	<b>29</b>	<b>4</b>	<b>59</b>	<b>NA</b>	<b>3</b>	<b>NA</b>	<b>NA</b>	<b>6</b>	<b>6</b>
Elgin-ND	ND	2012	31	5	59	1	6	5	6	6	4
Faller	ND	2007	30	5	61	1	7	8	7	5	4
Glenn	ND	2005	30	4	58	1	6	4	6	4	4
Lang-MN	MN	2017	30	5	61	1	2	1	7	3	4
Lanning	MT	2017	26	3	60	NA	NA	NA	NA	8	6
LCS Breakaway	Limagrain	2011	26	5	58	1	3	6	4	6	6
LCS Cannon	Limagrain	2018	27	4	57	NA	7	NA	NA	7	6
LCS Rebel	Limagrain	2017	30	5	58	1	7	4	8	4	5
LCS Trigger	Limagrain	2016	29	5	64	1	1	2	6	3	4
Linkert	MN	2013	26	2	60	1	3	1	4	6	5
<b>MN-Washburn</b>	<b>MN</b>	<b>2019</b>	<b>27</b>	<b>3</b>	<b>60</b>	<b>NA</b>	<b>1</b>	<b>NA</b>	<b>NA</b>	<b>5</b>	<b>5</b>
Mott <sup>6</sup>	ND	2009	32	3	60	1	6	6	6	5	6
MS Barracuda	Meridian	2018	27	3	57	NA	2	NA	NA	7	6
MS Camaro	Meridian	2016	26	5	59	1	1	2	8	7	6
MS Chevelle	Meridian	2014	28	5	59	1	4	3	6	7	6
ND VitPro	ND	2016	29	3	59	1	4	3	7	3	4
Shelly	MN	2016	27	5	61	2	6	5	3	7	5
Surpass	SD	2016	28	5	58	1	4	6	8	4	5
<b>SY 611CL2</b>	<b>Syngenta/AgriPro</b>	<b>2019</b>	<b>27</b>	<b>5</b>	<b>59</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>6</b>	<b>5</b>
SY Ingmar	Syngenta/AgriPro	2014	28	3	60	1	3	6	6	5	5
<b>SY Longmire<sup>6</sup></b>	<b>Syngenta/AgriPro</b>	<b>2019</b>	<b>28</b>	<b>5</b>	<b>60</b>	<b>NA</b>	<b>7</b>	<b>NA</b>	<b>NA</b>	<b>6</b>	<b>7</b>
<b>SY McCloud</b>	<b>Syngenta/AgriPro</b>	<b>2019</b>	<b>28</b>	<b>4</b>	<b>58</b>	<b>NA</b>	<b>5</b>	<b>NA</b>	<b>NA</b>	<b>6</b>	<b>5</b>
SY Rockford	Syngenta/AgriPro	2017	30	3	61	NA	NA	NA	NA	8	6
SY Soren	Syngenta/AgriPro	2011	27	3	60	1	2	7	2	7	7
SY Valda	Syngenta/AgriPro	2015	27	4	60	1	2	7	6	6	5
TCG-Climax	21 <sup>st</sup> Century Genetics	2017	29	2	64	1	6	3	8	5	5
<b>TCG-Heartland</b>	<b>21st Century Genetics</b>	<b>2019</b>	<b>27</b>	<b>5</b>	<b>58</b>	<b>NA</b>	<b>2</b>	<b>NA</b>	<b>NA</b>	<b>7</b>	<b>6</b>
TCG-Spitfire	21 <sup>st</sup> Century Genetics	2015	29	4	62	1	5	4	8	4	6
<b>TCG-Stalwart<sup>6</sup></b>	<b>21st Century Genetics</b>	<b>2019</b>	<b>28</b>	<b>4</b>	<b>59</b>	<b>NA</b>	<b>8</b>	<b>NA</b>	<b>NA</b>	<b>9</b>	<b>7</b>

<sup>1</sup>Refers to agent or developer: 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.

<sup>2</sup>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.

<sup>3</sup>Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2019.

<sup>4</sup>Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.

<sup>5</sup>Fargo stem rust nursery inoculated with Puccinia graminis f. sp. Tritici races TPMK, TMLK, RTQQ, QFCQ and QTHJ.

<sup>6</sup>Solid stemmed or semisolid stem, imparting resistance to sawfly.

**Quality data from 2018 western locations.**

<b>Variety</b>	<b>Test Weight<sup>1</sup></b>	<b>Vitreous Kernels<sup>2</sup></b>	<b>1,000 KWT<sup>3</sup></b>	<b>Falling Number<sup>4</sup></b>	<b>Wheat Protein<sup>5</sup></b>	<b>Flour Extraction<sup>6</sup></b>	<b>Farinograph Absorption<sup>7</sup></b>	<b>Farinograph Stability<sup>8</sup></b>	<b>Loaf Volume<sup>9</sup></b>
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	64.2	97	36.8	398	14.8	68.1	64.1	10.0	1,005
Barlow	64.3	98	33.8	414	14.8	71.2	67.9	9.0	1,025
Bolles	63.0	97	36.5	431	16.6	68.0	67.5	17.3	1,095
Boost	62.5	97	36.4	414	15.0	68.7	67.1	7.7	1,021
CP3504	62.6	96	35.4	454	13.9	70.0	64.9	7.1	948
CP3530	62.0	95	34.5	445	14.3	68.2	65.4	8.2	996
CP3616	63.4	97	37.4	404	15.4	68.0	67.2	9.2	1,053
CP3888	63.0	94	36.2	450	14.8	68.9	65.6	8.4	1,016
Elgin-ND	62.9	97	33.3	377	14.7	69.1	67.5	6.6	1,013
Faller	64.0	99	38.7	397	14.2	71.2	66.8	6.6	1,021
Glenn	65.7	99	33.7	382	15.3	68.6	66.4	11.2	1,029
Lang-MN	64.4	98	33.6	386	15.2	68.4	66.5	7.5	968
Lanning	62.7	93	37.5	404	15.0	67.4	65.5	6.7	1,059
LCS Breakaway	64.5	96	37.0	414	15.6	69.3	66.0	7.1	966
LCS Cannon	64.7	94	33.0	373	14.2	70.2	65.0	9.9	953
LCS Rebel	64.5	98	36.7	405	14.7	70.7	66.0	10.5	1,006
LCS Trigger	62.1	99	31.2	454	13.0	69.6	65.8	7.5	816
Linkert	63.4	97	39.5	452	15.8	68.2	66.3	14.6	1,084
MN Washburn	63.1	98	32.8	405	14.3	71.6	62.2	11.8	953
MS Barracuda	63.4	97	38.1	451	15.6	69.4	66.2	8.5	1,026
MS Camaro	63.9	96	34.8	383	15.2	66.4	66.1	6.4	963
MS Chevelle	63.4	97	33.2	371	13.7	69.1	65.1	11.8	1,000
ND VitPro	65.1	99	35.8	409	15.0	69.0	66.1	7.9	990
Shelly	64.0	98	36.0	444	13.4	69.6	61.9	12.6	894
Surpass	62.8	98	31.3	381	14.9	68.0	62.1	8.5	1,008
SY Ingmar	64.1	97	33.5	414	14.1	71.5	63.8	10.0	989
SY Rockford	61.9	97	35.8	409	14.3	68.8	66.4	8.4	1,011
SY Soren	64.1	97	33.0	422	15.3	68.4	65.5	9.2	1,084
SY Valda	63.2	99	35.5	398	13.8	68.0	64.5	6.9	976
TCG-Climax	63.6	97	32.4	267	16.5	68.3	65.8	8.2	1,028
TCG-Spitfire	62.4	95	38.6	419	14.1	66.7	67.5	8.4	1,035

<sup>1</sup>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.

<sup>2</sup>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.

<sup>3</sup>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.

<sup>4</sup>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.

<sup>5</sup>Wheat Protein- measured by NIR at a 12 percent moisture basis. A high protein is desirable for baking quality.

<sup>6</sup>Flour Extraction- Percentage of milled flour recovered from cleaned and tempered wheat. A high flour extraction percentage is desirable.

<sup>7</sup>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.

<sup>8</sup>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.

<sup>9</sup>Loaf volume- The volume of the pup loaf of bread, expressed in cubic centimeters. A high volume is desirable.

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2019</b>	<b>Hettinger, ND</b>
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Variety	Days to	Plant	Plant	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Head	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	----- Bushels per acre -----				
AP Murdock	67	30	0	57.4	14.2	--	--	70.0	--	--
Barlow	66	35	0	58.8	15.1	40.1	40.0	66.3	53.2	48.8
Bolles	68	31	0	56.7	15.8	32.8	25.9	65.1	45.5	41.3
Boost	68	35	0	57.4	14.6	31.2	27.6	67.5	47.6	42.1
CP3504	68	31	0	56.3	13.3	32.7	38.1	70.0	54.1	46.9
CP3530	67	33	0	56.9	14.5	35.9	37.7	66.9	52.3	46.8
CP3616	67	32	0	56.7	15.0	38.7	36.7	62.8	49.8	46.1
CP3888	67	32	0	56.8	14.5	--	36.0	70.6	53.3	--
CP3910	65	30	0	59.0	14.6	--	--	68.4	--	--
CP3915	67	32	0	58.1	15.2	--	--	65.8	--	--
CP3939	67	32	0	56.7	15.6	--	--	65.0	--	--
Dyna-Gro Ambush	66	31	0	58.2	15.4	36.3	39.6	61.6	50.6	45.8
Dyna-Gro Ballistic	67	27	0	56.8	15.1	--	--	57.4	--	--
Dyna-Gro Commander	66	31	0	58.0	14.7	--	--	69.0	--	--
Elgin ND	67	37	0	56.9	15.2	38.4	43.8	68.2	56.0	50.1
Faller	67	35	0	56.9	14.3	41.5	38.2	71.8	55.0	50.5
Glenn	65	34	0	57.3	15.4	32.1	38.9	57.6	48.3	42.9
Lang MN	68	32	0	58.1	14.6	36.3	38.4	68.7	53.6	47.8
Lanning	66	31	0	56.7	16.0	--	45.7	64.5	55.1	--
LCS Breakaway	66	30	0	58.6	15.7	34.8	30.0	67.5	48.8	44.1
LCS Cannon	65	29	0	59.2	15.1	--	36.9	63.5	50.2	--
LCS Rebel	66	33	0	58.0	15.2	36.8	40.0	63.7	51.9	46.8
LCS Trigger	70	32	0	57.9	12.5	44.5	50.3	70.0	60.2	54.9
Linkert	67	29	0	58.3	16.7	34.0	30.3	57.0	43.7	40.4
MN Washburn	67	29	0	57.2	14.5	--	30.1	64.7	47.4	--
Mott	68	38	0	57.2	15.1	36.6	31.5	62.8	47.2	43.6
MS Barracuda	65	30	0	57.7	15.2	--	35.0	66.9	51.0	--
MS Camaro	67	29	0	58.4	15.1	31.4	24.1	63.7	43.9	39.7
MS Chevelle	67	30	0	57.6	13.7	37.5	42.5	71.8	57.2	50.6
ND VitPro	66	31	0	57.3	16.0	31.9	37.9	61.5	49.7	43.8
Prestige	67	31	0	56.3	15.0	32.6	40.1	59.7	49.9	44.1
Redstone	71	33	0	57.2	13.7	38.3	33.7	69.2	51.5	47.1
Shelly	69	30	0	57.0	14.3	43.9	38.2	68.3	53.3	50.1
Surpass	65	31	0	57.0	14.4	36.7	29.1	67.4	48.3	44.4
SY 611 CL2	67	30	0	59.0	13.9	--	33.4	73.8	53.6	--
SY Ingmar	67	31	0	58.8	15.4	39.9	29.0	62.7	45.9	43.9

*Table continued on next page*



NDSU Hettinger Research Extension Center

**Hard Red Spring Wheat - 2019** **Hettinger, ND**

Variety	Days to	Plant	Plant	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Head	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	----- Bushels per acre -----				
<i>Table continues from previous page</i>										
SY Longmire	67	30	0	58.2	14.4	--	35.0	69.0	52.0	--
SY McCloud	66	31	0	58.2	15.7	--	31.7	62.8	47.3	--
SY Rockford	68	32	0	57.3	14.2	39.3	38.8	70.9	54.9	49.7
SY Soren	67	29	0	58.6	15.3	36.5	31.5	67.9	49.7	45.3
SY Valda	67	29	0	57.4	13.9	35.1	36.7	68.7	52.7	46.8
TCG Climax	72	33	0	58.5	15.6	34.5	37.9	57.0	47.5	43.1
TCG Heartland	66	30	0	58.1	15.6	--	--	65.5	--	--
TCG Spitfire	69	33	0	56.5	14.1	37.6	38.9	69.4	54.2	48.6
TCG Stalwart	66	32	0	56.0	15.4	--	--	59.8	--	--
Trial Mean	67	32	0	57.7	14.9	35.8	35.5	66.0	50.9	46.1
C.V. %	0.7	4.4	--	1.2	3.6	11.4	12.2	7.1	--	--
LSD 5%	0.6	1.9	--	1.0	0.7	5.7	6.1	6.6	--	--
LSD 10%	0.5	1.6	--	0.8	0.6	4.8	5.1	5.5	--	--

<sup>1</sup> Days to Head = the number of days from planting to head emergence from the boot.

<sup>2</sup> 0 = no lodging, 9 = 100% lodged.

Planting Date: April 24

Harvest Date: August 20

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2019</b>	<b>Scranton, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
Barlow	31	0	55.7	14.9	15.2	33.0	28.3	30.7	25.5
Bolles	31	0	53.8	16.8	12.5	34.4	18.9	26.7	21.9
CP3504	28	0	54.2	14.3	--	--	34.9	--	--
CP3530	32	0	54.6	14.9	14.8	37.0	26.5	31.8	26.1
CP3616	29	0	53.5	15.7	--	35.4	26.0	30.7	--
DynaGro Ambush	30	0	56.0	14.6	--	36.3	26.7	31.5	--
Elgin-ND	33	0	52.6	15.1	16.4	44.0	30.2	37.1	30.2
Glenn	31	0	52.1	14.8	16.1	33.7	21.2	27.5	23.7
Lang-MN	32	0	56.1	15.2	16.4	44.0	29.5	36.8	30.0
Lanning	30	0	51.2	15.8	--	--	25.0	--	--
LCS Cannon	28	0	56.7	13.8	--	--	27.8	--	--
LCS Rebel	32	0	56.7	14.6	--	33.9	25.8	29.9	--
LCS Trigger	32	0	53.7	13.1	13.8	57.0	39.1	48.1	36.6
MN Washburn	29	0	54.0	14.1	--	--	29.0	--	--
Mott	34	0	52.9	15.5	15.4	37.2	25.6	31.4	26.1
MS Chevelle	29	0	53.7	13.6	13.5	37.1	26.7	31.9	25.8
ND VitPro	29	0	54.1	15.3	13.7	35.4	24.1	29.8	24.4
Shelly	28	0	53.5	14.2	18.9	44.2	26.0	35.1	29.7
SY Ingmar	27	0	54.8	14.9	14.1	37.0	28.0	32.5	26.4
SY Longmire	28	0	53.1	14.7	--	--	35.7	--	--
SY Rockford	30	0	53.7	14.9	--	41.1	29.5	35.3	--
SY Soren	27	0	51.9	15.1	18.1	37.2	28.0	32.6	27.8
SY Valda	28	0	56.7	14.6	13.8	35.5	30.7	33.1	26.7
TCG Climax	30	0	56.7	16.4	--	45.1	32.5	38.8	--
TCG Spitfire	30	0	54.4	14.2	17.8	46.7	36.0	41.4	33.5
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Trial Mean	30	0	54.3	14.9	15.6	39.9	28.1	33.2	27.2
C.V. %	4.9	--	3.4	3.2	16.5	5.3	16.8	--	--
LSD 5%	2.0	NS	2.6	0.7	3.6	3.0	6.6	--	--
LSD 10%	1.7	NS	2.2	0.6	3.0	2.5	5.6	--	--

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

Planting Date: May 15

Harvest Date: September 4

Scranton suffered from hail damage in 2019.

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2019</b>	<b>Regent, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
Barlow	31	0	55.3	14.6	17.7	45.1	40.9	43.0	34.6
Bolles	28	0	55.2	16.3	15.5	45.2	41.5	43.4	34.1
CP3504	27	0	55.0	14.1	--	--	44.3	--	--
CP3530	32	0	54.6	14.5	14.5	49.9	39.7	44.8	34.7
CP3616	28	0	55.3	15.1	--	--	42.9	--	--
DynaGro Ambush	28	4	56.3	14.4	--	45.4	41.5	43.5	--
Elgin-ND	32	0	55.2	14.7	18.8	48.6	48.7	48.7	38.7
Glenn	30	0	54.0	14.7	17.2	46.3	39.0	42.7	34.2
Lang-MN	31	0	56.8	14.7	19.4	53.4	47.7	50.6	40.2
Lanning	29	0	52.5	15.0	--	--	46.0	--	--
LCS Cannon	26	0	55.5	13.8	--	--	37.5	--	--
LCS Rebel	30	0	56.3	14.7	--	48.8	42.7	45.8	--
LCS Trigger	29	0	56.7	12.4	20.7	52.9	58.8	55.9	44.1
MN Washburn	26	0	55.0	13.7	--	--	44.6	--	--
Mott	33	0	55.6	14.6	16.7	46.8	49.4	48.1	37.6
MS Chevelle	28	0	55.0	13.4	21.3	46.3	37.6	42.0	35.1
ND VitPro	29	0	53.3	14.6	16.9	48.3	38.0	43.2	34.4
Shelly	26	0	55.6	13.2	18.9	51.6	44.3	48.0	38.3
SY Ingmar	26	0	56.9	14.8	19.8	44.3	42.3	43.3	35.5
SY Longmire	27	0	54.6	14.2	--	--	49.6	--	--
SY Rockford	29	0	53.8	14.6	--	51.3	44.0	47.7	--
SY Soren	27	0	56.5	14.9	15.4	47.3	44.1	45.7	35.6
SY Valda	27	0	54.7	14.5	18.7	51.4	43.7	47.6	37.9
TCG Climax	28	0	56.9	15.9	--	44.8	47.3	46.1	--
TCG Spitfire	28	0	54.7	13.9	16.7	48.9	51.9	50.4	39.2
<b>Trial Mean</b>	<b>29</b>	<b>0</b>	<b>55.3</b>	<b>14.5</b>	<b>17.7</b>	<b>48.1</b>	<b>44.2</b>	<b>46.3</b>	<b>36.9</b>
C.V. %	4.8	69.2	1.6	1.9	13.5	6.3	6.9	--	--
LSD 5%	2.0	0.1	1.2	0.4	3.4	4.3	4.3	--	--
LSD 10%	1.7	0.1	1.0	0.3	2.8	3.6	3.6	--	--

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

Planting Date: May 15

Harvest Date: September 4

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2019</b>	<b>Mandan, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
AP Murdock	26	0	56.6	11.2	--	--	40.6	--	--
Barlow	31	0	57.0	12.5	16.0	46.2	34.4	40.3	32.2
Bolles	29	0	56.3	12.8	7.5	48.6	35.6	42.1	30.6
Boost	31	0	56.9	12.3	16.0	50.5	34.8	42.7	33.8
CP3504	27	0	56.4	11.3	--	46.2	43.7	45.0	--
CP3530	33	0	56.7	12.3	18.3	48.2	38.8	43.5	35.1
CP3616	28	0	55.4	13.3	--	46.5	36.8	41.7	--
CP3888	28	0	55.9	12.3	--	51.5	40.0	45.8	--
CP3910	25	0	55.9	12.7	--	--	33.6	--	--
CP3915	28	0	55.4	12.2	--	--	36.2	--	--
CP3939	28	0	54.8	13.0	--	--	34.0	--	--
DynaGro Ambush	27	0	57.3	12.4	--	50.5	36.2	43.4	--
DynaGro Ballistic	24	0	54.8	14.2	--	--	31.9	--	--
DynaGro Commander	29	0	55.7	12.9	--	--	35.0	--	--
Elgin-ND	31	0	56.4	12.4	17.4	48.9	38.7	43.8	35.0
Faller	31	0	56.1	11.5	--	45.6	42.1	43.9	--
Glenn	32	0	56.3	12.3	11.1	56.0	34.8	45.4	34.0
Lang-MN	32	0	56.8	13.1	21.1	51.3	40.0	45.7	37.5
Lanning	28	0	54.1	13.0	--	46.3	36.7	41.5	--
LCS Breakaway	27	0	56.5	12.6	--	49.6	34.1	41.9	--
LCS Cannon	27	0	56.8	11.7	--	50.0	37.1	43.6	--
LCS Rebel	31	0	56.5	13.1	--	52.0	36.8	44.4	--
LCS Trigger	29	0	57.5	10.5	28.7	43.5	41.7	42.6	38.0
Linkert	26	0	56.5	13.8	--	45.9	35.5	40.7	--
MN Washburn	28	0	54.5	12.5	--	52.4	35.4	43.9	--
Mott	33	0	56.8	12.4	18.2	45.1	40.0	42.6	34.4
MS Barracuda	26	0	55.8	12.0	--	50.2	34.7	42.5	--
MS Camaro	26	0	55.9	13.5	--	51.6	31.9	41.8	--
MS Chevelle	28	0	55.7	11.6	22.6	49.8	36.3	43.1	36.2
ND VitPro	28	0	54.4	13.0	16.2	47.1	36.9	42.0	33.4
Prestige	28	0	56.3	12.4	--	46.5	25.7	36.1	--
Redstone	29	0	57.2	10.6	22.3	44.7	34.4	39.6	33.8
Shelly	28	0	55.4	11.9	15.0	51.8	37.2	44.5	34.7
Surpass	31	0	56.4	11.2	17.4	51.4	41.9	46.7	36.9
SY 611 CL2	28	0	57.4	11.7	--	45.3	40.7	43.0	--
SY Ingmar	27	0	56.2	13.3	20.5	55.4	33.0	44.2	36.3

*Table continued on next page*

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2019</b>	<b>Mandan, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2017	2018	2019	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
<i>Table continues from previous page</i>									
SY Longmire	28	0	54.4	12.8	--	52.6	32.6	42.6	--
SY McCloud	29	0	56.8	13.2	--	45.8	32.5	39.2	--
SY Rockford	29	0	55.3	12.3	--	46.0	38.2	42.1	--
SY Soren	26	0	55.5	13.0	18.3	48.0	30.4	39.2	32.2
SY Valda	26	0	57.1	11.8	19.1	46.0	41.5	43.8	35.5
TCG Climax	27	0	59.2	13.1	--	54.8	36.2	45.5	--
TCG Heartland	26	0	54.9	13.1	--	--	30.9	--	--
TCG Sptifire	28	0	55.1	11.8	23.2	49.2	38.5	43.9	37.0
TCG Stalwart	27	0	51.1	14.0	--	--	26.6	--	--
Trial Mean	29	0	56.2	12.5	18.5	49.3	36.1	43.2	34.5
C.V. %	4.9	--	1.7	4.0	15.7	12.2	7.6	--	--
LSD 5%	2.0	--	1.3	0.7	4.1	8.4	3.8	--	--
LSD 10%	1.7	--	1.1	0.6	3.4	7.0	3.2	--	--

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

Planting Date: May 16

Harvest Date: September 5



NDSU Dickinson Research Extension Center

**2019 Hard Red Spring Wheat - Recrop** **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height in	Test Weight lbs/bu	Protein %	----- Grain Yield-----			----- Average Yield-----	
						2017	2018	2019	2	3
						-----bu/ac-----			-----bu/ac-----	
Barlow	63	14,270	33	61.1	16.6	38.1	60.2	45.2	52.7	47.8
Bolles	65	14,096	32	59.6	18.7	34.4	65.0	38.4	51.7	45.9
Boost	66	14,469	32	59.4	16.4	34.7	57.5	47.7	52.6	46.6
DynaGro Ambush	63	13,139	31	61.3	17.5	34.1	61.6	46.5	54.0	47.4
Dyna-gro Commander	64	13,331	31	60.6	16.6	--	--	47.2	--	--
Elgin-ND	64	14,587	33	59.5	16.1	36.2	60.1	47.3	53.7	47.9
Faller	65	13,915	32	59.4	15.6	34.5	72.1	51.2	61.6	52.6
Glenn	63	14,218	34	62.1	16.9	34.9	63.5	44.8	54.2	47.7
CP3504	65	15,063	28	59.3	15.9	34.8	70.3	53.9	62.1	53.0
CP3530	65	13,618	35	59.6	15.7	33.1	63.1	52.0	57.6	49.4
CP3616	65	13,218	31	59.6	17.0	32.7	69.1	50.6	59.9	50.8
CP3888	65	13,722	30	59.4	16.4	--	65.5	47.1	56.3	--
CP3910	62	14,684	29	61.5	16.3	--	--	51.0	--	--
CP3915	64	15,231	31	61.5	17.0	--	--	51.5	--	--
CP3939	63	14,283	31	60.6	16.8	--	--	51.8	--	--
LCS Breakaway	63	13,700	30	61.6	16.8	32.7	49.6	41.0	45.3	41.1
LCS Cannon	62	13,258	30	61.6	16.5	--	56.6	47.3	52.0	--
LCS Rebel	63	12,677	32	61.0	16.8	33.3	60.4	48.9	54.7	47.5
LCS Trigger	67	15,662	30	59.6	14.3	34.0	76.0	47.1	61.6	52.4
Lang-MN	65	15,670	30	60.9	16.7	35.7	61.3	51.2	56.2	49.4
Lanning	63	12,944	30	60.2	17.5	--	69.5	49.2	59.3	--
Linkert	65	13,062	29	60.0	17.1	32.8	58.8	47.1	53.0	46.3
MN Washburn	65	15,633	29	59.4	16.1	--	64.8	48.6	56.7	--
MS Barracuda	62	12,281	29	60.1	17.1	--	51.1	36.8	43.9	--
MS Camaro	64	14,929	28	60.3	17.0	33.5	54.0	48.2	51.1	45.2
MS Chevelle	63	14,404	30	60.3	15.7	35.3	67.3	54.8	61.0	52.5
Mott	65	15,099	33	60.3	17.0	29.8	60.1	42.7	51.4	44.2
ND-VitPro	63	14,145	32	61.9	17.3	28.8	59.6	44.7	52.2	44.4
Sy Ingmar	65	15,084	31	61.4	17.1	37.0	61.8	46.8	54.3	48.5
SY Longmire	65	13,971	31	60.9	16.7	--	61.5	49.8	55.6	--

*Table continued on next page*

NDSU Dickinson Research Extension Center

**2019 Hard Red Spring Wheat - Recrop** **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height in	Test Weight lbs/bu	Protein %	----- Grain Yield-----			----- Average Yield-----	
						2017	2018	2019	2	3
						-----bu/ac-----			-----bu/ac-----	
<i>Table continues from previous page</i>										
SY McCloud	64	12,691	31	61.1	17.3	--	60.5	46.2	53.3	--
SY Rockford	65	13,631	31	59.1	16.2	38.6	64.9	54.0	59.4	52.5
Sy Soren	65	14,297	29	61.1	17.7	32.4	61.9	48.6	55.3	47.6
Sy Valda	65	14,024	29	60.6	16.0	38.7	62.9	47.0	54.9	49.5
SY611CL2	65	14,545	29	61.0	16.8	--	--	49.8	--	--
Shelly	65	14,350	29	60.0	16.0	39.3	70.4	48.1	59.2	52.6
Surpass	62	16,525	31	60.0	16.7	35.6	65.1	45.8	55.4	48.8
TCG-Climax	69	15,915	31	60.4	17.6	33.9	62.3	39.6	50.9	45.3
TCG-Heartland	63	14,646	29	60.9	16.7	--	--	43.9	--	--
TCG Spitfire	66	13,966	31	59.5	15.8	35.0	66.1	52.6	59.4	51.3
TCG-Stalwart	65	13,317	31	59.1	17.2	--	--	48.2	--	--
Trial Mean	64	14,174	31	60.5	16.7	34.4	63.1	47.6	--	--
CV %	0.7	4.7	4.3	0.6	1.9	11.2	8.5	8.1	--	--
LSD 0.05	1	937	2	0.5	0.5	5.4	7.5	5.4	--	--
LSD 0.10	1	785	2	0.5	0.4	4.5	6.2	4.5	--	--

Planting Date: April 23, 2019  
 Harvest Date: August 19, 2019  
 Previous Crop: Cover Crop  
 Seeding Rate: 1.2 million live seeds/ac

**2019 North Dakota hard red winter wheat variety description and agronomic traits.**

Variety	Agent or Origin <sup>2</sup>	Year	Reaction to Disease <sup>1</sup>					Days to Heading <sup>3</sup>	Straw Strength <sup>4</sup>	Height <sup>5</sup> (inches)	Winter <sup>6</sup> Hardiness
			Stripe Rust	Leaf Rust	Stem Rust	Scab	Tan Spot				
Emerson	A.Can.	2011	1	6	1	3	5	1	2	32	3
Ideal	SD	2011	4	1	3	8	4	-1	4	28	5
Jerry	ND	2001	8	3	1	8	8	0	5	34	3
Keldin	WB	2011	2	3	3	5	3	0	3	29	3
Loma	MT	2016	1	NA	1	8	NA	3	4	26	3
Northern	MT	2015	1	8	1	8	6	2	4	29	6
Oahe	SD	2016	2	3	6	NA	NA	-2	5	29	3
Peregrine	CDC	2008	1	3	1	6	6	1	5	34	2
SY Monument	Agripro	2014	3	3	NA	6	NA	-2	3	27	4
SY Sunrise	Agripro	2015	3	NA	NA	6	NA	-2	3	23	5
SY Wolf	Agripro	2010	3	3	1	6	1	-2	3	27	6
<b>SY Wolverine</b>	<b>Agripro</b>	<b>2019</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>-5</b>	<b>3</b>	<b>25</b>	<b>NA</b>
<b>TCG-Boomlock</b>	<b>TCG</b>	<b>2019</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>-1</b>	<b>5</b>	<b>29</b>	<b>NA</b>
Thompson	SD	2017	5	3	3	3	NA	-1	3	30	NA
WB4462	WB	2016	7	3	NA	8	6	-5	4	28	3
<b>WB4595</b>	<b>WB</b>	<b>2019</b>	<b>4</b>	<b>4</b>	<b>NA</b>	<b>6</b>	<b>6</b>	<b>-1</b>	<b>3</b>	<b>28</b>	<b>3</b>

<sup>1</sup>Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.

<sup>2</sup>A.Can. = Agriculture and Agri-Food Canada; CDC = Crop Development Centre, University of Saskatchewan; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University; TCG = Twenty-first Century Genetics; WB = WestBred.

<sup>3</sup>Days to heading relative to Jerry.

<sup>4</sup>Straw strength: 1 = strongest, 9 = weakest. Based on field observations in 2018 only.

<sup>5</sup>Based on the average of several environments, and should be used for comparing varieties. The environment can impact the height of varieties.

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

Bold varieties are those recently released, so data are limited and rating values may change.

Analytical milling and baking characteristics of selected varieties evaluated at Agronomy Seed Farm, Casselton, in 2018.

Variety	Kernel			Flour					Farinograph			Loaf				
	Test Weight (lb/bu)	1,000 Kernel Weight (gram)	Whole Wheat Protein 12 MB (%)	Falling Number (seconds)	Flour Protein 14 MB (%)	Flour Ash 14 MB (%)	Milling Extraction (%)	Wet Gluten (%)	Gluten Index	Abs (%)	Peak Time (min)	Stability (min)	Mixing Tolerance Index (BU)	Loaf Volume (cc)	Crumb Structure (1-10) <sup>1</sup>	Crumb Color (1-10) <sup>1</sup>
AAC Gateway	58.7	28.2	13.6	426	12.6	0.52	67.6	33.9	98	54.9	7.3	13.4	26	1,030	7	7
AAC Goldrush	57.9	24.5	13.8	363	12.6	0.49	68.9	31.2	98	54.7	4.4	12.7	21	1,070	7	7
AAC Wildfire	55.7	23.1	14.0	429	12.9	0.54	65.3	33.5	98	57.5	7.0	11.9	24	1,035	7	6
Accipiter	58.8	25.2	13.0	449	11.7	0.51	78.5	28.8	100	54.5	6.5	15.5	23	1,040	7	7
Broadview	57.7	26.4	12.8	451	11.7	0.53	69.1	32.1	91	56.1	4.8	5.7	46	950	7	5
CDC Chase	60.2	29.1	13.3	465	12.2	0.47	71.5	31.5	98	55.3	7.5	15.7	24	1,025	7	7
Decade	56.7	25.9	13.8	447	11.8	0.99	68.3	27.9	100	53.2	5.0	20.7	18	975	6	0
Emerson	59.1	24.8	14.0	387	12.8	0.49	70.5	30.6	100	53.6	6.7	22.9	13	1,145	7	7
Ideal	58.4	27.7	13.2	456	12.0	0.53	70.1	28.2	100	54.4	4.5	38.3	13	995	7	6
Jerry	57.0	28.1	13.1	396	12.0	0.48	68.9	31.7	97	55.5	5.7	10.8	23	1,040	7	7
Keldin	58.2	29.2	13.7	432	12.6	0.54	67.9	29.5	99	56.8	5.7	14.7	21	1,070	7	8
Loma	51.9	18.5	15.3	372	13.9	0.55	64.9	35.1	98	57.9	8.4	19.7	18	1,070	8	7
Lyman	58.9	32.2	13.8	447	12.2	0.60	70.0	33.0	75	55.9	7.0	16.2	22	1,010	6	7
Moats	58.4	26.7	13.4	471	12.3	0.51	70.6	30.3	98	55.7	6.3	15.0	19	1,050	7	7
Northern	57.4	25.6	13.2	425	12.2	0.54	70.2	29.9	98	59.2	6.3	10.8	20	1,000	7	7
Oahe	58.6	29.7	13.1	484	12.0	0.50	71.0	34.5	75	58.8	4.2	4.3	53	910	7	7
Overland	59.2	36.1	13.7	408	12.2	0.49	69.8	41.2	70	56.4	5.2	5.7	47	1,015	7	7
Peregrine	58.7	27.0	12.8	442	11.8	0.50	71.5	30.3	96	55.6	5.2	9.9	29	865	6	7
Redfield	58.8	27.1	13.6	432	12.5	0.51	70.4	30.9	98	55.4	6.7	12.4	29	1,130	7	8
SY Monument	56.8	27.8	13.6	451	12.3	0.51	67.6	28.4	100	56.0	3.4	12.9	24	790	5	5
SY Sunrise	58.0	27.8	12.7	437	11.6	0.51	66.7	28.4	99	56.4	4.4	13.3	24	955	7	7
SY Wolf	57.3	24.4	15.1	415	13.1	0.51	66.8	35.3	83	57.1	8.0	11.7	23	975	7	6
Thompson	58.8	24.2	13.1	390	12.0	0.48	69.0	33.4	90	55.5	5.4	7.8	36	950	6	6
WB Matlock	59.2	27.6	14.3	438	13.0	0.53	69.9	36.7	91	57.8	5.5	10.4	28	1,015	7	8
WB4462	58.3	34.1	13.3	460	12.4	0.47	71.1	31.6	97	55.7	6.0	13.6	19	970	6	7
MEAN	57.9	27.2	13.6	431	12.3	0.53	69.4	31.9	94	56.0	5.9	13.8	26	1,003	7	7

<sup>1</sup>Scale 1-10, with 1 being low and 10 being superior.

**NDSU Hettinger Research Extension Center**

<b>Hard Red Winter Wheat - 2019</b>	<b>Hettinger, ND</b>
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Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield			Average Yield	
	Julian	inches	0-9 <sup>1</sup>	lbs/bu	%	2017	2018	2019	2 yr	3 yr
	----- Bushels per acre -----									
AC Emerson	177	33	0	61.4	12.4	70.6	30.6	60.9	45.8	54.0
Decade-Fhb1	172	29	0	59.5	12.1	76.2	19.5	65.4	42.5	53.7
Ideal	175	29	0	58.8	11.6	88.2	26.6	66.0	46.3	60.3
Jerry	175	36	0	59.9	12.3	76.1	29.7	64.8	47.3	56.9
Keldin	176	31	0	59.9	11.7	101.2	37.2	70.6	53.9	69.7
Loma	179	27	0	59.2	12.4	71.5	36.5	58.4	47.5	55.5
Northern	176	31	0	60.2	12.2	78.9	33.7	74.5	54.1	62.4
Oahe	173	33	0	61.2	12.1	83.1	28.2	69.5	48.9	60.3
Overland-Fhb1	173	29	0	57.4	11.9	90.9	26.9	53.3	40.1	57.0
Peregrine	177	37	0	61.0	11.0	81.1	38.0	66.0	52.0	61.7
SY Monument	173	29	0	58.3	11.4	99.6	27.6	71.6	49.6	66.3
SY Sunrise	172	24	0	60.4	12.0	85.6	20.4	64.5	42.5	56.8
SY Wolf	174	28	0	59.6	13.2	93.9	24.3	63.8	44.1	60.7
SY Wolverine	171	25	0	58.5	12.9	--	--	62.1	--	--
TCG-Boomlock	174	32	0	61.4	12.3	--	--	65.3	--	--
Thompson	174	32	0	58.6	12.1	--	33.0	64.9	49.0	--
WB4462	170	30	0	60.6	11.6	--	20.1	69.4	44.8	--
WB4595	174	29	0	63.1	11.9	--	--	71.2	--	--
<b>Trial Mean</b>	174	30	0.0	59.9	12.2	82.2	30.3	65.4	47.2	59.6
C.V. %	0.6	3.9	--	2.0	5.2	9.4	18.3	6.0	--	--
LSD 0.05	1.5	1.7	NS	1.7	0.9	10.8	7.8	5.6	--	--
LSD 0.10	1.2	1.4	NS	1.4	0.7	9.1	6.5	4.7	--	--

<sup>1</sup> 0 = no lodging, 9 = 100% lodged.

Previous Crop: Oats

Planting Date: September 28

Harvest Date: August 6



**NDSU Dickinson Research Extension Center**

**2019 Winter Wheat - Recrop**

**Dickinson, ND**

Variety	Winter Survival	Heading Date from 1/1	Seeds per Pound	Plant Height in	Test Weight lbs/bu	Protein %	----- Grain Yield-----			Average Yield	
							2017	2018	2019	Year 2 bu/ac	Year 3 bu/ac
AC Emerson	100	171	17,563	31	58.5	14.8	52.5	83.1	45.2	64.1	60.2
Decade-Fhb1	100	168	16,431	27	56.6	13.6	--	--	51.8	--	--
Ideal	100	171	16,982	27	58.1	12.8	52.1	90.6	49.6	70.1	64.1
Jerry	100	172	15,134	35	57.5	13.8	58.4	84.6	46.7	65.7	63.2
Keldin	100	171	13,762	29	57.0	13.0	59.9	99.0	53.9	76.5	70.9
Loma	100	173	17,172	27	54.4	14.4	45.2	80.2	46.7	63.5	57.4
Northern	100	173	15,839	30	57.5	13.3	51.5	85.2	54.0	69.6	63.6
Oahe	100	168	14,147	30	57.5	13.0	54.5	74.7	54.6	64.6	61.3
Overland-FHB1	100	167	16,312	30	57.1	13.3	55.8	71.0	48.6	59.8	58.5
Peregrine	100	171	17,750	34	57.0	12.7	58.6	90.6	51.3	71.0	66.8
SY Monument	100	169	16,306	28	54.5	12.8	62.0	76.2	54.9	65.6	64.4
SY Sunrise	100	167	17,035	22	54.9	13.2	60.2	64.1	49.3	56.7	57.9
SY Wolf	100	168	15,473	27	58.3	13.4	57.9	80.5	60.4	70.5	66.3
TCG-Boomlock	100	170	16,520	29	58.3	13.5	--	--	53.2	--	--
Thompson	100	169	16,557	31	58.5	13.3	--	84.4	53.2	68.8	--
WB4462	100	166	14,942	30	55.6	12.8	56.2	68.7	55.2	61.9	60.0
WB4595	100	168	16,140	27	60.6	12.1	--	--	60.0	--	--
Trial Mean	100	169	15,938	29	57.2	13.2	55.2	83.3	53.0	--	--
CV %	0	0.5	5.2	6.3	1.0	3.0	9.0	8.8	8.5	--	--
LSD 0.05	0	1	1,167	3	0.8	0.7	7.0	10.3	6.4	--	--
LSD 0.10	0	1	975	2	0.7	0.5	5.9	8.6	5.3	--	--

Planting Date: September 17, 2018

Harvest Date: August 6, 2019

Previous Crop: Cover Crop

Seeding Rate: 1 million live seeds/ac

**NDSU Hettinger Research Extension Center**

<b>Winter Rye - 2019</b>	<b>Hettinger, ND</b>
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Variety	Spring Stand	Heading Date	Plant Height	Plant Lodge	Test Weight	----- Grain Yield -----			----- Average Yield -----	
	%		inches	0-9 <sup>1</sup>	lbs/bu	2017	2018	2019	2 yr	3 yr
						----- Bushels per acre -----				
Aroostok	90	6/11	54	5	52.1	53.2	27.6	54.1	40.9	45.0
Bono (hybrid)	90	6/13	39	0	55.5	--	--	98.2	--	--
Brasetto (hybrid)	90	6/13	40	0	53.1	97.8	58.6	89.9	74.3	82.1
Dacold	48	6/14	51	2	47.9	76.6	37.6	43.8	40.7	52.7
ND Dylan	90	6/12	51	7	53.6	74.5	21.6	69.5	45.6	55.2
ND Gardner	90	6/11	51	5	52.9	61.1	28.6	61.7	45.2	50.5
Hancock	68	6/13	53	3	51.0	66.1	29.7	47.0	38.4	47.6
Hazlet	90	6/12	51	2	53.3	84.9	40.2	68.6	54.4	64.6
Rymin	90	6/12	51	4	52.5	85.4	39.6	65.0	52.3	63.3
Spooner	90	6/11	49	4	53.1	61.4	32.6	63.2	47.9	52.4
Wheeler	90	6/12	55	0	52.0	50.8	25.6	27.9	26.8	34.8
<b>Trial Mean</b>	84	6/12	50	3	52.4	70.0	34.2	62.6	46.6	54.8
C.V. %	2.6	0.1	5.9	32.7	2.3	6.7	15.3	6.9	--	--
LSD 0.05	3.1	1.8	4.2	1.3	1.7	6.8	7.6	6.2	--	--
LSD 0.10	2.6	1.5	3.5	1.1	1.4	5.6	6.3	5.2	--	--

<sup>1</sup> 0 = no lodging, 9 = 100% lodged.

Planting Date: September 28

Harvest Date: August 6

**Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2019.**

	Agent or Origin <sup>1</sup>	Year Released	Height (inches) <sup>2</sup>	Straw Strength <sup>3</sup>	Days to Heading <sup>4</sup>	Reaction to Disease <sup>5</sup>				
						Stem Rust	Leaf Rust	Foliar Disease	Bact. Leaf Streak	Head Scab
AC Commander	Can.	2002	31	5	60	1	1	6	NA	NA
Alkabo	ND	2005	33	2	61	1	1	5	7	6
Alzada	WB	2004	28	6	59	1	1	8	NA	9
Ben	ND	1996	35	3	60	1	1	4	7	8
Carpio	ND	2012	34	5	63	1	1	5	6	5
CDC Verona	Can.	2010	32	4	61	1	1	4	NA	8
Divide Grenora	ND	2005	35	5	62	1	1	5	7	5
Joppa Lebsock	ND	2005	32	5	60	1	1	5	7	6
Maier Mountrail	ND	2013	33	5	61	1	1	5	7	5
ND Grano <sup>7</sup> ND	ND	1999	33	3	60	1	1	5	7	6
Riveland <sup>7</sup> Pierce	ND	1998	32	5	61	1	1	5	NA	8
Rugby	ND	1998	34	5	62	1	1	5	7	8
Strongfield <sup>7</sup>	ND	2017	34	5	63	1	1	NA	7	6
Tioga	ND	2017	34	4	61	1	1	NA	7	5
VT Peak	ND	2001	32	5	61	1	1	6	7	8
	ND	1973	36	5	60	1	1	4	NA	8
	Can.	2004	34	6	62	1	1	6	NA	8
	ND	2010	29	4	61	1	1	5	7	6
	Viterra	2010	25	6	61	NA	NA	NA	NA	NA

<sup>1</sup>Refers to agent or developer: Can. = Agriculture Canada, WB = Westbred, ND = North Dakota State University.

<sup>2</sup>Plant height was obtained from the average of six variety trials in 2018.

<sup>3</sup>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.

<sup>4</sup>Days to Heading = the number of days from planting to head emergence from the boot. Averaged from several locations in 2018.

<sup>5</sup>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.

<sup>7</sup>Low cadmium accumulating variety.

**Durum wheat variety quality descriptions, milling and processing data averaged for five years (2014-2018) from drill strips (32 locations/year).**

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein <sup>1</sup>	Gluten Index <sup>2</sup>	Pasta Color <sup>3</sup>	Spaghetti Firmness	Overall Quality <sup>4</sup>
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
Alkabo	61.4	80	56	400	13.6	44	8.7	3.8	good
Alzada <sup>5</sup>	59.6	87	66	475	14.1	84	8.3	4.2	good
Carpio	61.4	77	63	456	13.6	91	8.6	4.0	good
Divide	61.0	84	56	447	13.8	71	8.4	3.9	good
Joppa	61.3	83	48	428	13.3	81	8.8	3.9	good
Maier	60.8	87	53	413	14.3	52	8.4	4.1	good
Mountrail	60.7	87	48	435	13.8	20	8.1	3.7	fair
ND Grano <sup>6</sup>	61.6	83	50	461	13.8	64	8.9	4.0	good
ND Riveland <sup>6</sup>	61.3	88	60	442	13.8	79	8.7	4.0	good
Strongfield	60.6	85	57	436	14.3	63	8.2	4.0	good
Tioga	60.9	83	61	401	13.7	73	8.4	4.0	good
Average	61.0	84	56	436	13.8	66	8.5	4.0	

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

**Durum wheat variety quality descriptions, milling and processing data for 2018 at all locations in the drill strips.**

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein <sup>1</sup>	Gluten Index <sup>2</sup>	Pasta Color <sup>3</sup>	Spaghetti Firmness	Overall Quality <sup>4</sup>
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
Alkabo	62.1	87	67	478	14.1	22	7.9	4.0	good
Alzada <sup>5</sup>	60.5	90	72	519	15.1	64	7.3	4.5	good
Carpio	62.4	83	74	532	14.2	79	7.6	4.1	good
Divide	61.9	87	68	540	14.5	50	7.5	3.8	good
Joppa	62.3	90	63	514	13.9	62	8.0	3.8	good
Maier	61.4	93	59	521	15.2	32	7.7	4.1	good
Mountrail	61.6	90	60	494	14.6	11	7.2	3.8	fair
ND Grano <sup>6</sup>	62.6	88	66	533	14.3	43	8.2	3.9	good
ND Riveland <sup>6</sup>	62.1	93	71	503	14.1	57	7.9	4.0	good
Strongfield	62.0	88	69	528	15.1	46	7.3	4.2	good
Tioga	62.0	89	72	498	14.3	48	7.5	4.1	good
Average	61.9	89	67	515	14.5	47	7.6	4.0	

<sup>1</sup>Wheat protein is reported on a 12 percent moisture basis.

<sup>2</sup>Gluten index is unitless. Numbers less than 15 = very weak and greater than 80 = very strong gluten proteins.

<sup>3</sup>Pasta Color Score: Higher number indicates better color, with 8.5+ typically considered good.

<sup>4</sup>Overall Quality is determined based on agronomic, milling and spaghetti processing performance.

<sup>5</sup>Alzada has good quality when grown in environments where it is adapted. Low test weight can affect quality in some environments.

<sup>6</sup>Low cadmium accumulating variety.

**NDSU Hettinger Research Extension Center**

<b>Durum Wheat - 2019</b>	<b>Hettinger, ND</b>
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Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield -----			Average Yield	
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	2017	2018	2019	2 yr	3 yr
						----- Bushels per acre -----				
AC Commander	69	30	4	56.8	14.4	38.0	37.3	57.5	47.4	44.3
Alkabo	69	35	2	57.6	13.5	32.6	38.1	73.6	55.9	48.1
Alzada	67	29	6	54.9	14.4	34.0	35.6	48.2	41.9	39.3
Ben	68	36	3	58.0	14.5	35.1	31.9	60.3	46.1	42.4
Carpio	70	36	3	57.5	13.6	36.5	41.9	63.7	52.8	47.4
CDC Verona	69	36	1	57.4	14.6	36.0	36.2	67.7	52.0	46.6
Divide	69	35	3	58.4	13.8	33.5	34.1	70.8	52.5	46.1
Grenora	68	33	2	56.9	14.2	33.3	38.3	67.9	53.1	46.5
Joppa	69	35	3	58.3	12.9	35.7	34.6	66.2	50.4	45.5
Lebsock	68	33	3	58.1	13.4	37.8	33.2	64.8	49.0	45.3
Maier	68	36	2	57.2	14.8	33.5	35.9	62.7	49.3	44.0
Mountrail	68	35	4	57.9	13.2	38.9	37.7	66.9	52.3	47.8
ND Grano	69	36	3	56.9	13.5	35.7	34.6	68.5	51.6	46.3
ND Riveland	69	36	1	58.2	13.4	37.3	36.3	73.0	54.7	48.9
Pierce	68	36	3	59.2	13.8	34.7	32.2	69.6	50.9	45.5
Rugby	67	37	3	57.7	14.1	34.1	31.5	59.8	45.7	41.8
Strongfield	70	36	3	56.9	14.5	38.9	38.8	67.0	52.9	48.2
Tioga	69	36	3	58.0	13.6	33.8	32.1	64.5	48.3	43.5
VT Peak	68	35	2	59.2	14.1	37.2	39.5	72.4	56.0	49.7
Trial Mean	69	36	3	57.8	13.9	36.1	36.7	67.6	51.5	46.1
C.V. %	0.7	4.2	33.9	1.3	4.2	9.7	8.1	7.6	--	--
LSD 5%	0.7	2.1	1.3	1.1	0.8	4.9	4.1	7.2	--	--
LSD 10%	0.6	1.8	1.1	0.9	0.7	4.1	3.5	6.1	--	--

<sup>1</sup> Days to Head = the number of days from planting to head emergence from the boot.

<sup>2</sup> 0 = no lodging, 9 = 100% lodged.

Planting Date: April 24

Harvest Date: August 26



**NDSU Hettinger Research Extension Center**

<b>Durum Wheat - 2019</b>	<b>Scranton, ND</b>
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Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield -----			Average Yield		
	inches	0-9*	lbs/bu	%	2017	2018	2019	2 yr	3 yr	
					----- Bushels per acre -----					
Alkabo	31	0	50.2	12.7	20.2	33.6	23.6	28.6	25.8	
Carpio	32	0	52.6	13.5	21.6	36.4	23.3	29.9	27.1	
Joppa	31	0	53.4	12.8	24.9	34.9	24.9	29.9	28.2	
ND Grano	29	0	52.2	13.3	23.7	32.1	22.0	27.1	25.9	
ND Riveland	32	0	53.0	13.3	18.8	36.4	21.6	29.0	25.6	
Tioga	32	0	52.1	14.1	19.9	34.0	26.3	30.2	26.7	
Trial Mean	31	0	52.2	13.3	21.3	34.6	23.6	29.1	26.6	
C.V. %	3.2	--	2.3	2.5	12.3	7.7	14.4	--	--	
LSD 5%	1.5	NS	1.8	0.5	3.9	4.0	5.1	--	--	
LSD 10%	1.3	NS	1.5	0.4	3.2	3.3	4.2	--	--	

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

Planting Date: May 15

Harvest Date: September 4

Scranton suffered from hail damage in 2019.

<b>Durum Wheat - 2019</b>	<b>Regent, ND</b>
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Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield -----			Average Yield		
	inches	0-9*	lbs/bu	%	2017	2018	2019	2 yr	3 yr	
					----- Bushels per acre -----					
Alkabo	32	0	52.5	13.8	9.8	52.4	43.8	48.1	35.3	
Carpio	33	0	52.2	13.6	12.3	49.3	46.5	47.9	36.0	
Joppa	32	0	51.3	13.6	12.9	53.8	38.1	46.0	34.9	
ND Grano	30	0	52.8	14.1	14.0	50.2	44.1	47.2	36.1	
ND Riveland	32	0	52.9	13.6	14.2	52.0	40.9	46.5	35.7	
Tioga	34	0	52.6	14.0	13.1	52.3	45.2	48.8	36.9	
Trial Mean	32	0	52.4	13.8	13.3	51.7	43.1	47.4	35.8	
C.V. %	4.8	--	2.1	2.1	16.5	5.4	8.0	--	--	
LSD 5%	2.3	NS	1.6	0.4	3.2	4.2	5.2	--	--	
LSD 10%	1.9	NS	1.4	0.4	2.7	3.4	4.3	--	--	

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

Planting Date: May 15

Harvest Date: September 4

NDSU Dickinson Research Extension Center

**2019 Durum - Recrop** **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	----- Grain Yield-----			Average Yield	
						2017	2018	2019	2	3
			in	lbs/bu	%	-----bu/ac-----			----bu/ac----	
AC Commander	68	11,008	34	60.5	15.6	31.1	48.1	53.6	50.9	44.3
Alkabo	68	11,506	36	60.6	15.2	32.0	63.2	46.8	55.0	47.3
Alzada	67	10,740	31	59.9	15.5	35.0	38.4	50.2	44.3	41.2
Ben	68	11,413	39	60.6	15.4	33.0	56.5	52.7	54.6	47.4
CDC Verona	69	11,864	37	60.0	16.3	29.8	64.1	49.7	56.9	47.9
Carpio	70	10,759	36	60.1	15.8	33.2	57.9	47.0	52.5	46.0
Divide	69	11,174	37	60.6	15.2	33.2	62.4	49.7	56.1	48.4
Grenora	68	11,794	35	59.8	14.9	35.2	55.9	51.5	53.7	47.5
Joppa	69	11,911	37	60.4	14.5	34.0	65.8	51.0	58.4	50.3
Lebsock	68	11,336	37	61.0	15.1	31.8	59.1	53.9	56.5	48.3
Maier	68	11,988	35	60.4	15.8	32.4	57.5	47.7	52.6	45.9
Mountrail	69	11,219	37	60.3	15.9	35.9	64.8	52.1	58.4	50.9
ND Grano	70	12,405	35	60.8	15.1	32.9	64.5	53.9	59.2	50.4
ND Riveland	68	11,315	37	60.6	15.7	32.4	60.1	45.8	53.0	46.1
Pierce	68	11,952	36	61.3	15.1	32.5	56.8	47.2	52.0	45.5
Rugby	68	11,625	40	60.4	16.0	31.8	63.2	44.5	53.9	46.5
Strongfield	69	12,144	37	59.8	16.8	33.8	60.3	49.8	55.0	48.0
Tioga	69	12,041	40	60.4	15.1	32.8	63.3	52.1	57.7	49.4
VT Peak	68	11,551	37	61.0	15.4	30.0	60.3	50.5	55.4	46.9
Trial Mean	69	11,486	37	60.5	15.5	31.9	61.6	51.1	--	--
CV %	0.9	5.9	5.7	0.9	2.6	9.9	9.0	9.3	--	--
LSD 0.05	1	943	3	0.8	0.6	4.4	7.8	6.6	--	--
LSD 0.10	1	790	2	0.6	0.5	3.7	6.5	5.6	--	--

Planting Date: April 24, 2019  
 Harvest Date: August 20, 2019  
 Previous Crop: Cover Crop  
 Seeding Rate: 1.2 million live seeds/ac

**2019 North Dakota barley variety descriptions.**

Variety	Use <sup>1</sup>	Origin <sup>2</sup>	Year Released	Rachilla			Height (inch)	Days to Head	Straw Strength <sup>5</sup>	Reaction to Disease <sup>6</sup>			
				Awn Type <sup>3</sup>	Hair Length <sup>4</sup>	Aleurone Color				Stem Rust	Spot-form Net Blotch	Spot Blotch	Net Blotch
<b>Six-rowed</b>													
Lacey	M/F	MN	2000	S	S	White	30	58	4	8	4	3	7
Tradition	M/F	BARI	2003	S	L	White	30	58	3	8	6	3	7
<b>Two-rowed</b>													
AAC Connect	M/F	Canterra	2017	R	L	White	27	62	3	4	5	4	5
AAC Synergy	M/F	Syngenta	2015	R	L	White	27	63	5	4	3	4	4
ABI Balster	M/F	BARI	2015	R	L	White	27	64	6	NA	4	8	NA
Conlon <sup>7</sup>	M/F	ND	1996	S	L	White	27	57	7	8	4	6	3
Explorer	M	Secobra	NA	R	L	White	25	61	4	NA	NA	8	4
ND Genesis	M/F	ND	2015	S	L	White	29	61	5	8	4	4	6
Pinnacle	M/F	ND	2006	S	L	White	29	60	6	8	8	4	6

<sup>1</sup>M = malting; MT = being tested in plant-scale tests for malting and brewing quality; F = feed.

<sup>2</sup>BARI = Busch Agricultural Resources Inc.; MN = University of Minnesota; ND = North Dakota State University.

<sup>3</sup>R = rough; S = smooth.

<sup>4</sup>S = short; L = long.

<sup>5</sup>Lodging scores from 1-9, with 1 = strong, 9 = very weak.

<sup>6</sup>Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA – not available.

<sup>7</sup>Lower DON accumulations than other varieties tested.

**Yield and test weight of barley varieties at three locations in eastern North Dakota, 2017-2019.**

Variety	<u>Fargo</u>			<u>Carrington</u>			<u>Langdon</u>			<u>Avg. eastern N.D.</u>		
	Test	Yield		Test	Yield		Test	Yield		Test	Yield	
	Wt.	2019	3 Yr.	Wt.	2019	3 Yr.	Wt.	2019	3 Yr.	Wt.	2019	3 Yr.
	(lb/bu)	-----(bu/a)-----		(lb/bu)	-----(bu/a)-----		(lb/bu)	-----(bu/a)-----		(lb/bu)	-----(bu/a)-----	
<b>Six-rowed</b>												
Lacey	49.9	66.4	92.0	43.4	76.5	95.0	48.9	124.3	130.5	47.4	89.1	105.8
Tradition	49.4	81.0	105.7	42.1	82.3	96.2	48.3	121.0	124.9	46.6	94.8	108.9
<b>Two-rowed</b>												
AAC Connect	49.1	74.4	--	43.4	64.6	--	49.7	120.1	--	47.4	86.4	--
AAC Synergy	50.2	74.6	102.8	43.1	60.0	96.9	50.1	122.5	133.4	47.8	85.7	111.0
ABI Balster	51.8	64.2	95.5	41.5	55.5	90.2	49.5	123.9	127.9	47.6	81.2	104.5
Conlon	51.9	63.5	86.4	44.3	50.2	80.0	51.0	109.8	99.5	49.1	74.5	88.6
Explorer	48.8	53.6	88.0	39.5	48.9	85.5	49.1	122.7	126.1	45.8	75.1	99.9
ND Genesis	50.8	79.6	104.1	41.4	50.9	81.3	48.7	123.2	130.6	47.0	84.6	105.3
Pinnacle	49.0	65.5	90.2	39.4	49.6	78.2	50.6	127.3	130.0	46.3	80.8	99.5
Mean	49.7	71.5	96.0	42.3	61.5	87.9	49.4	122.9	125.4	47.1	85.3	103.1
CV %	--	10.5	--	2.1	14.0	--	0.7	3.4	--	1.9	7.8	5.2
LSD 0.05	--	11.8	--	1.3	12.2	--	0.5	5.9	--	1.3	9.6	7.9
LSD 0.10	--	9.9	--	1.1	10.2	--	0.4	4.9	--	0.8	5.9	4.9

**Plump and protein of barley varieties at three locations in eastern North Dakota, 2019.**

Variety	<u>Fargo</u>		<u>Carrington</u>		<u>Langdon</u>		<u>Avg. eastern N.D.</u>	
	Plump	Protein	Plump	Protein	Plump	Protein	Plump	Protein
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>Six-rowed</b>								
Lacey	86.9	13.7	83.4	12.1	95.0	12.7	88.4	12.8
Tradition	81.2	13.5	79.2	10.9	92.0	12.8	84.1	12.4
<b>Two-rowed</b>								
AAC Connect	78.8	11.8	80.4	10.8	97.0	13.1	85.4	11.9
AAC Synergy	89.2	11.9	90.9	10.1	97.0	12.4	92.4	11.5
ABI Balster	88.8	12.3	81.0	11.5	94.0	12.2	87.9	12.0
Conlon	95.1	13.5	83.3	11.0	98.0	13.0	92.1	12.5
Explorer	86.3	11.6	75.4	11.0	96.0	12.4	85.9	11.7
ND Genesis	94.0	10.9	78.3	11.1	97.0	11.3	89.8	11.1
Pinnacle	87.3	11.6	72.4	10.7	99.0	12.1	86.2	11.5
Mean	88.9	12.1	83.1	10.7	96.5	12.1	89.5	11.6
CV %	--	--	6.1	7.0	1.3	3.5	3.8	4.0
LSD 0.05	--	--	7.1	1.0	1.8	0.6	5.0	0.7
LSD 0.10	--	--	6.0	0.9	1.5	0.5	3.1	0.4

**NDSU Hettinger Research Extension Center**

**Barley - 2019** **Hettinger, ND**

Variety	Days to	Plant	Plant		Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Head	Height	Lodge	Plump	Weight	Protein	2017	2018	2019	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	%	lbs/bu	%	----- Bushels per acre -----				
<b>TWO ROW</b>											
AAC Connect	67	34	4.5	92	46.7	12.5	--	--	109.8	--	--
AAC Synergy	68	36	3	94	47.2	13.0	41.8	88.6	117.4	103.0	82.6
ABI Balster	69	33	4	90	46.8	13.2	53.0	85.1	113.3	99.2	83.8
Conlon	64	36	6	97	48.1	13.0	24.2	75.5	89.0	82.3	62.9
Explorer	67	30	7	91	46.1	13.1	57.8	95.5	90.1	92.8	81.1
ND Genesis	66	39	3	94	48.2	11.9	40.0	90.3	124.7	107.5	85.0
Pinnacle	67	36	7	93	46.4	12.1	49.4	90.4	80.9	85.7	73.6
<b>SIX ROW</b>											
Lacey	65	37	5	95	47.6	13.8	49.9	70.3	101.7	86.0	74.0
Tradition	66	38	5	94	45.7	13.4	46.3	76.4	113.2	94.8	78.6
Trial Mean	66	35	4	94	46.9	12.6	45.4	82.9	107.6	96.7	80.0
C.V. %	0.9	3.8	24.6	3.1	2.3	4.3	15.0	5.7	4.4	--	--
LSD 5%	0.8	1.9	1.5	3.0	1.4	0.8	9.6	6.7	6.7	--	--
LSD 10%	0.7	1.6	1.3	2.5	1.2	0.6	8.0	5.6	5.6	--	--

<sup>1</sup> Days to Head = the number of days from planting to head emergence from the boot.

<sup>2</sup> 0 = no lodging, 9 = 100% lodged.

Planting Date: April 25

Harvest Date: August 21

**NDSU Hettinger Research Extension Center**

<b>Barley - 2019</b>	<b>Regent, ND</b>
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Variety	Plant	Plant	Test	Grain	Grain	Grain Yield			Average Yield	
	Height	Lodge				Plump	Weight	Protein	2017	2018
	inches	0-9*	%	lbs/bu	%	----- Bushels per acre -----				
<b>TWO ROW</b>										
ND Genesis	30	0	85	43.8	12.7	19.3	87.0	76.3	81.7	60.9
ABI Balster	27	0	81	44.2	14.7	--	--	78.5	--	--
Explorer	23	0	71	41.9	14.7	--	--	70.9	--	--
Pinnacle	28	0	75	42.2	14.1	19.1	82.5	70.7	76.6	57.4
<b>SIX ROW</b>										
Tradition	27	0	81	44.1	14.0	21.1	85.4	67.6	76.5	58.0
Trial Mean	27	0	79	43.2	14.1	19.3	83.7	72.8	26.3	50.1
C.V. %	6.4	--	5.1	2.4	3.7	27.4	6.7	7.8	--	--
LSD 5%	2.7	NS	2.2	1.6	0.8	8.1	8.6	8.8	--	--
LSD 10%	2.2	NS	1.8	1.3	0.7	6.6	7.0	7.2	--	--

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

Planting Date: May 15

Harvest Date: September 4

NDSU Dickinson Research Extension Center

2019 Barley - Recrop

Dickinson, ND

Variety	Days to Head	Seeds per Pound	Plant Height in	Test Weight lbs/bu	Protein %	% Plump >6/64	----- Grain Yield-----			----- Average Yield-----	
							2017	2018	2019	Year 2	Year 3
							-----bu/ac-----			-----bu/ac-----	
<b>Six Row</b>											
Lacey	66	11,462	32	49.4	16.3	88	45.6	126.3	70.3	98.3	80.7
Tradition	66	12,114	33	50.0	16.9	87	45.6	124.9	67.3	96.1	79.3
<b>Two Row</b>											
AAC Connect	69	10,476	27	48.5	15.5	90	--	--	73.7	--	--
AAC Synergy	71	10,858	28	49.0	15.1	94	47.4	141.3	73.8	107.5	87.5
ABI Balster	70	11,730	29	48.6	16.1	89	47.8	134.6	84.8	109.7	89.1
Conlon	64	9,286	30	52.0	15.8	98	45.8	79.9	60.7	70.3	62.1
Explorer	69	9,955	27	49.4	15.2	93	54.1	134.5	86.9	110.7	91.8
ND Genesis	67	10,418	31	50.0	13.9	95	49.3	134.4	69.1	101.8	84.3
Pinnacle	68	9,589	30	51.3	14.8	97	45.7	133.9	76.4	105.1	85.3
Trial Mean	67	10,186	29	49.7	15.0	94	48.8	127.8	73.0	--	--
CV %	0.9	3.9	5.5	1.1	1.6	1.7	9.7	7.2	11.3	--	--
LSD 0.05	1	564	2	0.8	0.4	3	6.7	13.0	11.8	--	--
LSD 0.10	1	470	2	0.6	0.3	2	5.6	10.8	9.8	--	--

Planting Date: April 23, 2019

Harvest Date: August 7, 2019

Previous Crop: Cover Crop

Seeding Rate: 1.2 million live seeds/ac

Grain protein percentages reported on a 0% moisture basis



2019 North Dakota oat variety descriptions.

Variety	Origin <sup>1</sup>	Year Released	Grain Color	Straw Height	Straw Strength	Maturity <sup>2</sup>	Reaction to Diseases			Bu/Wt.	Protein <sup>5</sup>
							Stem Rust <sup>3</sup>	Crown Rust <sup>3</sup>	Barley Y.Dwf <sup>4</sup>		
AC Pinnacle	AAFC	1999	White	39	Med.	63	8	8	8	V.good	L
Beach	ND	2004	White	35	M.strg.	63	8	4	6	V.good	M
CDC Dancer	Sask.	2000	White	35	Strong	63	8	6	8	V.good	M
CDC Minstrel	Sask.	2006	White	34	M.strg.	64	8	8	8	Good	M
CS Camden	Canterra	2016	White	33	Strong	64	8	6	NA	Good	NA
Deon	MN	2013	Yellow	37	Strong	65	8	1	2	V.good	NA
Hayden	SD	2014	White	36	Med.	62	8	7	NA	V.good	NA
HiFi	ND	2001	White	35	Strong	63	4	8	2	Good	M
Hyttest	SD	1986	White	38	M.strg.	62	8	6	8	V.good	H
Jury	ND	2012	White	34	M.strg.	64	1	8	4	V.good	M
Killdeer	ND	2000	White	32	Strong	63	8	6	4	Good	M
Leggett	AAFC	2005	White	33	Strong	63	3	1	8	Good	M
Newburg	ND	2011	White	38	Med.	62	1	8	4	Good	M
Otana	MT	1977	White	36	M.weak	63	8	8	8	V.good	M/L
Paul <sup>6</sup>	ND	1994	Hull-less	37	Strong	68	1	4	2	Good	H
Rockford	ND	2008	White	38	Strong	65	8	8	4	V.good	M
Souris	ND	2006	White	33	Strong	63	6	8	6	V.good	M
Stallion	SD	2006	White	34	Med.	64	8	3	NA	V.good	M
Warrior	SD	2018	White	32	Strong	62	NA	1	NA	V.good	M

<sup>1</sup>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.

<sup>2</sup>Days after planting.

<sup>3</sup>Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible.

<sup>4</sup>Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA – not available.

<sup>5</sup>H = high; M = medium; L = low; NA = not available.

<sup>6</sup>Hull-less variety.

**NDSU Hettinger Research Extension Center**

**Oat - 2019** **Hettinger, ND**

Variety	Days to	Plant	Plant	Test	----- Grain Yield -----			Average Yield	
	Head	Height	Lodge	Weight	2017	2018	2019	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	----- Bushels per acre -----				
Beach	70	43	7	37.2	50.9	90.9	153.9	122.4	98.6
CS Camden	71	40	3	32.3	73.3	114.1	173.9	144.0	120.4
CDC Dancer	71	43	4	35.7	72.4	98.9	172.9	135.9	114.7
Deon	71	42	6	34.8	70.9	89.8	160.6	125.2	107.1
Hayden	70	43	7	36.7	75.4	105.2	174.1	139.7	118.2
HiFi	71	43	6	35.4	57.5	94.1	161.7	127.9	104.4
Hyttest	69	45	4	38.3	63.5	84.3	146.4	115.4	98.1
Jury	71	42	7	33.9	58.0	92.3	162.2	127.3	104.2
Killdeer	70	37	6	34.2	58.2	108.3	150.5	129.4	105.7
Leggett	71	40	7	35.2	65.6	99.7	160.5	130.1	108.6
CDC Minstrel	70	40	5	33.3	66.6	99.6	183.6	141.6	116.6
Newburg	70	45	7	33.3	57.5	95.6	159.1	127.4	104.1
Otana	71	44	7	35.6	67.2	97.1	159.3	128.2	107.9
AC Pinnacle	70	46	8	34.8	79.5	95.5	142.1	118.8	105.7
Rockford	71	43	4	37.3	76.2	112.3	167.7	140.0	118.7
Souris	70	39	6	35.3	74.2	103.6	152.3	128.0	110.0
Stallion	70	43	7	36.4	58.2	96.5	144.9	120.7	99.9
Warrior	69	41	3	32.3	--	--	168.1	--	--
Paul (hull-less)	75	45	3	40.3	39.3	72.7	105.5	89.1	72.5
Trial Mean	71	43	5	35.3	62.3	97.3	157.6	129.5	107.3
C.V. %	0.6	3.6	18.8	4.3	26.0	6.0	7.3	--	--
LSD 5%	0.9	2.2	1.4	2.1	22.7	8.2	16.2	--	--
LSD 10%	0.7	1.8	1.2	1.8	19.0	6.9	13.5	--	--

<sup>1</sup> Days to Head = the number of days from planting to head emergence from the boot.

<sup>2</sup> 0 = no lodging, 9 = 100% lodged.

Planting Date: April 25

Harvest Date: August 22

NDSU Dickinson Research Extension Center

**2019 Oat - Recrop** **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height in	Test Weight lbs/bu	----- Grain Yield-----			----- Average Yield -----	
					2017	2018	2019	2017	2018
					-----bu/ac-----			-----bu/ac-----	
AC Pinnacle	68	12,599	41	38.8	83.4	116.2	102.5	109.4	100.7
Beach	68	11,297	36	40.1	70.3	83.5	108.5	96.0	87.4
CDC Dancer	69	12,769	35	39.5	74.4	95.3	102.3	98.8	90.7
CDC Minstrel	68	12,381	32	37.6	70.2	106.0	127.5	116.7	101.2
Cs Camden	69	11,998	34	36.5	72.4	111.4	102.4	106.9	95.4
Deon	70	12,357	37	38.6	76.1	95.5	149.8	122.6	107.1
Hayden	68	12,131	37	39.8	80.9	117.4	129.5	123.4	109.3
HiFi	69	13,291	35	38.0	69.7	109.4	118.0	113.7	99.0
Hystest	68	12,960	38	39.5	66.0	101.6	90.5	96.1	86.0
Jury	69	11,979	33	38.5	73.2	95.2	122.6	108.9	97.0
Killdeer	68	13,042	31	37.6	81.8	109.3	125.7	117.5	105.6
Leggett	68	12,919	31	39.1	70.9	95.4	97.9	96.7	88.1
Newburg	68	12,915	40	37.8	73.2	82.1	107.5	94.8	87.6
Otana	69	14,158	37	39.5	76.5	97.7	108.0	102.8	94.1
Paul	72	19,743	37	43.5	43.3	82.2	87.5	84.8	71.0
Rockford	69	14,349	38	39.6	71.2	99.1	123.4	111.2	97.9
Souris	68	12,965	33	37.6	78.2	94.5	110.9	102.7	94.5
Stallion	69	13,814	35	40.4	83.2	103.6	113.7	108.7	100.2
Warrior	68	13,992	31	38.3	--	--	97.0	--	--
Trial Mean	69	13,144	36	38.9	72.9	100.7	113.7	--	--
CV %	0.7	6.1	5.1	1.5	9.6	13.7	14.6	--	--
LSD 0.05	1	1,133	3	0.8	9.8	19.3	23.2	--	--
LSD 0.10	1	948	2	0.7	8.2	16.1	19.4	--	--

Planting Date: April 24, 2019  
 Harvest Date: August 14, 2019  
 Previous Crop: Cover Crop  
 Seeding Rate: 1 million live seeds/ac

**NDSU Hettinger Research Extension Center**

<b>Oil Type Sunflower - 2019</b>											<b>Hettinger, ND</b>		
Company/Brand	Hybrid	Oil Type & Traits <sup>1</sup>	Days to Bloom <sup>2</sup>	Plant Height	Lodging %	Test Weight	Oil Content %	Grain Yield					
								2019	2-Year	3-Year			
								-----lbs/ac-----					
CROPLAN	CP3845	HO, DM	68	63	0	26.5	41.2	2530	--	--			
CROPLAN	CP432E	NS, EX, DM	65	66	0	27.2	31.6	1658	2540	2635			
CROPLAN	CP450E	HO, EX, DM	69	67	0	23.9	33.1	1824	--	--			
CROPLAN	CP455E	HO, EX, DM	68	70	0	24.9	35.7	1959	2837	2705			
CROPLAN	CP4909E	NS, EX, DM	68	63	0	26.1	34.6	1899	--	--			
CROPLAN	CP545CL	NS, CL, DM	69	67	0	24.8	35.9	2420	--	--			
CROPLAN	CPX57919CLP	NS, CLP, DM	70	72	0	25.4	35.6	2499	--	--			
CROPLAN	CPX59619CLP	NS, CLP, DM	71	70	0	24.7	37.2	1590	--	--			
Dyna-Gro	H42HO18CL	HO, CL	65	63	0	25.9	39.0	1885	--	--			
Dyna-Gro	H44HO12CL	HO, CL	65	65	0	25.6	41.5	2140	--	--			
Dyna-Gro	H45HO10EX	HO, EX	68	67	0	23.4	37.8	2027	--	--			
Dyna-Gro	H45NS16CL	NS, CL	65	61	0	26.5	38.8	2485	--	--			
Dyna-Gro	H48HO15CL	HO, CL	71	69	0	23.5	42.4	2275	--	--			
Dyna-Gro	H49HO19CL	HO, CL	69	68	0	24.7	38.9	2567	--	--			
Dyna-Gro	H49NS14CL	NS, CL	69	63	0	24.9	35.3	2311	--	--			
Dyna-Gro	XH81H52CP	HO, CP	70	68	0	24.2	39.5	2210	--	--			
Dyna-Gro	XH91H54CL	HO, CL	67	76	0	25.3	35.5	2206	--	--			
Dyna-Gro	XH91H55CL	HO, CL	72	69	0	24.3	38.4	2534	--	--			
Dyna-Gro	XH93H75CL	HO, CL	69	67	0	24.2	34.0	2109	--	--			
Dyna-Gro	XH93H76CL	HO, CL	68	68	0	25.5	35.8	1698	--	--			
Dyna-Gro	XH93H77CL	HO, CL	68	70	0	23.5	31.4	1679	--	--			
Dyna-Gro	XH93H78CL	HO, CL	66	64	0	24.9	36.1	1943	--	--			
Dyna-Gro	XH93H79CL	HO, CL	71	69	0	24.1	38.4	2675	--	--			
FBN	F2FS1	NS,	70	68	0	23.8	38.1	1873	--	--			
FBN	F2FS2	NS, EX	70	77	0	23.2	34.2	1949	--	--			
FBN	F2FS3	HO,	70	71	0	24.1	33.1	1622	--	--			
FBN	F2FS4	NS, EX	73	77	0	22.2	32.2	1526	--	--			
Mycogen	MY8H270CL	HO, CL, DM	64	63	0	27.2	37.8	2084	--	--			
Mycogen	MY8H400E	HO, EX	69	73	0	25.7	35.5	1697	--	--			
Mycogen	MY8H460CP	HO, CP	71	72	0	24.0	40.5	1638	2442	--			
Mycogen	MY8H477CL	HO, CL	73	74	0	23.0	37.2	2026	--	--			
Mycogen	MY8H131CL	HO, CL	60	58	0	25.4	37.2	1251	--	--			
Mycogen	MY8M380E	NS, EX	68	68	0	24.7	33.7	1403	--	--			
Nuseed	Camaro II	NS, CL, DMR	67	68	0	26.0	35.9	2591	2748	2573			
Nuseed	Falcon	NS, EX	68	67	0	25.7	36.1	2053	2534	2515			
Nuseed	Hornet	HO, CL, DMR	71	70	0	24.1	37.1	2372	2895	2857			
Nuseed	N4H302 E	HO, EX	68	61	0	23.3	35.6	2022	2281	--			
Nuseed	N4H470 CL Plus	HO, CLP, DMR	70	72	0	24.1	39.5	2212	2889	2997			
Nuseed	N4H521 CL	HO, CL, DMR	71	66	0	24.8	37.6	2474	2917	--			
Nuseed	N4HM354	NS, CL, DMR	66	68	0	25.9	37.5	1909	2339	2406			

*Table continued on next page*

**NDSU Hettinger Research Extension Center**

<b>Oil Type Sunflower - 2019</b>	<b>Hettinger, ND</b>
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Company/Brand	Hybrid	Oil Type & Traits <sup>1</sup>	Days to Bloom <sup>2</sup>	Plant Height	Lodging	Test Weight	Oil Content	Grain Yield		
								2019	2-Year	3-Year
<i>Table continues from previous page</i>										
SunOpta	4415 HO/CLP/DM	HO, CL	68	69	0	25.3	36.3	2454	2722	--
SunOpta	4425CL	NS, CL	68	72	0	24.4	32.6	1979	2493	--
SunOpta	9583CLP	Conv, CL	71	78	0	18.7	21.6	1591	--	--
SunOpta	EXOIL725CL	NS, CL	68	76	0	22.7	36.8	2257	--	--
Mycogen(Check)	8N270CLDM	NS, CL, DM	64	64	0	27.0	37.1	1949	2105	2008
USDA (Check)	894	TR	67	69	0	26.2	35.0	1622	2215	2307
Croplan(Check)	559 CL	NS, CL, DM	68	74	0	26.0	39.7	2500	--	--
Trial Mean			69	69	0	24.6	35.8	1959	2435	2423
C.V. %			1.2	6.4	--	3.9	4.8	13.9	--	--
LSD 5%			1.2	6.2	NS	1.3	2.4	380	--	--
LSD 10%			1.0	5.2	NS	1.1	2.0	318	--	--

<sup>1</sup> Type: TR-Traditonal, NS-NuSun, HO-High Oleic, CL=Clearfield, CLP=Clearfield Plus, EX=ExpressSun, DM=Downy Mildew Resistant

<sup>2</sup> Days after planting.

Planting Date: June 7

Harvest Date: November 21

**NDSU Hettinger Research Extension Center**

<b>Safflower - 2019</b>	<b>Hettinger, ND</b>
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Variety	Days to Plant	Test	Oil	-----Grain Yield-----			-----Average Yield-----		
	Flower Height	Weight	Content	2016	2018	2019	2-Yr	3-Yr	
	DAP <sup>1</sup>	inches	lbs/bu	%	----- lbs per acre -----				
<b>Linoleic Types</b>									
Cardinal	87	30	32.0	35.9	1805	1825	1577	1701	1736
Chickadee	88	23	31.9	23.9	--	1497	1299	1398	--
Finch	85	27	30.0	36.7	1669	1335	1456	1396	1487
NutraSaff	90	26	27.5	39.0	1223	1425	555	990	1068
Rubis Red	91	25	30.9	17.0	--	1393	706	1050	--
<b>Oleic Types</b>									
Hybrid 1601	88	29	28.4	29.1	2095	1929	1142	1536	1722
Hybrid 200	89	23	30.5	20.5	1723	1397	1108	1253	1409
Hybrid 446	86	25	31.3	22.5	--	1297	1665	1481	--
MonDak	88	25	31.3	24.0	1559	1680	1668	1674	1636
Montola 2003	89	23	30.5	20.7	1555	1830	851	1341	1412
Trial Mean	88	26	30.4	26.9	1661	1561	1203	1382	1496
C.V. %	1.4	6.0	3.4	6.4	13.6	9.5	15.3	--	--
LSD 5%	1.8	2.2	1.5	2.5	333	215	268	--	--
LSD 10%	1.5	1.8	1.2	2.1	276	179	222	--	--

<sup>1</sup> Days after planting.

Planting Date: May 14

Harvest Date: September 24

Safflower Trial was not harvested in 2017

Very poor seed quality due to a week of wet conditions prior to harvest.

## NDSU Hettinger Reserch Extension Center

<b>Canola - Conventional - 2019</b>	<b>Hettinger, ND</b>
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Brand	Cultivar	Oil Type <sup>1</sup>	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Oil Content	Seed Yield	
			DAP <sup>2</sup>	days	DAP <sup>2</sup>	inches	0 - 9 <sup>3</sup>	%	2019	2-Yr. Avg.
Photosyntech	NCC101S	MO	44	21	83	35	0	38.2	1169	679
BrettYoung	6090 RR (RR Check)	TR	47	21	85	44	0	42.4	965	682
Croplan	CP930RR (RR Check)	TR	45	19	82	40	0	46.7	1093	765
NDSU	Experemntal		48	20	85	41	0	41.8	703	--
NDSU	Experemntal		46	20	83	37	0	39.4	987	--
NDSU	Experemntal		46	21	85	40	0	41.5	953	594
NDSU	Experemntal		49	20	87	47	0	43.2	850	524
NDSU	Experemntal		49	21	88	47	0	40.9	524	--
NDSU	Experemntal		45	22	85	44	0	42.7	875	--
NDSU	Experemntal		47	23	88	45	0	42.1	1128	--
Trial Mean			47	21	85	42	0	41.9	1076	708
C.V. %			0.9	3.1	0.6	5.4	--	2.2	11.3	--
LSD 5%			0.6	1.0	8.0	3.3	--	1.4	151	--
LSD 10%			0.5	0.8	0.7	2.7	--	1.1	125	--

<sup>1</sup> Type: TR-Traditional Oil Type, MO-Mid Oleic Type, HO-High Oleic Oil Type.

<sup>2</sup> Days after planting.

<sup>3</sup> Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 15

Harvest Date: August 28

**NDSU Hettinger Reserch Extension Center**

**Canola - Roundup Ready - 2019**

**Hettinger, ND**

Brand	Cultivar	Oil Type <sup>1</sup>	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Shatter	Oil Content %	Seed Yield	
			DAP <sup>2</sup>	days	DAP <sup>2</sup>	inches	0 - 9 <sup>3</sup>	0 - 9 <sup>4</sup>		2019 <sup>5</sup>	2-Yr. Avg.
										-----lbs/a-----	
BrettYoung	4187 RR	TR	48	20	86	46	0	5	43.7	512	631
BrettYoung	6074 RR	TR	46	20	84	44	0	3	43.6	621	624
BrettYoung	6090 RR	TR	47	20	84	46	0	2	43.8	777	640
Canterra Seeds	CS2100	TR	45	20	84	39	0	0	45.1	1221	872
Canterra Seeds	CS2300	TR	47	21	86	47	0	3	43.9	611	648
Canterra Seeds	CS2600 CR-T	TR	46	19	83	45	0	0	45.7	1268	928
Croplan	CP930RR	TR	45	19	82	43	0	0	47.2	1069	808
Croplan	CP955RR	TR	46	19	83	43	0	2	45.9	887	700
Croplan	CP9919RR	TR	44	20	82	34	0	0	42.0	1059	--
Croplan	CP9978TF	TR	45	20	83	40	0	0	44.3	1737	--
Croplan	CP9982RR	TR	46	22	86	46	0	7	40.4	237	--
Proseed	300 MAG	TR	46	21	85	43	0	2	44.2	787	744
Proseed	PS 5000	TR	46	20	84	41	0	2	43.4	779	597
Star Specialty Seed	Star 402	TR	46	19	83	42	0	0	47.8	959	688
Star Specialty Seed	StarFlex	TR	45	20	83	39	0	0	46.0	1341	--
Integra	7389RT	TR	46	20	84	43	0	0	45.3	1271	--
Trial Mean			46	20	84	43	0	1	44.4	905	688
C.V. %			1.0	2.7	0.6	5.8	--	28.1	2.3	12.4	--
LSD 5%			0.6	0.8	0.7	3.5	--	0.5	1.4	160	--
LSD 10%			0.5	0.6	0.6	2.9	--	0.5	1.2	133	--

<sup>1</sup> Type: TR-Traditional Oil Type, HO-High Oleic Oil Type.

<sup>2</sup> Days after planting.

<sup>3</sup> Lodging: 0 = none, 9 = lying flat on ground.

<sup>4</sup> Shatter: 0 = none, 9 = 100% shattered.

<sup>5</sup> Note because wet conditions delayed harvest combined with a severe thunderstorm with high winds just prior to harvest, some cultivars suffered from severe shatter.



**NDSU Dickinson Research Extension Center**

<b>2019 Flax - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days to Flower	Days to Mature	Plant Height in	Test Weight lbs/bu	Oil Content %	-- Grain Yield-- 2019 bu/ac
Bison	53	103	19	46.5	43.6	16.2
CDC Bright	54	106	18	45.7	46.2	13.6
CDC Buryu	54	103	18	50.2	43.1	15.4
CDC Glas	55	105	20	47.0	44.4	13.3
CDC Melyn	56	101	19	43.3	46.1	12.1
CDC Neela	54	106	17	48.5	43.3	13.9
CDC Plava	55	104	17	46.0	43.7	9.9
Carter	54	106	17	50.5	42.8	14.7
Gold ND	54	106	20	48.2	43.9	14.1
ND Hammond	54	103	18	43.7	42.4	11.0
Omega	56	104	18	47.8	42.7	13.3
Prairiethunder	54	105	19	48.3	42.6	15.9
Webster	54	105	20	46.3	44.2	13.9
York	54	107	18	47.5	43.0	18.4
Trial Mean	55	105	18	48.1	43.9	14.6
CV %	1.7	1.6	6.2	2.7	1.5	15.0
LSD 0.05	2	3	2	2.1	1.1	3.6
LSD 0.10	1	2	2	1.8	0.9	3.0

Planting Date: May 6, 2019  
Harvest Date: September 19, 2019  
Previous Crop: Cover Crop  
No Lodging observed  
Oil content reported on 9% moisture basis

**NDSU Hettinger Research Extension Center**

<b>Dry Bean - 2019</b>	<b>Hettinger, ND</b>
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Variety	Type	Plant	Plant	Test	----- Grain Yield -----			----- Average Yield -----	
		Height	Lodge	Weight	2017	2018	2019	2 yr	3 yr
		inches	0-9 <sup>1</sup>	lbs/bu	----- lbs per acre -----				
LaPaz	Pinto	30	6	52.2	1507	1691	1441	1566	1546
Lariat	Pinto	29	8	51.3	1140	1375	1245	1310	1253
Monterrey	Pinto	31	5	51.9	1496	1653	1345	1499	1498
ND-Falcon	Pinto	28	6	49.5	--	--	1509	--	--
Palomino	Pinto	31	6	51.5	1282	1536	1611	1574	1476
Stampede	Pinto	27	6	50.4	1415	1609	1797	1703	1607
Torreón	Pinto	28	6	50.8	--	--	1437	--	--
Vibrant	Pinto	29	5	52.5	--	--	1286	--	--
Windbreaker	Pinto	30	6	52.2	1110	1534	1295	1415	1313
Blizzard	Navy	27	4	56.5	--	--	1166	--	--
HMS Medalist	Navy	24	3	56.9	1466	937	1130	1034	1178
T9905	Navy	27	4	56.6	1652	1243	1350	1297	1415
Merlot	Sm Red	26	5	50.7	1449	1011	1757	1384	1406
Viper	Sm Red	25	5	54.2	--	--	1659	--	--
Rosetta	Pink	28	4	53.5	1597	1060	1519	1290	1392
Black Tails	Black	23	5	57.0	--	--	1870	--	--
Eclipse	Black	24	3	57.3	1451	1162	1661	1412	1425
Loreto	Black	22	4	55.9	1298	1006	1618	1312	1307
Zorro	Black	23	3	56.2	1391	1071	1570	1321	1344
ND Pegasus	Great Northern	31	3	52.2	--	--	1811	--	--
Powderhorn	Great Northern	30	4	48.8	1900	1303	1497	1400	1567
Trial Mean		27	5	53.3	1427	1288	1488	1393	1397
C.V. %		13.1	14.6	1.8	13.1	13.0	15.7	--	--
LSD 5%		5.0	1.0	1.4	266	240	330	--	--
LSD 10%		4.2	0.8	1.2	222	200	275	--	--

<sup>1</sup> 0 = no lodging, 9 = lying flat on ground.

Planting Date: May 30

Harvest Date: October 8

Previous Crop: Durum Wheat

**NDSU Hettinger Research Extension Center**

**Chickpea - 2019** **Hettinger, ND**

Variety	Days to		Lodging	-----Seed Size (mm)-----				Seed Size	Test Weight	----- Grain Yield -----			----- Average Yield -----	
	Flower DAP <sup>1</sup>	Height inches		<8	8-9	9-10	>10			2016	2018	2019	2 yr	3 yr
			0 - 9 <sup>2</sup>	-----%-----				seed/lb	lb/bu	-----lbs/ac-----				
<b>Kabuli Type</b>														
CDC Frontier	55	27	0	38	46	13	3	2092	46.2	2119	1802	1483	1643	1801
CDC Leader	55	25	0	20	45	26	9	1670	46.3	--	--	2307	--	--
CDC Luna	57	24	0	22	46	23	9	1742	45.3	2054	1589	1850	1720	1831
CDC Orion	55	24	0	17	47	26	9	1709	44.6	--	1456	1918	1687	--
CDC Palmer	55	25	0	6	41	36	17	1320	43.8	--	--	2762	--	--
Sawyer	53	26	0	44	39	14	3	2227	**	1387	1439	662	1051	1163
Sierra	55	26	0	44	34	15	7	2452	**	879	1066	280	673	742
<b>Desi Type</b>														
CDC Anna	55	27	0	91	8	1	0	2813	36.5	2136	1687	1791	1739	1871
MS-19CP1	53	22	0	33	62	5	0	1721	44.3	--	--	2780	--	--
MS-19CP2	56	25	0	50	48	2	0	2074	44.3	--	--	2394	--	--
Mean	55	25	0	37	42	16	6	1982	43.9	1736	1507	1823	1419	1482
C.V. %	5.6	9.7	--	22.2	11.7	29.0	57.1	10.7	4.0	12.7	11.1	13.0	--	--
LSD 5%	4.4	3.5	--	12	7	7	5	310	2.6	324	253	343	--	--
LSD 10%	3.7	2.9	--	10	6	6	4	258	2.1	268	208	284	--	--

<sup>1</sup> Days after planting.

<sup>2</sup> Lodging: 0 = none, 9 = lying flat on ground.

\*\* Not enough sample for a test weight.

Planting Date: May 13

Harvest Date: September 24

NDSU Hettinger Research Extension Center

Field Pea - 2019 Hettinger, ND

Variety	Days to Flower	Flower Duration	Days to Mature	Canopy Height	Canopy Lodging	Seed Protein	1,000 Seed Wt.	Seeds Lb	Test Weight	Seed Yield		
	DAP <sup>1</sup>	days	DAP <sup>1</sup>	inches	0 - 9 <sup>2</sup>	%	gm	seeds	lb/bu	2019	2-Yr. Avg.	3-Yr. Avg.
-----bu/a-----												
<b>Yellow Cotyledon Type</b>												
AAC Asher	52	14	77	28	8	25.8	245	1853	57.7	46.0	--	--
AAC Carver	52	14	77	34	6	24.5	223	2034	58.4	50.4	--	--
AAC Chrome	52	15	78	29	7	25.1	229	1979	58.8	48.5	--	--
AAC Profit	56	12	79	32	7	27.4	218	2094	58.9	50.2	40.1	--
AC Earlystar	51	15	77	32	6	25.0	198	2303	57.7	44.8	--	--
Agassiz	51	16	78	31	7	27.4	220	2059	57.8	48.4	36.8	28.6
Bridger	50	16	77	31	7	26.3	213	2133	58.7	46.5	29.7	24.0
CDC Amarillo	56	11	78	31	6	26.1	216	2099	58.1	44.1	--	--
CDC Inca	54	13	78	33	6	26.5	206	2209	58.5	50.9	--	--
CDC Saffron	54	12	77	30	8	26.4	232	1962	58.7	46.9	--	--
CDC Spectrum	55	13	79	32	7	27.4	208	2186	57.9	46.6	--	--
DL Apollo	52	14	77	33	7	26.6	207	2196	59.2	47.8	--	--
DS Admiral	51	15	77	33	7	25.7	222	2045	58.2	44.0	31.8	25.5
Durwood	52	15	78	34	5	26.6	226	2011	58.3	45.3	33.3	26.8
Hyline	52	15	77	30	7	26.1	228	1991	58.7	45.4	30.4	24.2
Jetset	51	15	78	31	7	26.0	226	2008	58.0	46.0	--	--
Korando	50	17	78	31	7	28.0	246	1845	57.2	41.7	--	--
LG Amigo	51	15	77	30	7	27.2	211	2161	58.3	41.5	29.7	24.4
LG Sunrise	50	17	78	32	6	25.9	217	2097	58.3	45.8	32.5	--
LGPN4909	48	18	77	31	7	27.1	213	2129	57.8	44.2	29.2	24.1
LGPN4913	51	15	77	31	7	27.9	210	2162	58.3	39.1	27.5	--
LGPN4915	50	16	77	31	6	29.4	200	2275	58.1	44.6	34.5	--
N13022-7	50	16	77	32	7	26.9	247	1839	58.2	46.6	--	--
N13029-10	49	17	77	35	7	26.3	235	1937	57.4	49.7	--	--
N13057-4	48	18	77	33	7	27.2	227	2003	58.3	46.8	--	--
N13057-5	51	17	79	34	7	27.5	240	1893	57.2	45.0	--	--
N13068-1	51	16	77	34	7	25.4	245	1860	56.9	47.4	--	--
NDP121587	51	15	77	31	8	24.8	212	2141	57.8	42.7	--	--
Nette 2010	51	15	77	30	7	26.0	205	2220	59.1	45.5	31.8	26.0
Salamanca	53	13	77	32	7	27.2	246	1847	58.3	49.3	34.7	28.0
Spider	54	14	78	33	8	27.1	234	1942	59.0	45.2	36.0	27.5
SW Midas	52	14	77	28	7	25.5	189	2400	58.7	40.5	26.3	22.4
<b>Green Cotyledon Type</b>												
12CP3032	53	14	77	30	8	26.8	237	1917	57.4	44.8	--	--
AAC Comfort	58	9	78	31	8	26.9	230	1975	57.4	40.1	--	--
Arcadia	51	15	77	26	8	25.9	191	2377	58.4	40.5	23.1	19.5
Banner	47	19	77	30	7	24.2	190	2385	57.3	41.4	24.2	--
CDC Greenwater	54	13	78	31	6	25.2	223	2042	58.3	44.2	--	--
CDC Striker	51	15	77	29	9	26.0	192	2370	58.3	43.4	26.4	21.9
Cruiser	51	15	77	31	7	26.4	190	2396	58.7	40.6	27.1	22.4
Empire	54	12	78	34	6	27.6	207	2195	58.7	40.4	--	--
Ginny	51	15	77	28	8	26.1	185	2456	58.2	32.5	22.6	18.6
Hampton	52	14	77	27	9	29.2	200	2266	56.8	32.3	--	--
LG Koda	54	13	77	31	7	25.5	206	2200	59.0	39.9	30.2	24.3
LN1131	50	16	77	30	6	28.1	222	2042	57.9	44.6	--	--
N13073-17	54	13	77	31	8	25.7	220	2066	56.4	44.2	--	--
N13073-19	48	19	78	31	8	26.0	244	1862	57.0	45.2	--	--
Shamrock	54	12	77	31	7	25.7	218	2080	57.3	41.0	29.8	23.6
Viper	50	16	77	32	7	27.8	215	2112	57.3	38.6	25.6	21.5
	52	15	77	31	7	26.5	218	2097	58.0	44.2	30.1	24.1
C.V. %	1.4	5.5	0.6	6.6	9.3	2.2	4.0	4.0	1.0	7.9	--	--
LSD 5%	1.0	1.1	0.6	2.9	0.9	0.8	12	117	0.8	4.9	--	--
LSD 10%	0.8	0.9	0.5	2.4	0.8	0.7	10	98	0.7	4.1	--	--

<sup>1</sup> Days after planting.

<sup>2</sup> Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 13

Harvest Date: August 19

NDSU Dickinson Research Extension Center

**2019 Field Pea - Recrop** **Dickinson, ND**

Variety	Days to Flower	Days to Mature	1000 Seed Weight gm	Seeds per Pound	Plant Height in	Test Weight lbs/bu	Protein %	--Grain Yield--			Average Yield	
								2017	2018	2019	2	3
								-----bu/ac-----			--bu/ac--	
<b>Yellow Types</b>												
AAC Carver	57	88	287	1,589	29	64.5	24.5	--	--	47.0	--	--
AAC Chrome	57	92	262	1,735	24	65.0	24.2	--	--	50.1	--	--
AAC Profit	58	89	256	1,773	28	65.4	25.9	--	--	55.7	--	--
AC Earlystar	57	89	245	1,859	25	64.4	24.9	--	--	40.9	--	--
Agassiz	57	87	259	1,758	26	64.3	25.0	21.6	23.1	52.2	37.7	32.3
Bridger	56	89	267	1,699	23	65.1	25.9	--	23.1	45.6	34.4	--
CDC Amarillo	58	91	227	1,999	27	65.0	24.5	--	--	43.2	--	--
CDC Inca	58	88	242	1,882	28	65.8	25.1	--	--	54.4	--	--
CDC Saffron	58	88	266	1,707	24	64.9	25.1	--	--	47.5	--	--
CDC Spectrum	58	90	254	1,787	28	64.9	26.4	--	--	45.8	--	--
DS Admiral	57	89	257	1,789	26	64.9	25.2	23.1	25.7	40.7	33.2	29.9
Hyline	57	88	276	1,645	25	65.1	23.9	--	25.3	48.7	37.0	--
Jetset	57	88	266	1,711	22	64.9	26.2	--	--	43.6	--	--
Salamanca	57	87	294	1,545	26	65.4	26.8	--	26.5	45.5	36.0	--
Spider	57	90	242	1,882	24	64.6	26.1	18.5	28.8	43.4	36.1	30.2
<b>Green Types</b>												
AAC Comfort	59	93	290	1,576	25	64.5	25.2	--	--	46.5	--	--
Arcadia	57	87	244	1,868	24	64.1	25.2	25.8	27.9	44.3	36.1	32.6
CDC Greenwater	58	92	239	1,903	25	64.8	24.0	--	--	41.1	--	--
CDC Striker	57	88	259	1,754	22	65.0	25.4	24.8	25.7	46.2	35.9	32.2
Cruiser	57	87	244	1,867	24	63.9	25.8	22.7	21.0	35.6	28.3	26.4
Hampton	57	90	247	1,841	24	63.8	27.1	--	--	46.5	--	--
Trial Mean	57	89	255	1,791	25	64.8	25.3	22.8	24.8	45.2	--	--
CV %	1.0	1.4	6.8	6.5	10.7	0.6	2.3	8.5	17.2	11.2	--	--
LSD 0.05	1	2	25	165	4	0.5	0.8	2.8	NS	7.1	--	--
LSD 0.10	1	2	21	138	3	0.4	0.7	2.3	NS	6.0	--	--

Planting Date: May 3, 2019  
 Harvest Date: August 7, 2019  
 Previous Crop: Cover Crop  
 Seeding Rate: 325,000 live seeds/ac  
 Grain protein percentages reported on 0% moisture basis

**NDSU Hettinger Reserach Extension Center**

<b>Lentil - 2019</b>							<b>Hettinger, ND</b>				
Variety	Days to	Height	Lodging	1,000	Seeds	Test	----- Grain Yield -----			Average Yield	
	Flower			Seed Wt.	Lb	Weight	2016	2018	2019	2 yr	3 yr
	DAP <sup>1</sup>	inches	0 - 9 <sup>2</sup>	gm	seeds	lb/bu	-----lbs/acre-----				
<b>Large Green Type</b>											
CDC Greenland	55	15	8	48	9456	51.5	1219	1028	1823	1426	1357
Pennell	54	14	8	52	8819	52.2	1079	1268	2042	1655	1463
Riveland	51	14	9	53	8631	54.6	1118	951	1404	1177	1158
<b>Medium Green Type</b>											
CDC Richlea	52	15	8	39	11562	51.6	1299	1233	1830	1531	1454
<b>Small Green Type</b>											
CDC Viceroy	52	16	8	30	15304	56.0	1352	1634	2138	1886	1708
ND Eagle	51	15	8	35	12891	54.7	890	1455	2134	1794	1493
<b>French Green Type</b>											
CDC Lemay	56	15	5	36	12790	54.2	598	1334	2038	1686	1323
<b>Small Red Type</b>											
CDC Red Rider	54	13	7	30	15128	57.0	1359	1466	1446	1456	1424
CDC Redberry	54	16	4	37	12183	55.3	902	1258	2117	1687	1426
CDC Rosetown	55	14	6	28	16500	55.2	1304	1557	1745	1651	1535
CDC Rouleau	54	16	6	31	14540	54.6	1157	1180	2316	1748	1551
Trial Mean	53	15	7	38	12528	54.2	1043	1306	1912	1609	1445
C.V. %	2.0	7.3	13.1	4.5	4.3	3.7	11.8	18.9	11.5	--	--
LSD 5%	1.6	1.6	1.3	2.5	772	2.9	174	357	317	--	--
LSD 10%	1.3	1.3	1.1	2.1	642	2.4	145	297	264	--	--

<sup>1</sup> Days after planting.

<sup>2</sup> Lodging: 0 = none, 9 = lying flat on ground.

Planting Date: May 3

Harvest Date: August 27

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

NDSU Dickinson Research Extension Center

**2019 Lentil - Recrop** **Dickinson, ND**

Variety	Days to Flower	Days to Mature	1000 Seed Weight gm	Seeds per Pound	Plant Height in	Test Weight lbs/bu	protein %	----Grain Yield----			Average Yield	
								2016	2017	2019	2	3
								-----lbs/ac-----			---lbs/ac---	
<b>Large Green Types</b>												
CDC Greenland	58	96	60	7,528	13	59.9	27.0	971	800	1,394	1,097	1,055
Pennell	59	95	58	7,809	11	59.8	26.6	1,302	721	1,348	1,034	1,124
Riveland	58	96	63	7,178	13	59.1	26.3	1,124	698	1,350	1,024	1,057
<b>Medium Green Type</b>												
CDC Richlea	58	96	48	9,438	12	61.8	26.3	1,584	858	1,400	1,129	1,281
<b>Small Green Type</b>												
CDC Viceroy	58	95	31	14,437	12	62.9	28.0	1,521	730	1,598	1,164	1,283
ND Eagle	58	95	35	12,949	11	63.0	26.2	--	624	1,226	925	--
<b>Small French Green Type</b>												
CDC Lemay	58	94	31	14,550	10	63.0	26.5	1,315	369	1,227	798	970
<b>Medium Red Type</b>												
CDC Red Rider	59	95	43	10,614	14	62.3	26.1	1,585	816	1,387	1,102	1,263
<b>Small Red Types</b>												
CDC Redberry	58	96	42	10,766	11	62.4	28.5	1,229	700	1,588	1,144	1,172
CDC Rouleau	59	96	34	13,232	12	62.1	25.4	1,511	590	1,533	1,061	1,211
<b>Extra Small Red Type</b>												
CDC Rosetown	59	95	27	16,858	11	63.3	28.7	1,406	759	1,350	1,054	1,172
<b>Trial Summary</b>												
Trial Mean	58	95	43	11,396	12	61.8	26.9	1,355	697	1,400	--	--
CV %	0.7	0.8	3.7	3.3	12.4	0.7	2.7	9.0	10.7	12.7	--	--
LSD 0.05	1	1	2	547	2	0.7	1.4	177	107	257	--	--
LSD 0.10	0	1	2	454	2	0.6	0.9	147	89	214	--	--

Planting Date: May 3, 2019  
 Harvest Date: August 16, 2019  
 Previous Crop: Cover Crop  
 Seeding Rate: 600,000 live seeds/ac  
 Grain protein percentages reported on 0% moisture basis

## NDSU Hettinger Research Extension Center

<b>Soybean - Roundup Ready - 2019</b>	<b>Hettinger, ND</b>
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Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield
				inches	lbs/bu	%	%	Bu/Ac
NDSU	ND18008GT	00.8	9/15	30	54.4	17.1	33.0	34.3
NDSU	ND17009GT	00.9	9/16	30	55.9	17.1	34.0	40.5
Proseed	30-20	0.2	9/20	32	54.7	16.0	34.2	44.0
Proseed	BX 80-35	0.3	9/24	30	55.6	16.3	34.6	42.4
REA Hybrids	RX0330	0.3	9/23	29	54.7	16.4	33.1	36.1
Integra	50309N	0.3	9/22	30	54.8	16.4	32.8	43.0
Proseed	XT 60-40N	0.4	9/23	31	54.6	16.6	33.8	40.1
REA Hybrids	RX0520	0.5	9/26	33	55.3	16.2	33.2	38.5
Integra	50510N	0.5	9/27	30	55.4	16.5	32.5	47.9
MN	M06R-614008GT	0.6	9/21	30	54.5	16.4	33.7	35.4
REA Hybrids	RX0719	0.7	9/22	30	55.4	16.2	34.2	41.9
REA Hybrids	RX0929	0.9	10/1	32	55.9	16.4	32.9	42.9
Trial Mean			9/23	31	55.0	16.4	33.4	40.7
C.V. %			0.5	6.5	1.4	3.2	2.4	10.6
LSD 5%			1.2	2.8	1.1	0.8	1.2	6.1
LSD 10%			1.0	2.3	0.9	0.6	1.0	5.1

Planting Date: May 30

Harvest Date: October 23

<b>Soybean - Roundup Ready - 2019</b>	<b>Mandan, ND</b>
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Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield
				inches	lbs/bu	%	%	Bu/Ac
Proseed	30-20	0.2			54.6	15.7	33.9	36.2
Proseed	BX 80-35	0.3			55.8	15.8	33.9	43.7
REA Hybrids	RX0330	0.3			55.1	15.2	33.1	42.7
Integra	50309N	0.3			54.8	15.2	33.5	39.8
Proseed	XT 60-40N	0.4			55.2	15.7	33.0	39.7
REA Hybrids	RX0520	0.5			55.1	15.2	33.7	42.6
Integra	50510N	0.5			55.0	16.1	32.0	46.9
MN	M06R-614008GT	0.6			55.7	15.4	34.4	42.2
REA Hybrids	RX0719	0.7			55.0	15.9	33.3	44.8
NDSU	ND15-22873	0.7			55.9	16.4	32.7	43.7
REA Hybrids	RX0929	0.9			55.5	15.8	32.2	40.0
Trial Mean					55.2	15.7	33.0	42.3
C.V. %					0.7	2.0	2.1	8.3
LSD 5%					0.6	0.5	1.0	5.1
LSD 10%					0.5	0.4	0.8	4.2

Planting Date: June 5

Harvest Date: October 24



## NDSU Hettinger Research Extension Center

<b>Soybean - Conventional - 2019</b>	<b>Hettinger, ND</b>
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Company/Brand Variety		Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield	Average Yield	
									2-Yr	3-Yr
				inches	lbs/bu	%	%			
NDSU	ND Benson	0.4	9/27	32	56.0	16.5	33.7	36.5	33.4	30.8
NDSU	ND Stutsman	0.7	9/26	31	55.6	16.8	32.4	42.1	39.5	35.6
MN	MN0810CN	0.8	9/28	35	55.5	15.6	35.0	32.2	--	--
MN	MN0083	00.8	9/13	27	54.2	16.5	34.3	29.2	--	--
Trial Mean			9/27	32	55.6	16.6	32.6	37.5	36.4	33.2
C.V. %			0.7	4.8	0.8	1.7	2.1	10.7	--	--
LSD 5%			1.3	2.3	0.7	0.4	1.0	5.8	--	--
LSD 10%			1.1	1.9	0.5	0.3	0.8	4.8	--	--

Planting Date: May 30

Harvest Date: October 23

**NDSU Hettinger Research Extension Center**

<b>Corn - 2019</b>	<b>Hettinger, ND</b>
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Company	Hybrid	Relative Maturity <sup>1</sup> days	Plant Height inches	Ear Height inches	Stalk Lodge %	Moisture Content %	Test Weight lbs/bu	Grain Yield	
								2019 -----bu/ac-----	2-Yr
Integra	3282	82	101	44	0	17.8	51.4	127.7	119.6
Integra	3537	85	102	45	0	17.9	51.0	134.8	122.8
Integra	3718	87	103	42	0	20.7	47.8	142.6	128.0
Legend Seeds	40J081	81	105	46	0	21.0	53.5	109.0	--
Legend Seeds	LR 9583	83	99	44	0	19.1	52.0	136.0	123.4
Legend Seeds	LR 9983	83	99	44	0	19.4	51.4	132.4	--
Legend Seeds	40J684	84	102	44	0	22.0	49.1	125.5	120.0
Legend Seeds	LR 9886	86	106	44	0	21.2	46.9	128.7	109.4
Proseed	1882	82	100	42	0	19.7	55.1	112.1	--
Proseed	1483	83	98	43	0	18.6	52.0	135.3	126.4
Proseed	1487	87	103	46	0	18.8	48.4	116.6	115.3
Proseed	1787	87	105	42	0	18.5	51.1	129.5	122.5
Trial Mean			102	44	0	19.5	50.8	127.5	120.8
C.V. %			2.6	5.6	--	11.6	5.0	7.9	--
LSD 5%			3.8	3.5	--	3.3	3.6	17.0	--
LSD 10%			3.2	2.9	--	2.7	3.0	14.1	--

<sup>1</sup> Relative maturity provided by company.

Planting Date: May 30

Harvest Date: November 19

**NDSU Hettinger Reserch Extension Center**

**Industrial Hemp Variety Trial - 2019**

**Hettinger, ND**

Variety	Plant Stand plants/ft <sup>2</sup>	PLSE <sup>1</sup> %	Seedling Mortality %	Height inches	Lodging <sup>2</sup> 0-9	Test Weight lbs/bu	Oil Content %	Seed Yield lbs/ac
CRS-1	9.9	62	38	49	0	*	32.8	210
CFX-1	9.0	56	44	44	0		32.4	157
CFX-2	10.3	65	35	39	0		33.0	214
Grandi	11.3	71	29	42	0		32.4	229
Katani	10.1	63	37	40	0		32.1	191
Piccolo	13.8	86	14	38	0		32.4	214
Canda	10.9	68	32	57	0		31.7	229
Joey	12.2	76	24	54	0		31.3	286
X-59	8.5	53	47	45	0		30.9	362
Anka-Trt	9.4	59	41	59	0		32.2	276
Anka-CK	8.5	53	47	65	0		31.9	186
	10.7	67	33	50	0		32.1	232
C.V. %	20.8	20.8	42.1	11.1	--		2.0	47.4
LSD 5%	3.2	20	20	8.0	--		0.9	159
LSD 10%	2.7	17	17	6.6	--		0.8	132

<sup>1</sup> Pure live seed emergence.

<sup>2</sup> Lodging: 0 = none, 9 = lying flat on ground.

\* Not enough sample to obtain a test weight.

Planting Date: June 3

Harvest Date: September 25

Trial suffered from significant bird feeding which greatly reduced yields before harvest.

NDSU Dickinson Research Extension Center

**2019 Industrial Hemp - Recrop** **Dickinson, ND**

Variety	Plant Stand	1000 KWT	PLSE <sup>1</sup>	Seedling Mortality	Seeds per Pound	Test Weight	Oil Content <sup>3</sup>	Grain Yield 2019
	ft <sup>2</sup>	g	%	%		lbs/bu	%	lbs/ac
Altair	6.4	15.6	37	63	29,095	39.8	30.6	860
Altair TRT <sup>2</sup>	4.5	15.9	26	74	28,506	39.8	30.4	770
Anka	5.2	14.9	28	72	30,439	39.0	29.9	729
Anka TRT	4.6	15.4	25	75	29,501	39.6	29.9	736
CFX-1	4.9	16.2	31	69	27,978	40.9	32.5	684
CFX-2	3.7	15.9	23	77	28,661	41.0	31.7	722
CRS-1	7.2	16.5	45	55	27,434	40.8	31.8	744
Canda	4.6	19.0	29	71	23,940	40.3	30.5	897
Cyclone V-1	2.7	6.7	17	83	67,458	41.8	31.9	293
Cyclone V-1 TRT	5.5	6.9	35	65	65,847	41.6	32.6	320
Grandi	4.3	15.2	27	73	29,867	40.8	31.7	653
Joey	4.6	16.9	29	71	26,875	41.3	30.9	785
Katani	5.0	14.4	31	69	31,599	40.9	31.1	671
Piccolo	6.0	14.5	38	62	31,394	40.9	31.1	604
Rigel	4.1	16.8	31	69	27,113	39.8	30.5	804
Rigel TRT	4.1	16.8	31	69	26,943	39.5	31.0	839
X-59	2.7	16.4	17	83	27,752	40.8	29.1	891
Trial Mean	4.8	15	30	70	32,694	40.1	31.0	697
CV %	42.2	3.7	42.4	18.1	3.3	1.1	1.5	13.8
LSD 0.05	2.9	0.8	18	18	1,522	0.6	0.7	136
LSD 0.10	2.4	0.7	15	15	1,270	0.5	0.6	114

<sup>1</sup> Pure live seed emergence

<sup>2</sup> TRT = Metalaxyl + Ipconazole 3 fl oz/100 lb seed

<sup>3</sup> oil content reported as is basis (uniformly dried to approximately 3% moisture)

Target seeding rate was 12 seeds/ft<sup>2</sup> + additional 25% for expected mortality loss. Altair, Anka, and Rigel were 13, 14, and 10 seeds/ft +25% mortality loss, respectively. This was due to late seed arrival with germinations and seed weight completed after seeding the trial.

Planting Date: May 29, 2019

Harvest Dates: October 8, 2019 Cyclone V-1 and Cyclone V-1 TRT

September 4, 2019 All others

Previous Crop: wheat

**Sunflower Response to Preemergence Herbicides  
Hettinger Research Extension Center**

Sunflower was planted at a seeding rate of 18,000 seeds/acre on June 7, 2019 using a John Deere planter in 30 inch rows and at a depth of 1.5 inches. Preemergence herbicide treatments were applied on June 10 using a tractor-mounted research sprayer at a spray volume of 10 gallons per acre. Glyphosate (Roundup PowerMax) was included with all treatments, including the untreated control, to control weeds that had emerged prior to planting. Preemergence treatments included Authority Supreme (sulfentrazone + pyroxysulfone), Authority Elite (sulfentrazone + metolachlor), Spartan Charge (carfentrazone + sulfentrazone), Anthem Flex (carfentrazone + pyroxasulfone), and Zidua SC (pyroxasulfone). Sunflower emerged on June 17. In the week following application adequate rainfall occurred for activation of preemergence herbicides. At 7 days after sunflower emergence, slight injury in the form of bronzing of the cotyledon leaves was noticed for many of the herbicide treatments that contained the active ingredient sulfentrazone. This injury was not observed on any of the later true leaves. Control of green foxtail and tumble pigweed was evaluated. Green foxtail control was less in the Spartan Charge treatment than any other herbicide treatment. This was not unexpected as Spartan Charge does not contain any herbicide that is known to provide good control of green foxtail. Tumble pigweed was also controlled at 90% or more with all herbicide treatments. Sunflower were harvested on November 21, 2019 using a small plot combine with a 5 foot all-crop header. Sunflower yield was less in the untreated control, but there was no difference in yield when comparing herbicide treatments. Of the herbicide treatments, sunflower yield was lowest in the Spartan Charge treatment, which was not statistically greater than the untreated control. This was likely due to poor grass control in this treatment. And although yield was still good in the untreated control, weeds that were left uncontrolled produced seed that will need to be controlled in future crops.

Table. Comparison of preemergence herbicide treatments for weed control and sunflower yield at Hettinger ND.

Treatment	Rate oz/A	7 DAE <sup>1</sup> % injury	Green foxtail			Tumble pigweed			Sunflower Yield lbs/acre
			16 DAE	23 DAE	39 DAE	16 DAE	23 DAE	39 DAE	
1 Untreated		0 b	0 c	0 c	0 c	0 b	0 b	0 b	2214 b
2 Authority Supreme	8	6 a	95 a	89 a	86 a	100 a	100 a	100 a	2662 a
3 Authority Elite	24	8 a	98 a	91 a	88 a	100 a	98 a	100 a	2705 a
4 Spartan Charge	5.1	6 a	73 b	73 b	45 b	100 a	95 a	95 a	2432 ab
5 Anthem Flex	4.5	1 b	95 a	94 a	89 a	100 a	99 a	100 a	2552 a
6 Zidua SC	5	0 b	93 a	91 a	82 a	100 a	100 a	98 a	2636 a
LSD P=.05		3.1	6.3	6.1	9	0.6	4.7	3.9	318
Standard Deviation		2.6	5.3	5.2	7.6	0.5	4.0	3.3	268
Treatment Probability (F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

<sup>1</sup> DAE, days after emergence.

## **Spring Wheat Response to Pre-Plant Burndown Herbicides Hettinger Research Extension Center**

A trial was conducted to evaluate herbicides that can be applied preplant in wheat to control existing weeds and to see if there is any residual control of weeds from these herbicides. Herbicide treatments were applied on May 13, 2019. Weeds present at time of application included downy brome, prickly lettuce, shepherds purse, tansy mustard, kochia, and common lambsquarters. Green foxtail emerged later. Wheat 'Elgin' was planted on May 15 using a no-till drill at a seeding rate of 120 lbs/acre and at a depth of 2 inches. Wheat emerged on May 29. Downy brome was controlled 100% by all treatments containing Gramoxone (paraquat) or Roundup PowerMax (glyphosate), but only 78 to 87% with Section Three (clethodim). Shepherds purse was control 99 to 100% with glyphosate alone or with glyphosate tank mixes. Paraquat alone or with 2,4-D controlled shepherds purse 89 and 91%, respectively, with 99% control with tank-mixed with Sharpen (saflufencil). Control of flixweed was 90% or better with all treatments, however tank-mixes with clethodim provided lower control than other treatments. Prickly lettuce was controlled 100% by all treatments except tank-mixes containing clethodim. Kochia control was best (98%) with the tank mix of glyphosate plus Anthem Flex (carfentrazone + pyroxasulfone). Other treatments provided only fair control of kochia. Similar to kochia, common lambsquarters control was best (95%) with the tank mix of glyphosate + carfentrazone + pyroxasulfone. Green foxtail was controlled only by the tank mix of glyphosate + carfentrazone + pyroxasulfone. This was due to the ingredient pyroxasulfone in the tank-mix which provides residual control of grasses and some small-seeded broadleaf weeds. Pyroxasulfone works best when there is a minimum of one-half inch of rainfall in the week following application. At Hettinger, 2.9 inches of rainfall occurred in the week following treatment application. There was no significant difference in yield in this trial due to herbicide treatment. Weed populations were light and growing conditions in Hettinger were good so that the presence of weeds did not cause significant yield losses. Although, yield in the untreated plot was the lowest of all treatments.

Table. Comparison of pre-plant burndown herbicide treatments for weed control and wheat yield at Hettinger ND.

Treatment <sup>1</sup>	Rate oz/A	Downy	Shepherds	Prickly	Kochia	Lambs	Green	Wheat	
		brome	purse	Flixweed	lettuce	quarters	foxtail	Yield	
		% control <sup>2</sup>							bu/acre
1 Untreated		0 d	0 d	0 d	0 d	0 f	0 b	34	
2 Gramoxone SL 2.0	32	100 a	89 b	100 a	100 a	69 de	61 de	47	
3 Gramoxone SL 2.0 + 2,4-D LV6	32+16	100 a	91 b	98 ab	100 a	65 cd	65 cd	47	
4 Gramoxone SL 2.0 + Sharpen	32+2	100 a	99 a	99 a	100 a	77 bc	78 bc	52	
5 Roundup PowerMax	24	100 a	100 a	100 a	100 a	71 bcd	70 bcd	46	
6 Roundup PowerMax + 2,4-D LV6	24+16	100 a	100 a	100 a	100 a	65 bcd	68 bcd	50	
7 Roundup PowerMax + Sharpen	24+2	100 a	99 a	100 a	100 a	78 b	80 b	47	
8 Roundup PowerMax + Aim	24+2	100 a	100 a	100 a	100 a	71 bc	62 de	44	
9 Roundup PowerMax + Anthem Flex	24+4	100 a	100 a	100 a	100 a	98 a	95 a	48	
10 Roundup PowerMax + Quelex	24+0.75	100 a	100 a	100 a	100 a	78 bcd	66 b	47	
11 Roundup PowerMax + Elevore	24+1	100 a	100 a	100 a	100 a	63 bcd	68 bcd	47	
12 Roundup PowerMax + Starane Ultra + Elevore	24+4.5+1	100 a	100 a	100 a	100 a	75 de	60 b	45	
13 Section Three + Elevore	5.3+1	87 b	76 c	90 c	37 c	56 de	59 cd	42	
14 Section Three + Starane Ultra + Elevore	5.3+4.5+1	78 c	78 c	93 bc	83 b	66 bc	79 bc	46	
LSD P=.05		3.3	6.3	6.0	9.1	16.2	14.5	0.9	
Standard Deviation		2.75	5.3	5.1	7.7	13.6	12.2	0.8	
Treatment Probability (F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.4811	

<sup>1</sup> NIS (0.5% v/v) was added to treatments 2 and 3; MSO (1% v/v) was added to treatments 4, and 7-14; AMS (17 lbs/100 gal) was added to treatments 5-14.

<sup>2</sup> Downy brome, shepherds purse, flixweed, and prickly lettuce were evaluated 18 days after treatment. Kochia, common lambsquarters, and green foxtail were evaluated 31 days after treatment.

## **Flax Response to Preemergence Herbicides Hettinger Research Extension Center**

Flax “Carter” was planted at a seeding rate of 40 lbs/acre on May 6, 2019 using a no-till planter to a depth of 1.5 inches. Preemergence herbicide treatments were applied immediately after planting using a tractor-mounted research sprayer at a spray volume of 10 gallons per acre. In the week following application 0.44 inches of rainfall occurred. Flax emerged on May 23. In the period between planting and flax emergence 3.3 inches of rainfall occurred. Rainfall was more than adequate to move the herbicides into the soil for activation. At 12 days after flax emergence, injury was apparent from nearly all herbicides. Although most herbicides caused minor injury, the herbicides Fierce and Valor, which contain the active ingredient flumioxazin, caused major damage to the flax (84%) mostly related to reduction in flax stand. At 33 days after flax emergence, Zidua and Spartan + Zidua, caused low to moderate injury to flax (8 and 18%). At 48 days after emergence, injury was observed only with Fierce and Valor. This injury was apparent in flax stand counts, which were reduced 50% compared to the untreated control. Flax height was not reduced by herbicide treatments, indicating that herbicides were more active during the germination and emergence growth stages and did not cause continued injury following crop emergence. Control of wild buckwheat, common mallow, and kochia were also evaluated. Wild buckwheat was control best with Zidua, Spartan + Zidua, BroadAxe + Dual, Fierce, Prowl, and Valor. Common mallow was control best following application of Zidua, Spartan + Zidua, BroadAxe + Dual, Fierce, and Valor. Kochia was controlled 88 to 100% by all herbicide treatments except Warrant (70%) and Dual II Magnum (63%). Application of Fierce reduced flax yield by 46%, but yield was reduced by just 22% following application of Valor. All other treatments yielded similarly to the untreated control. At Hettinger, growing conditions were cool and wet with nearly 20 inches of rainfall during the growing season and only one day where temperature exceeded 90 F. These conditions were ideal for testing flax herbicide tolerance to preemergence herbicides, but they also allowed the flax to recover somewhat, which reduced yield losses.

**Note: the vast majority of the treatments listed in this trial are experimental and are not labelled for use in flax. Only use herbicides that have been labelled for use in flax crop.**



Table. Comparison of preemergence herbicides applied to flax. Flax ‘Carter’ was evaluated for injury from herbicide treatments and resulting yield. Weed control was also evaluated.

Treatment	Rate	12 DAE <sup>1</sup>			33 DAE			48 DAE			Flax	Flax	Wild	Common	Kochia	Flax Yield
		Stand	Height	buckwheat	stand	Height	mallo	stand	Height	mallo	plants/m	cm	buckwheat	mallo	stand	lbs/acre
	oz/A	% injury			% control											
1 Untreated		0 d	0 d	0 b	29 a	57.8 -	0 e	0 e	0 d						1495 ab	
2 Zidua	3	10 bc	8 c	0 b	34 a	59.8 -	80 a	79 ab	90 a						1506 ab	
3 Spartan + Zidua	4 +1.5	15 b	18 b	1.3 b	32 a	58.8 -	76 ab	85 a	96 a						1645 ab	
4 Warrant	48	1.3 cd	3.8 cd	0 b	34 a	57.3 -	55 d	59 d	70 bc						1430 b	
5 Dual II Magnum	24	7.5 bcd	4.3 cd	0 b	27 a	58.2 -	63 cd	64 cd	63 c						1445 ab	
6 BroadAxe + Dual	22.8 + 5.2	8 bcd	1.3 d	0 b	30 a	58.6 -	80 a	91 a	100 a						1692 a	
7 Fierce	3	84 a	79 a	68 a	14 b	58.1 -	73 ab	90 a	100 a						812 d	
8 Prowl H2O	24	7 bcd	1.3 d	1.3 b	32 a	57.6 -	75 ab	68 bcd	96 a						1451 ab	
9 Valor	2	84 a	78 a	68 a	15 b	59.3 -	75 ab	78 abc	94 a						1165 c	
10 Outlook	18	3.8 cd	0 d	0 b	30 a	59.4 -	68 bc	55 d	88 ab						1391 bc	
LSD P=.05		9.06	5.80	3.48	82.85	2.36	9.96	13.96	19						255.87	
Standard Deviation		6.24	4.00	2.40	57.11	1.63	6.86	9.62	13.1						176.36	
Treatment Probability (F)		0.0001	0.0001	0.0001	0.0001	0.4528	0.0001	0.0001	0.0001						0.0001	

<sup>1</sup> DAE, days after emergence.

**Flax Response to Postemergence Herbicides  
Hettinger Research Extension Center**

Flax “Carter” was seeded at a rate of 40 lbs/acre on May 6, 2019 using a no-till drill to a depth of 1.5 inches. Flax emerged on May 23. Postemergence herbicide treatments were applied on June 6 using a tractor-mounted research sprayer at a spray volume of 10 gallons per acre. Rainfall totaling 0.45 inches occurred on June 7, with rainfall beginning 38 hours after application, which should not have had any impact on herbicides applied. Flax was evaluated for injury at 8, 15, and 34 days after treatment (DAT). Talinor was excessively injurious to flax causing bleaching and necrosis of leaves. Armezon also caused bleaching injury, but was only moderate to minor injury. This injury was hardly noticeable at 15 DAT and not detected at 34 DAT. Bison caused minor injury in the form of leaf burn. Armezon + Bison was more injurious than either alone. Basagran caused little or no injury to flax. Raptor alone resulted in stunting and yellowing of flax. When Raptor was combined with Basagran this injury was reduced. Even with the observed injury, flax height was not measurably reduced 42 DAT. Wild buckwheat was best controlled with Talinor at 18.2 oz/acre, Bison, Bison + Armezon, and Raptor. However, none of the treatments provided good control of wild buckwheat. Common mallow was best controlled with Raptor or Raptor + Basagran. Even with the serious visual injury caused by the application of Raptor, flax yield was greatest with this treatment. Also yielding similar to Raptor alone was Basagran alone and Armezon + Bison. These yields were in part due to improved weed control that resulted from these treatments. However, it is remarkable at how well flax is able to overcome severe visual injury, especially under good growing conditions.

**Note: the vast majority of the treatments listed in this trial are experimental and are not labelled for use in flax. Only use herbicides that have been labelled for use in flax or any other crop.**

Table. Comparison of postemergence applied herbicides in flax. Flax ‘Carter’ was evaluated for injury and resulting yield from herbicide treatments and weed control was also evaluated.

Treatment	Rate	8 DAT <sup>1</sup>	15 DAT	34 DAT	Flax Height	Wild buckwheat	Common mallow	Flax Yield
	oz/A	—————% injury—————			cm	—————% control—————		lbs/acre
1 Untreated		0 d	0 c	0 d	58 -	0 e	0 f	899 f
2 Talinor	13.7	49 a	48 a	33 a	55 -	59 c	50 d	986 def
3 Talinor	18.2	58 a	40 a	19 b	59 -	75 ab	73 bc	1119 cdef
4 Armezon	0.5	5.5 d	2.5 c	0 d	58 -	0 e	0 f	934 ef
5 Armezon	0.75	11 cd	2.8 c	0 d	58 -	0 e	0 f	778 f
6 Bison	16	8.8 d	1.3 c	0 d	60 -	75 ab	54 cd	1367 bcd
7 Armezon+Bison	0.75 + 16	25 b	21.3 b	9 bcd	60 -	78 a	82 ab	1640 ab
8 Basagran	16	2 d	0 c	0 d	59 -	39 d	28 e	1478 abc
9 Raptor	4	23 bc	39 a	11 bc	59 -	75 ab	93 a	1804 a
10 Basagran + Raptor	16 + 4	9 d	7.5 c	2.5 cd	58 -	65 bc	92 a	1344 bcde
LSD P=.05		12.01	11.82	10.28	3.69	19.49	10.58	424.6
Standard Deviation		8.33	8.21	7.14	2.56	13.53	7.34	295.14
Treatment Prob(F)		0.0001	0.0001	0.0001	0.3217	0.0001	0.0001	0.0001

<sup>1</sup> DAE, days after emergence.

**Timing of glyphosate application in Roundup Ready Canola  
Hettinger Research Extension Center**

A trial comparing different timings for glyphosate application to Roundup Ready Canola was conducted at the Hettinger Research Extension Center. A single application of glyphosate (Roundup PowerMax) was applied prior to planting, at planting, at the 1-2 leaf stage, or at the 3-4 leaf stage. Sequential applications of glyphosate were also evaluated and included the following combinations: prior to planting and at the 3 to 4 leaf stage, prior to planting and at the 5-6 leaf stage, just after planting and at the 3-4 leaf stage, and just after planting and at the 5 to 6 leaf stage. Weeds present at time of application were controlled regardless of application timing. Canola was harvested on August 23 using a plot combine with a 5 foot header. With a single application of glyphosate, timing was important and the 1 to 2 leaf stage of canola had the highest yield when using a single application. A single application just before planting or just after planting yielded 26 to 33% less than when applied at the 1-2 leaf stage. Canola yield was not statistically greater with sequential applications, compared with a single application at the 1 to 2 leaf stage.

Table. Comparison of glyphosate application timing on canola yield at the Hettinger Research Extension Center.

Treatment <sup>1</sup>	Rate oz/A	Timing	Canola Yield
1 Untreated			342 d
2 Roundup PowerMax	22	0-3 days before planting	927 bc
3 Roundup PowerMax	22	0-3 days before planting	1439 a
Roundup PowerMax	15	3 to 4 leaf stage	
4 Roundup PowerMax	22	0-3 days before planting	1309 a
Roundup PowerMax	15	5 to 6 leaf stage	
5 Roundup PowerMax	22	0 to 3 days after planting	838 c
6 Roundup PowerMax	22	0 to 3 days after planting	1372 a
Roundup PowerMax	15	3 to 4 leaf stage	
7 Roundup PowerMax	22	0 to 3 days after planting	1170 ab
Roundup PowerMax	15	5 to 6 leaf stage	
8 Roundup PowerMax	15	1 to 2 leaf stage	1254 a
9 Roundup PowerMax	15	1 to 2 leaf stage	1209 ab
Roundup PowerMax	15	5 to 6 leaf stage	
10 Roundup PowerMax	15	3 to 4 leaf stage	1207 ab
LSD P=.05			281
Standard Deviation			192
Treatment Prob(F)			0.0001

<sup>1</sup> Ammonium Sulfate (AMS) was included with all glyphosate treatments at a rate of 17 lbs per 100 gallons of spray solution.

## **Comparison of Fall versus Spring Preemergence Herbicide Application in Field Pea Hettinger Research Extension Center**

Preemergence herbicides sulfentrazone and metolachlor were applied in the fall or in the spring to compare weed control and field pea response. The fall application occurred on October 17, 2018. Spring application occurred just after planting on May 6, 2019. Field pea ‘Salamanca’ was seeded at a rate of 146 lbs/acre at a depth of 2 inches using a no-till drill. Peas emerged on May 25. All preemergence herbicides were tank mixed with glyphosate (Cornerstone Plus at 32 oz/A). Peas were evaluated for visible injury due to herbicide treatments and no injury was observed during any evaluation. Fall applications were very effective at controlling downy brome resulting in 90% or better control 3 days before planting. Spring applications were also very effective at controlling downy brome with control being greater than 90% at 25 days after treatment (DAT), with the fall application of glyphosate alone being the only treatment with reduced downy brome control (85%). Wild buckwheat was control fairly well BroadAxe treatments with spring applications providing better control than fall. This was especially apparent at 39 DAT. However fall applied BroadAxe controlled wild buckwheat much better than fall applications of Dual or glyphosate alone. Kochia control 25 DAT was fairly similar comparing fall with spring applications of BroadAxe. However, at 39 DAT, it was apparent that fall applied herbicides were losing their effectiveness and control was less than spring applications in most cases. All herbicide treatments increased yield compared with the untreated control. However, spring applications generally resulted in greater yield compare with fall applications. The benefit of fall application is that fields have fewer weeds in the spring at planting reducing need for herbicide application prior to planting. The benefit is even greater under dry spring conditions where activity of spring herbicides is reduced due to lack of rainfall. In this trial, more than adequate rainfall occurred for activity of spring applied herbicides, reducing the benefit of fall application. Further, the high amount of rainfall that occurred likely reduced weed control from fall applied preemergence herbicides through dilution in the soil.

Table. Comparison of fall and spring applied preemergence herbicides for weed control in field peas at the Hettinger Research Extension Center.

Treatment	Rate oz/A	Timing <sup>2</sup>	Downy Brome			Wild buckwheat			Kochia			Common mallow		
			-3 DAT <sup>1</sup>	25 DAT	25 DAT	25 DAT	39 DAT	25 DAT	39 DAT	25 DAT	39 DAT	53 DAT	53 DAT	Pea Yield bu/acre
1 Untreated			0 d	0 c	0 d	0 f	0 c	0 f	0 f	0 f	0 f	0 f	0 f	35 f
2 BroadAxe	19	Fall	97 ab	91 ab	84 ab	70 bc	95 a	79 ab	79 ab	60 bc	60 bc	60 bc	60 bc	49 bc
3 BroadAxe	25	Fall	99 ab	94 ab	88 a	71 bc	89 a	75 bc	75 bc	76 ab	76 ab	76 ab	76 ab	42 def
4 BroadAxe + Dual	19 + 10	Fall	100 a	91 ab	67 b	48 de	86 a	63 cd	63 cd	64 bc	64 bc	64 bc	64 bc	48 bcd
5 BroadAxe + Dual	19 + 26	Fall	100 a	93 ab	70 b	35 e	85 a	48 e	48 e	71 ab	71 ab	71 ab	71 ab	47 bcde
6 Dual	32	Fall	100 a	94 a	36 c	8 f	34 b	9 f	9 f	6 ef	6 ef	6 ef	6 ef	46 bcde
7 Glyphosate	32	Fall	96 b	85 b	10 d	0 f	15 c	0 f	0 f	0 f	0 f	0 f	0 f	41 ef
8 Glyphosate	32	Fall+Spring	90 c	96 a	91 a	60 cd	93 a	63 cd	63 cd	21 de	21 de	21 de	21 de	52 ab
9 BroadAxe	19	Spring	0 d	95 a	97 a	90 a	96 a	91 a	91 a	83 a	83 a	83 a	83 a	49 bc
10 BroadAxe	25	Spring	0 d	94 a	96 a	89 a	97 a	89 a	89 a	87 a	87 a	87 a	87 a	57 a
11 BroadAxe + Dual	10 + 16	Spring	0 d	94 ab	94 a	79 ab	95 a	82 ab	82 ab	77 ab	77 ab	77 ab	77 ab	50 abc
12 BroadAxe + Dual	10 + 26	Spring	0 d	96 a	94 a	80 ab	92 a	80 ab	80 ab	78 ab	78 ab	78 ab	78 ab	45 cde
13 Dual	32	Spring	0 d	98 a	94 a	61 cd	87 a	60 de	60 de	51 c	51 c	51 c	51 c	51 abc
14 Glyphosate	32	Spring	0 d	95 a	93 a	63 c	88 a	55 de	55 de	28 d	28 d	28 d	28 d	50 abc
LSD P=.05			3.9	8.1	16.1	13.36	17.5	11.8	11.8	18.13	18.13	18.13	18.13	6.9
Standard Deviation			2.74	5.65	11.28	9.34	12.21	8.26	8.26	12.68	12.68	12.68	12.68	4.85
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002

<sup>1</sup> DAT, days after treatment (spring application on May 6).

<sup>2</sup> Fall treatments were applied on October 17, 2018 and spring treatments were applied on May 6, 2019.

## Comparison of Preemergence Herbicides for Weed Control in Field Pea Hettinger Research Extension Center

Preemergence herbicides were applied in the spring after planting to compare weed control and field pea response. Field pea ‘Salamanca’ was seeded at a rate of 146 lbs/acre at a depth of 2 inches using a no-till drill on May 6, 2019. Peas emerged on May 25. All preemergence herbicides were tank mixed with glyphosate (Roundup PowerMax at 22 oz/A). Peas were evaluated for visible injury due to herbicide treatments and no injury was observed during any evaluation. All treatments provided good to excellent control of downy brome. At 34 days after crop emergence, most herbicide treatments provided good control of wild buckwheat, with the exception of Anthem Flex (carfentrazone + pyroxasulfone). Kochia was control 84 to 93% with all preemergence herbicide treatments. Common mallow control was fair to good with all herbicide treatments, with the best control following application of Authority Supreme HL (sulfentrazone + pyroxasulfone), but this treatment was similar in control to all but Sharpen (saflufenil), and Anthem Flex at 3 oz/A. There was no difference in field pea stand, and yield was only reduced in the untreated plots. Herbicide activity in 2019 was aided by higher than normal rainfall. Under lower rainfall conditions, reduced weed control would likely occur. However, under these conditions, field pea showed tolerance to all of the herbicides used in this trial.

Table. Comparison of preemergence herbicides for weed control in field peas at the Hettinger Research Extension Center.

Treatment	Rate oz/A	Downy Brome		Wild buckwheat		Kochia		Common mallow		Stand plants/m <sup>2</sup>	Field Pea Yield bu/acre
		10 DAE <sup>1</sup>	10 DAE	34 DAE	10 DAE	34 DAE	34 DAE	% control			
1 Untreated		0 f	0 e	0 c	0 b	0 b	0 d	0 d	58 -	17 b	
2 Authority Supreme	5.8	98 ab	81 bcd	84 a	95 a	92 a	79 ab	72 -	55 a		
3 Authority Supreme HL	4.4	99 a	86 ab	83 a	96 a	91 a	83 a	67 -	56 a		
4 Spartan Elite	19	91 de	86 ab	87 a	99 a	88 a	76 abc	74 -	54 a		
5 Spartan Charge	3.75	91 d	86 ab	81 a	99 a	91 a	76 abc	76 -	55 a		
6 Sharpen	2	87 e	91 a	78 a	93 a	84 a	73 bc	75 -	56 a		
7 Anthem Flex	3	96 abc	76 cd	66 b	97 a	90 a	68 c	71 -	46 a		
8 Anthem Flex	4.5	93 cd	83 abc	66 b	99 a	93 a	82 a	68 -	49 a		
9 Dual + Metribuzin	27 + 4	97 abc	73 d	76 ab	100 a	89 a	75 abc	65 -	53 a		
10 Roundup PowerMax	22	94 bcd	0 e	0 c	0 b	0 b	0 d	74 -	51 a		
LSD P=.05		4.6	4.1	11.0	8.6	16.3	8.4	NS	12.7		
Standard Deviation		3.15	2.8	7.6	6.0	11.3	5.8	9.8	8.76		
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2776	0.0001		

<sup>1</sup> DAE, days after emergence (field pea planted on May 6; emerged on May 25).

## **Comparison of Preemergence Herbicides for Weed Control in Lentil Hettinger Research Extension Center**

Preemergence herbicides were applied in the spring after planting to compare weed control and lentil response. Lentil 'Invincible' was seeded at a rate of 18 seeds/ft<sup>2</sup> at a depth of 2 inches using a no-till drill on May 10, 2019. Lentil emerged on May 21. All preemergence herbicides were tank mixed with glyphosate (Roundup PowerMax at 22 oz/A). Lentil were evaluated for visible injury due to herbicide treatments. At 14 days after emergence, moderate injury of 8 to 19% was observed in many of the treatments in the form of leaf bronzing. This injury diminished over time and was no more than 10% at 42 days after lentil emergence. All treatments provided good to excellent control of downy brome and prickly lettuce. Wild buckwheat control 28 DAE was greatest with Anthem Flex + Metribuzin at 4 +8 oz/A or Anthem Flex at 6 oz/A. Kochia control was improved when Metribuzin was tank mixed with Anthem Flex or when Anthem Flex was applied alone at 6 oz/A. Some treatments had a slight reduction in lentil stand due to herbicide treatment but there was no difference in lentil height. Yield was reduced nearly 100% in the untreated control. With herbicide treatments, lentil yield ranged from 31 to 36 bu/A. Yield with Anthem Flex + Metribuzin at 4+8 oz/A was the lowest of all herbicide treatments at 31 bu/A. Herbicide activity in 2019 was aided by higher than normal rainfall. More than 2.4 inches of rainfall occurred in between planting and crop emergence. Under lower rainfall conditions, reduced weed control would likely occur. Under these conditions, injury to lentil was apparent early in the season but this injury was less noticeable later in the season showing good tolerance to all herbicide treatments. Good growing conditions of higher than normal rainfall and cooler than normal temperatures resulted in high yield for lentil.

Table. Comparison of preemergence herbicides for weed control in lentil at the Hettinger Research Extension Center.

Treatment	Rate	Lentil					Wild buckwheat					Kochia					Wild oat					Stand	Height	Yield
		14 DAE <sup>1</sup>	14 DAE	28 DAE	28 DAE	42 DAE	14 DAE	28 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE	42 DAE				
oz/A		%control																				plants/m <sup>2</sup>	cm	bu/acre
1	Untreated	0 g	0 c	0 d	0 b	0 d	0 b	0 d	0 b	0 b	113 f	39 -	0.2 c											
2	Anthem Flex	3.5	8 c-f	100 a	85 c	87 d	88 abc	84 a	153 a-e	35 -	35 a													
3	Anthem Flex	4	17 ab	99 ab	89 bc	91 cd	85 c	77 a	142 de	34 -	33 ab													
4	AF + Metribuzin	3.5+4	13 a-d	99 ab	86 c	95 abc	92 abc	83 a	140 e	35 -	36 a													
5	AF + Metribuzin	4+4	12 bcd	100 a	88 c	95 abc	93 ab	79 a	152 a-e	35 -	35 ab													
6	AF + Metribuzin	3.5+5.3	3 fg	96 b	85 c	98 ab	91 abc	80 a	150 b-e	35 -	35 ab													
7	AF + Metribuzin	4+5.3	19 a	99 ab	89 bc	97 abc	95 a	82 a	148 cde	35 -	36 a													
8	AF + Metribuzin	3.5+8	7 def	100 a	91 bc	96 abc	94 a	79 a	161 abc	37 -	36 a													
9	AF + Metribuzin	4+8	16 ab	100 a	98 a	99 a	93 ab	80 a	157 a-d	35 -	31 b													
10	Anthem Flex	6	13 abc	99 ab	95 ab	96 abc	93 ab	84 a	149 b-e	34 -	33 ab													
11	Dual + Metribuzin	27+4	4 efg	98 ab	87 c	92 bcd	87 bc	0 b	166 a	36 -	37 a													
LSD P=.05		5.9	3.5	6.3	6.1	6.7	7.1	17.5	NS	4.2														
Standard Deviation		4.9	2.9	5.3	5.1	5.6	5.9	14.6	1.7	3.5														
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2776	0.1158	0.0001														

<sup>1</sup> DAE, days after emergence lentil planted on May 10; emerged on May 21).



## **Preemergence Herbicides for Weed Control in Lentil Hettinger Research Extension Center**

Preemergence herbicides were applied in the spring after planting to compare weed control and lentil response. Lentil 'Invincible' was seeded at a rate of 18 seeds/ft<sup>2</sup> at a depth of 2 inches using a no-till drill on May 10, 2019. Lentil emerged on May 21. All preemergence herbicides were tank mixed with glyphosate (Roundup PowerMax at 22 oz/A). Lentil were evaluated for visible injury due to herbicide treatments. At 9 days after emergence (DAE), 49% injury was observed in the Spartan Charge + Dual (5+27 oz/A) treatment, injury in other treatments was 10% or less. At 22 DAE, Injury was 60% in the Spartan Charg + Dual treatment. Injury in other treatments ranged from 13 to 20%. Injury from these treatments was high due to the high amount of rainfall that occurred after treatments were applied. At 36 DAE, injury was less than at 22 DAE and lentil appeared to be recovering. All treatments provided excellent control of downy brome and prickly lettuce. Kochia control was 85 to 92% at 36 DAE. Wild buckwheat control ranged 86 to 91% in all herbicide treatments at 36 DAE. Lentil were harvested on August 22. Even though injury to lentil was moderate with many of the herbicide treatments, yield was reduced only with the Spartan Charge+Dual (5+27 oz/A) treatment (15 bu/A) or when weeds were not controlled. Yield with other herbicide treatments ranged from 30 to 35 bu/A. Herbicide activity in 2019 was aided by higher than normal rainfall. More than 2.4 inches of rainfall occurred in between planting and crop emergence. Under lower rainfall conditions, reduced weed control would likely occur. Under these conditions, injury to lentil was apparent early in the season but this injury was less noticeable later in the season showing good tolerance to all herbicide treatments except the Spartan Charge treatment. Good growing conditions of higher than normal rainfall and cooler than normal temperatures resulted in high yield for lentil.

Table. Comparison of preemergence herbicides for weed control in lentil at the Hettinger Research Extension Center.

Treatment	Rate	% control					#/m <sup>2</sup>	bu/acre
		Lentil	Wild buckwheat	Kochia	Stand	Yield		
1 Untreated		0 e	0 c	0 c	0 c	0 d	132 c	5.2 c
2 Sharpen+Outlook+Metribuzin	0.75+2+4	14 d	96 a	91 a	94 a	91 a	156 abc	30 a
3 Anthem Flex+Metribuzin	4+4	19 b	92 a	86 a	94 a	92 a	154 abc	31 a
4 Sharpen+Metribuzin+Prowl H2O	0.75+4+32	10 d	91 ab	86 a	89 ab	88 ab	172 ab	31 a
5 Sharpen+Dual+Metribuzin	0.75+27+4	21 b	91 ab	86 a	91 ab	92 a	175 a	34 a
6 Sharpen+Metribuzin+Zidua SC	0.75+4+3.25	14 cd	94 a	88 a	94 a	91 a	162 ab	33 a
7 Sharpen+Metribuzin+Zidua SC	0.75+4+5	18 bc	92 ab	81 a	92 ab	88 a	149 bc	31 a
8 Spartan Charge+Dual	5+27	60 a	97 a	91 a	95 a	80 b	131 c	15 b
9 Roundup PowerMax	24	0 e	85 b	80 b	73 b	70 c	164 ab	32 a
LSD P=.05		4.1	7.2	7.6	6.7	8.1	25	5.4
Standard Deviation		3.4	6.0	6.3	5.5	6.7	21	4.5
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

<sup>1</sup> DAE, days after emergence lentil planted on May 10; emerged on May 21.

## **Evaluation of Postemergence Weed Control Options in Soybean in Southwest North Dakota Hettinger Research Extension Center**

A trial comparing different postemergence options for weed control in dicamba tolerant soybean was conducted at the Hettinger Research Extension Center. Soybean 'AsGrow 03X7' were planted at a rate of 180,000 seed per acre on June 8, 2019 using a John Deere planter in 30 inch rows at a depth of 1.5 inches. Prior to planting, weeds were controlled with an application of glyphosate (Roundup PowerMax at 28 oz/A). Nine postemergence herbicide treatments were compared with and untreated control. Treatments were applied on July 8, 2019 using a tractor-mounted research sprayer using a spray volume of 15 gallons per acre using Turbo T-Jet Air Induction (TTI) nozzles. Weed control from burndown treatments was evaluated 16 and 37 days after treatment (DAT). Green foxtail was controlled 92% or more with all treatments except Engenia (dicamba) alone, Pursuit alone, or Engenia + Pursuit. As dicamba does not have any activity on grasses and Pursuit is primarily a broadleaf herbicide, this was not a surprise. Kochia was only control 63% with Roundup PowerMax (RU) at 28 oz/acre. This increased to 82% at the 42 oz/acre rate. RU + Anthem and Pursuit alone provided poor control of kochia. Wild buckwheat was controlled best with RU at 48 oz/A, RU + Engenia, RU + Engenia + Anthem, and Engenia + Pursuit. Field bindweed was controlled 78% at best by the RU + Engenia treatment. Soybean yield was highly variable due to differences in weed competition between plots. All treatments yielded more than the untreated control, but yields with Pursuit alone and Engenia + Pursuit were less than the highest yielding treatment. Rainfall during the summer of 2019 was well above average and temperature was below normal. This reduced the impact of weeds on soybean production. The number of soybean acres is increasing in southwest North Dakota. Controlling weeds will be important for economic production of this crop in this region. This will include a good preplant burndown of weeds prior to planting and will need to be followed with a postemergence herbicide application. Dicamba tolerant soybean may be a good option for controlling difficult weeds, such as kochia and prickly lettuce. As in other regions of the state where soybean are grown, applicators need to be careful not to impact nearby sensitive crops or other sensitive areas (trees, gardens, etc.) when applying dicamba.

Table. Comparison of postemergence herbicides for weed control in soybean at the Hettinger Research Extension Center.

Treatment <sup>1</sup>	Rate	Green foxtail		Kochia		Wild buckwheat		Field bindweed		Soybean	
		16 DAT <sup>2</sup>	37 DAT	16 DAT	37 DAT	16 DAT	37 DAT	16 DAT	37 DAT	Yield	
		oz/A _____ %control _____ bu/acre _____									
1 Untreated		0 d	0 d	0 d	0 d	0 e	0 g	0 f	0 d	0 d	7.4 c
2 Roundup PowerMax	28	98 a	92 ab	70 bc	63 c	70 b	71 cd	67 bc	66 b	37 a	
3 Roundup PowerMax	42	99 a	96 a	86 a	82 ab	81 ab	77 abc	80 a	74 ab	28 ab	
4 Engenia	12.8	0 d	0 c	83 ab	84 ab	81 ab	75 bcd	75 ab	72 ab	30 ab	
5 RU <sup>3</sup> + Engenia	28+12.8	100 a	98 a	87 a	88 ab	82 a	82 ab	76 ab	78 a	27 ab	
6 RU <sup>3</sup> + Anthem	28+10	98 a	96 a	66 c	55 c	70 b	68 d	68 bc	70 ab	24 ab	
7 RU <sup>3</sup> + Engenia + Anthem	28+12.8+10	98 a	98 a	85 ab	84 a	80 ab	79 abc	81 a	76 ab	29 ab	
8 Pursuit	3	55 c	83 b	60 c	44 d	55 c	50 e	61 c	54 c	20 bc	
9 RU <sup>3</sup> + Pursuit	28+3	100 a	100 a	81 a	77 b	68 bc	78 abc	74 abc	72 ab	30 ab	
10 Engenia + Pursuit	12.8+3	72 b	68 c	85 a	88 a	80 ab	85 a	74 abc	71 ab	21 bc	
LSD P=.05		12.8	12.7	8.4	9.8	8.5	7.7	11.4	11	14.5	
Standard Deviation		8.8	8.7	5.7	6.7	5.9	5.3	7.8	7.5	9.9	
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0313	

<sup>1</sup> Ammonium Sulfate (AMS) was included with treatments 2, 3, and 6; NIS (0.25% v/v) was included in treatments 2, 3, 4, 5, 6, and 7; MSO (1.5 pt/A) was included with treatments 8, 9, and 10.

<sup>2</sup> DAT, days after treatment (treatments applied on July 8, soybean planted on June 10).

<sup>3</sup> RU, Roundup PowerMax

## **Evaluation of Postemergence Weed Control Options in Soybean in Southwest North Dakota Hettinger Research Extension Center**

A trial comparing different postemergence options for weed control in dicamba tolerant soybean was conducted at the Hettinger Research Extension Center. Soybean 'AsGrow 03X7' were planted at a rate of 180,000 seed per acre on June 8, 2019 using a John Deere planter in 30 inch rows at a depth of 1.5 inches. Prior to planting, weeds were controlled with an application of glyphosate (Roundup PowerMax at 28 oz/A). Nine postemergence herbicide treatments were compared with and untreated control. Treatments were applied on July 8, 2019 using a tractor-mounted research sprayer using a spray volume of 15 gallons per acre using Turbo T-Jet Air Induction (TTI) nozzles. Weed control from burndown treatments was evaluated 16 and 37 days after treatment (DAT). Green foxtail was controlled 92% or more with all treatments except Engenia (dicamba) alone, Pursuit alone, or Engenia + Pursuit. As dicamba does not have any activity on grasses and Pursuit is primarily a broadleaf herbicide, this was not a surprise. Kochia was only control 63% with Roundup PowerMax (RU) at 28 oz/acre. This increased to 82% at the 42 oz/acre rate. RU + Anthem and Pursuit alone provided poor control of kochia. Wild buckwheat was controlled best with RU at 48 oz/A, RU + Engenia, RU + Engenia + Anthem, and Engenia + Pursuit. Field bindweed was controlled 78% at best by the RU + Engenia treatment. Soybean yield was highly variable due to differences in weed competition between plots. All treatments yielded more than the untreated control, but yields with Pursuit alone and Engenia + Pursuit were less than the highest yielding treatment. Rainfall during the summer of 2019 was well above average and temperature was below normal. This reduced the impact of weeds on soybean production. The number of soybean acres is increasing in southwest North Dakota. Controlling weeds will be important for economic production of this crop in this region. This will include a good preplant burndown of weeds prior to planting and will need to be followed with a postemergence herbicide application. Dicamba tolerant soybean may be a good option for controlling difficult weeds, such as kochia and prickly lettuce. As in other regions of the state where soybean are grown, applicators need to be careful not to impact nearby sensitive crops or other sensitive areas (trees, gardens, etc.) when applying dicamba.

Table. Comparison of postemergence herbicides for weed control in soybean at the Hettinger Research Extension Center.

Treatment <sup>1</sup>	Rate	Green foxtail		Kochia		Wild buckwheat		Field bindweed		Soybean	
		16 DAT <sup>2</sup>	37 DAT	16 DAT	37 DAT	16 DAT	37 DAT	16 DAT	37 DAT	Yield	
		oz/A _____ %control _____ bu/acre									
1 Untreated		0 d	0 d	0 d	0 e	0 g	0 f	0 d	0 d	0 d	7.4 c
2 Roundup PowerMax	28	98 a	92 ab	70 bc	63 c	70 b	71 cd	67 bc	66 b	37 a	
3 Roundup PowerMax	42	99 a	96 a	86 a	82 ab	81 ab	77 abc	80 a	74 ab	28 ab	
4 Engenia	12.8	0 d	0 c	83 ab	84 ab	81 ab	75 bcd	75 ab	72 ab	30 ab	
5 RU <sup>3</sup> + Engenia	28+12.8	100 a	98 a	87 a	88 ab	82 a	82 ab	76 ab	78 a	27 ab	
6 RU <sup>3</sup> + Anthem	28+10	98 a	96 a	66 c	55 c	70 b	68 d	68 bc	70 ab	24 ab	
7 RU <sup>3</sup> + Engenia + Anthem	28+12.8+10	98 a	98 a	85 ab	84 a	80 ab	79 abc	81 a	76 ab	29 ab	
8 Pursuit	3	55 c	83 b	60 c	44 d	55 c	50 e	61 c	54 c	20 bc	
9 RU <sup>3</sup> + Pursuit	28+3	100 a	100 a	81 a	77 b	68 bc	78 abc	74 abc	72 ab	30 ab	
10 Engenia + Pursuit	12.8+3	72 b	68 c	85 a	88 a	80 ab	85 a	74 abc	71 ab	21 bc	
LSD P=.05		12.8	12.7	8.4	9.8	8.5	7.7	11.4	11	14.5	
Standard Deviation		8.8	8.7	5.7	6.7	5.9	5.3	7.8	7.5	9.9	
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0313	

<sup>1</sup> Ammonium Sulfate (AMS) was included with treatments 2, 3, and 6; NIS (0.25% v/v) was included in treatments 2, 3, 4, 5, 6, and 7; MSO (1.5 pt/A) was included with treatments 8, 9, and 10.

<sup>2</sup> DAT, days after treatment (treatments applied on July 8, soybean planted on June 10).

<sup>3</sup> RU, Roundup PowerMax

## Acidic Soil in Southwestern North Dakota

Ryan Buetow

As awareness of the impacts of soil acidity continues to spread and we change our soil sampling techniques to better assess the issue, we are finding more and more fields diagnosed with low pH here in western North Dakota. Many soils near Dickinson, ND have portions of soil below 5.5 and in some cases below 4. As this is a soil chemistry issue, the best management option is to lime the soil to raise the pH closer to neutral and reduce N use to slow acidification. While this may seem like a simple solution to some, lime sources aren't abundant everywhere and with the large change needed this could be a costly endeavor. Many are reluctant to spend the money for liming, especially on rented acres. The main issue impacting crop growth in these low pH areas is the increased solubility of Aluminum (Al) in the soil. We also can run into issues with Manganese toxicity as well. Aluminum can inhibit water uptake of roots and cause drought stress, roots are generally abnormally shaped and greatly reduced. While not a long term solution, there are some crop species and varieties within those species that can better withstand this Al toxicity issue. Certain plant species and crop varieties have genetic traits that confer tolerance to aluminum toxicity. The more tolerant cereals include oat and rye (Table 1). For wheat, varieties can be tolerant or sensitive. Hard red spring wheat (HRSW) variety MT Lanning has some genetic tolerance, while others like SY Soren do not. (Figure 1).

Table 1. Aluminum tolerance of selected crops. (Soil Fertility and Fertilizer 7<sup>th</sup> Edition, Havlin et al.)

Highly Sensitive	Sensitive	Tolerant	Highly Tolerant
Alfalfa	Canola	Ryegrass	Oats
Annual medics	Barley	Orchard grass	Orchard grass
Red clover	Wheat*	Wheat*	Triticale
	Soybean	Lupins	Cereal rye
	Sorghum	Corn	

\*Some crops are listed twice because Al tolerance depends on variety

Anecdotal evidence from the region shows safflower and durum are highly sensitive

Some sources show teff is tolerant

MCCC Cover Crops Field Guide has optimal pH ranges for majority of cover crop species

To look at HRSW variety selection as a tool on acidic soils, we planted a variety trial in 2018. This was expanded in 2019, demonstrating that certain HRSW varieties perform better under adverse pH conditions (Figure 1). At this site, aluminum toxicity was a major concern as the soil pHs were 5.0 (0-2 inch), 4.5 (2-6 inch), and 5.6 (6-12 inch). With above average precipitation in 2019, there was also considerable leaf and head disease issues across all HRSW varieties. While fixing soil pH with lime should be prioritized, these results highlight that crop and variety selection should be included in an integrated approach to this problem. We plan to continue this work on crop and variety selection as well as surface-applied lime and in-furrow options in western North Dakota.

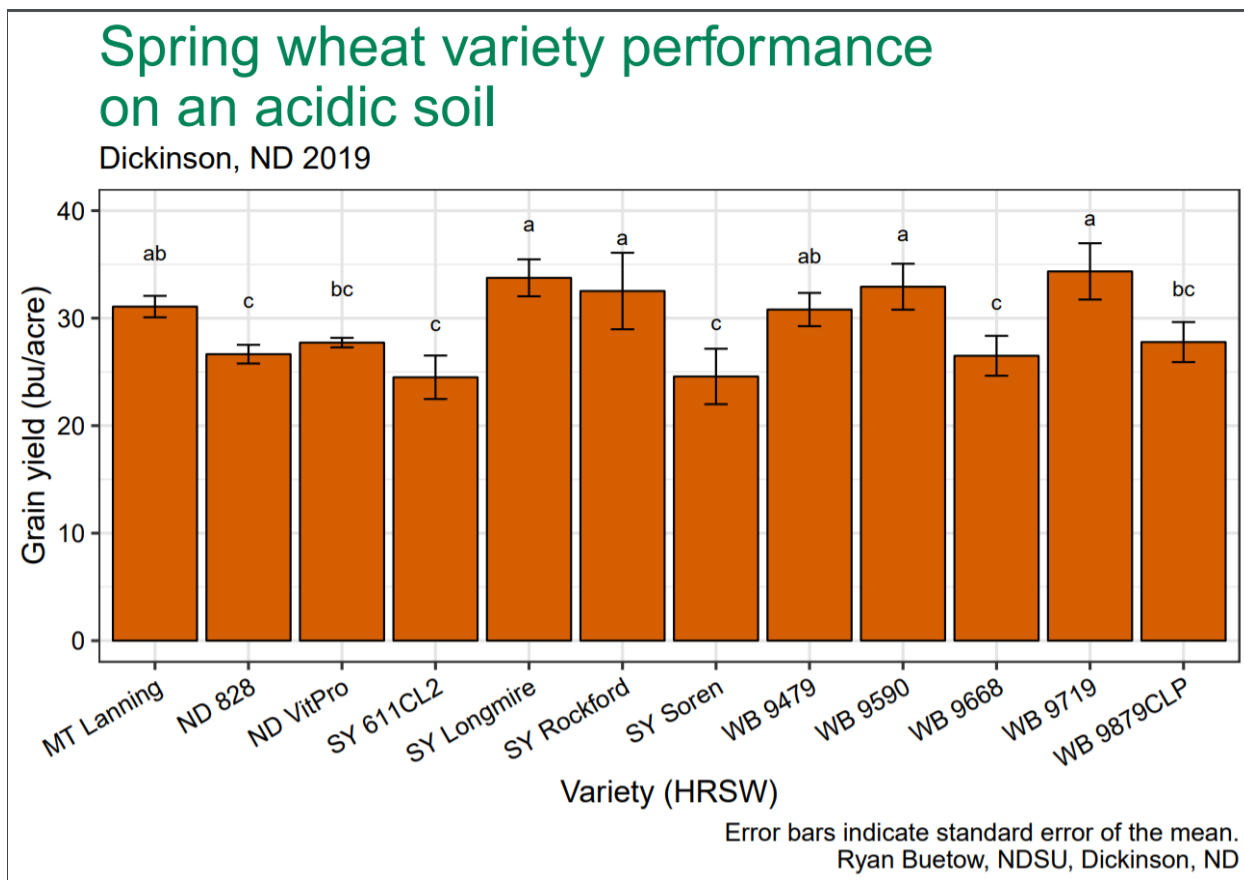


Figure 1. 2019 HRSW variety performance on acidic soils.

The issue of soil acidity is being tackled in many ways by some innovative producers in the region. Addressing the issue itself and fixing the pH should be top priority, but crop selection can be used in an integrated approach to this issue. If zones are found within a field with acidic soils it would be a wise decision to reduce seed inputs, especially if choosing to go with a susceptible crop. There are also several options for perennial cover such as ‘Copperhead’ slender wheatgrass or ‘Opportunity’ Nevada bluegrass, these can be found in the Montana State University resources at <http://landresources.montana.edu/soilfertility/acidif/acidif-mm.html>.



## Hettinger Soybean Seeding Rate Study

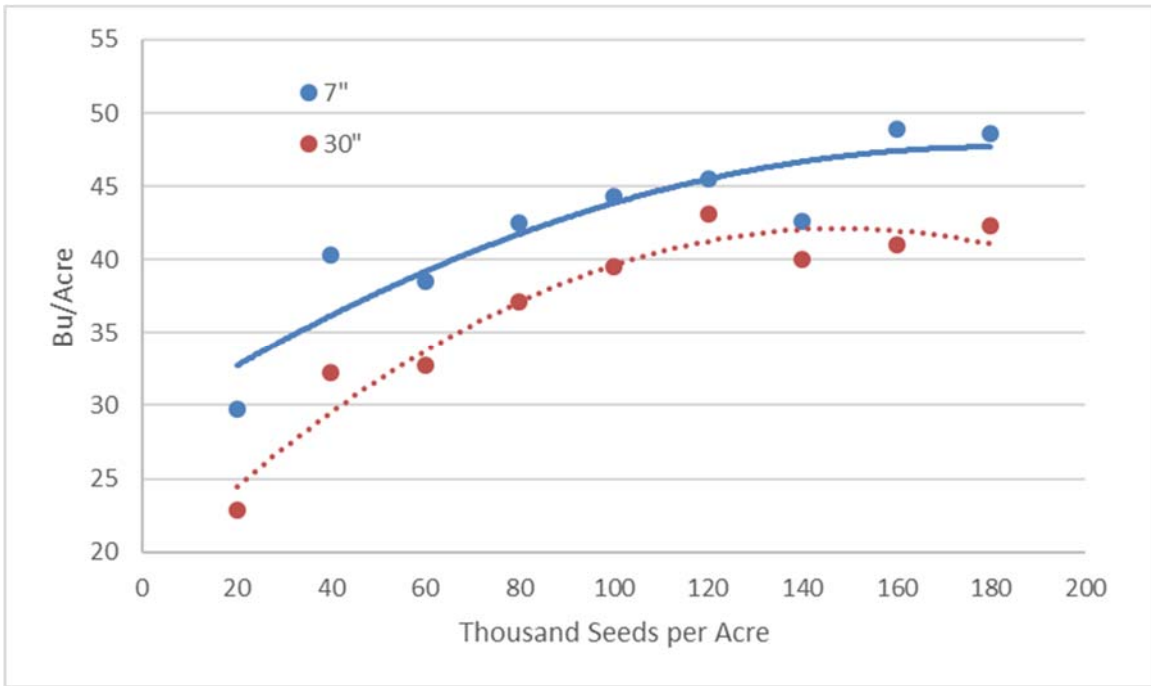
John Rickertsen & Michael Wells, Hettinger Research Extension Center, 2019

Over the past decade soybean seeding rate recommendations in the corn-soybean belt have been reduced from 180,000 - 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.

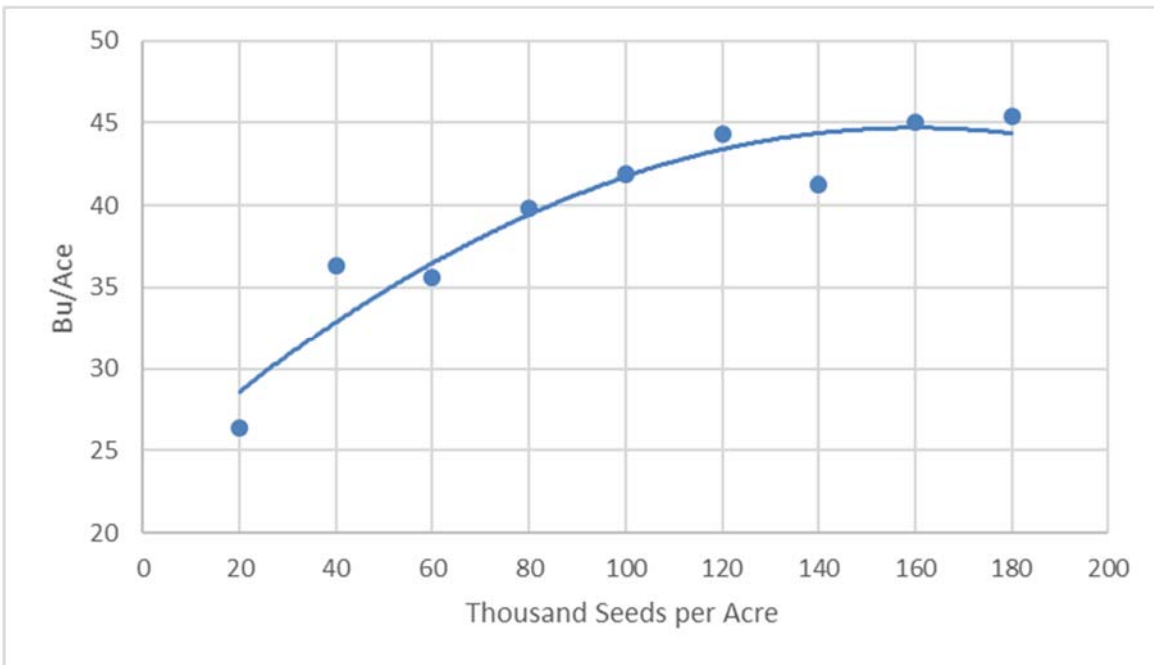
A study was initiated at Hettinger, ND in 2018 with nine seeding rates, 20,000 to 180,000 in 20,000 increments in both drilled (7") and row (30") configurations. In 2019 the Hettinger trial was planted on May 30. At Mandan, ND a trial with 30" rows with the same seeding rates was planted on June 5. The soybean variety Proseed 30-20 at Hettinger and REA RX0719 Mandan were no-till planted 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 trials were harvested with a Kincaid 8XP small plot combine on October 23 at Hettinger and October 24 at Mandan. 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 61% 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 populations, seed size increased and test weight decreased, but there was no significant difference in the 100,000 to 180,000 rates for seed size and no significant difference in 40,000 to 180,000 rates for test weight. In 2019 7" rows yielded 5.5 Bu/Acre higher than 30" rows, unlike 2018 where there was no difference in yield between 7" and 30" rows. Over the past two years the 120,000 seeding rate has looked like the best seeding rate at Hettinger.

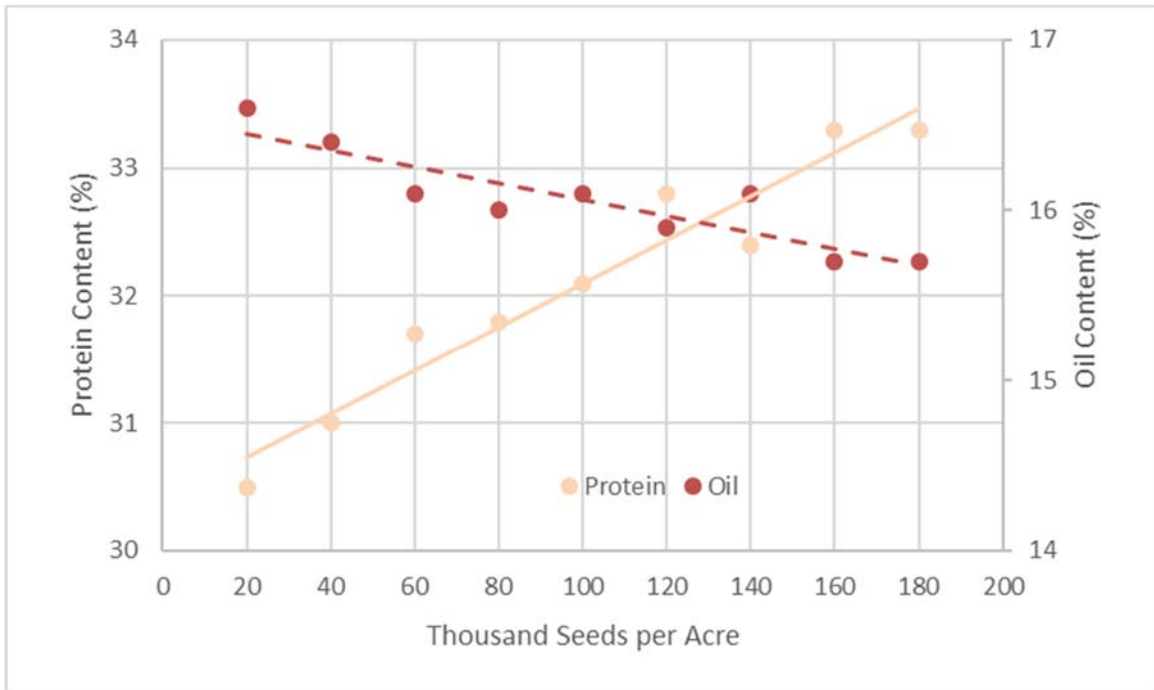
Soybean Seeding Rate Study Yields by Seeding Rate at Hettinger, ND.



Soybean Seeding Rate Study Yields by Seeding Rate at Mandan, ND.



Soybean Seeding Rate Study Protein and Oil Content by Seeding Rate at Mandan, ND.



**Soybean Seeding Rate Study - 2019** **Mandan, ND**

Treatment	Mature Date	Plant Height	Seeds Lb	Test Weight	Seed Oil	Seed Protein	Grain Yield
		inches	seeds	lbs/bu	%	%	bu/ac
30" - 20,000		31	3201	54.8	16.6	30.5	15.7
30" - 40,000		34	3129	54.9	16.4	31.0	26.8
30" - 60,000		37	3093	55.1	16.1	31.7	28.8
30" - 80,000		35	3176	55.0	16.0	31.8	32.1
30" - 100,000		37	3060	55.5	16.1	32.1	33.9
30" - 120,000		36	3010	55.1	15.9	32.8	35.9
30" - 140,000		35	3036	55.4	16.1	32.4	37.0
30" - 160,000		36	3000	55.3	15.7	33.3	39.1
30" - 180,000		37	3020	55.3	15.7	33.3	35.8
Trial Mean		35	3081	55.1	16.1	32.1	31.7
LSD 5%		2	114	0.4	0.5	0.9	5.6
C.V. %		3.2	2.5	0.5	2.1	2.0	12.0

**Soybean Seeding Rate Study - 2019**

**Hettinger, ND**

Treatment	Mature Date	Plant Height inches	Seeds Lb seeds	Test Weight lbs/bu	Seed Oil %	Seed Protein %	Grain Yield bu/ac
<b>Row Spacing</b>							
7" Rows	9/22	29	3441	54.7	16.3	33.5	42.3
30" Rows	9/21	33	3195	53.8	16.1	33.9	36.8
LSD 5%	NS	1	69	0.2	0.1	0.3	1.8
<b>Population</b>							
20,000	9/26	31	2924	53.8	16.5	32.9	26.4
40,000	9/23	33	3266	54.8	16.4	33.3	36.3
60,000	9/22	31	3268	54.1	16.5	33.1	35.6
80,000	9/22	32	3285	54.7	16.4	34.0	39.8
100,000	9/20	30	3400	54.4	16.3	33.9	41.9
120,000	9/21	31	3390	54.4	15.9	34.1	44.3
140,000	9/20	29	3433	54.2	16.0	34.0	41.3
160,000	9/19	30	3417	53.9	15.9	33.7	45.0
180,000	9/20	30	3480	54.0	15.9	34.2	45.4
LSD 5%	0.3	2	112	0.4	0.3	0.5	3.8
<b>Row Spacing X Population</b>							
7" - 20,000	9/27	30	2843	54.4	16.5	33.0	29.8
7" - 40,000	9/23	31	3275	55.1	16.7	33.3	40.3
7" - 60,000	9/23	29	3323	54.7	16.8	32.8	38.5
7" - 80,000	9/24	30	3314	55.0	16.6	34.1	42.5
7" - 100,000	9/21	27	3624	54.8	16.3	33.1	44.3
7" - 120,000	9/21	28	3613	55.0	16.0	33.7	45.5
7" - 140,000	9/20	27	3674	54.7	16.0	33.8	42.6
7" - 160,000	9/20	27	3656	54.2	15.8	33.4	48.9
7" - 180,000	9/19	28	3649	54.4	15.9	33.8	48.6
30" - 20,000	9/25	32	3005	53.1	16.4	32.9	22.9
30" - 40,000	9/22	34	3256	54.5	16.2	33.4	32.2
30" - 60,000	9/21	32	3212	53.5	16.1	33.4	32.7
30" - 80,000	9/20	34	3257	54.4	16.1	34.0	37.1
30" - 100,000	9/20	33	3176	53.9	16.3	34.7	39.5
30" - 120,000	9/21	33	3168	53.8	15.8	34.4	43.1
30" - 140,000	9/19	32	3192	53.7	16.1	34.2	40.0
30" - 160,000	9/19	33	3178	53.5	16.1	34.0	41.0
30" - 180,000	9/20	32	3311	53.6	16.0	34.5	42.3
Trial Mean	9/21	31	3318	54.2	16.2	33.7	39.6
LSD 5%	1.4	2	174	0.5	0.4	0.7	4.5
C.V. %	0.1	5.1	4.4	0.8	1.9	1.6	9.6

**Soybean Seeding Rate Study - 2018**

**Hettinger, ND**

Treatment	Mature Date	Plant Height inches	Seeds Lb seeds	Test Weight lbs/bu	Seed Oil %	Seed Protein %	Grain Yield bu/ac
<b>Row Spacing</b>							
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
<b>Population</b>							
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
<b>Row Spacing X Population</b>							
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

# NOTES



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