

# Thirty-Ninth Annual Western Dakota Crops Day Research Report 2022



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

## **December 15, 2022**

### **Hettinger Armory**

**MST**

**9:30 AM Registration**

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

**10:00 Early Bird Drawing and Opening Announcements**

**10:05 Crop Variety Updates and Highlights of Ongoing Regional Crop Production Research**

Dr. Caleb Dalley, Weed Scientist, NDSU Hettinger Research Extension Center.

- Herbicide and weed control research update.

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

- Variety updates and agronomy studies.

**11:00 Biologicals Impact on Crop Yield**

Leo Bortolon, Cropping Systems Specialist, NDSU North Central Research Extension Center

**12:00 Lunch**

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

**1:00 Fall and Spring Strategies for Weed Control**

Dr. Brian Jenks, Weed Scientist, NDSU North Central Research Extension Center

**2:00 Highlights of Ongoing Regional Crop Production Research (cont.)**

Dr. Chris Agustin, Director & Soil Scientist, NDSU Dickinson Research Extension Center.

- Dickinson REC agronomy research update.

Patrick Wagner, SDSU Extension Entomology Field Specialist, Rapid City, SD.

- Entomology update.

**3:00 Conclusion**

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

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

## **Acknowledgments**

The Hettinger and Dickinson Research Extension Centers 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.

### **2022 Western Dakota Crops Day Sponsors**

Hettinger Area Chamber of Commerce

AGT Foods

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Calcium Products

CHS

Farm Credit Services of Mandan

Helena Chemical Company

Minn-Dak Growers

North Dakota Grain Growers Association

North Dakota Soybean Council

Northern Pulse Growers Association

Proseed

ProPoint Cooperative

Southwest Grain

The Hettinger and Dickinson Research Extension Centers gratefully acknowledges 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.

Dr. Clair Keene, NDSU, Fargo

Dr. Hans Kandel, NDSU, Fargo

Eric Eriksmoen, NDSU NCREC Minot

Neal and Justin Freitag, Scranton

August and Perry Kirschmann, Regent

Dan Christman, Hettinger

USDA – ARS Northern Great Plains Research Center, Mandan

Ben Kuhn, Dickinson

Stuart Dilse, Scranton

Nathan Thomas, Mott

Keith Gietzen, Glen Ullin

This work is supported by the USDA National Institute of Food and Agriculture, Hatch projects ND06282 & ND06284.





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### **Trials Not Published**

The following trials were not published in this report because of hail or very poor yields and significant plot variation.

<b>Trial</b>	<b>Average Yield</b>
Hettinger Canola Variety Trial	Not harvested due to poor stands and weed pressure
Hettinger Flax Variety Trials	Not harvested due to very poor stands
Dickinson Winter Wheat, HRSW, Durum, Barley, Oat & Flax Variety Trials	Hail
Regent Durum & Barley	Not harvested due to poor uneven stands.

## 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 2022 Hettinger HRSW variety trial was 3.1% meaning that there was a 3.1 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 “Lanning” averaged 77.3 bu/ac in 2022 compared to “Glenn” at 71.2 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 6.1 bu/ac between the varieties ( $77.3 - 71.2$ ) to the LSD 5% value of 2.8 bu/ac. Since the 5.9 bu/ac difference is more than the LSD value of 3.8 bu/a, the varieties do differ significantly in yield. If the difference between these two varieties would have been 2.5 bu/ac, their difference would have been less than 2.8 bu/ac; therefore, the yield difference between these varieties would not have been statistically 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

	<b>28°F</b>	<b>32°F</b>	<b>50% Probability 32°F</b>
Date of Last Frost	May 21	June 2	May 20
Date of First Frost	October 5	October 5	September 16
<b>Frost Free Days</b>	<b>137</b>	<b>125</b>	<b>119</b>

### Precipitation (inches)

<b>Month</b>	<b>2017-18</b>	<b>2018-19</b>	<b>2019-20</b>	<b>2020-21</b>	<b>2021-22</b>	<b>67 Year Average</b>
October	0.0	0.6	2.2	0.6	3.9	1.1
November	0.2	0.7	0.6	0.0	0.1	0.5
December	0.2	0.4	0.3	0.0	0.8	0.3
January	0.3	0.4	0.1	0.0	0.1	0.4
February	0.6	1.1	0.2	0.0	0.4	0.4
March	0.3	0.3	0.1	0.1	0.1	0.7
April	1.6	1.3	0.2	0.6	4.0	1.6
May	1.7	4.0	0.5	4.5	2.3	2.7
June	3.7	3.9	1.7	0.5	3.8	3.3
July	2.7	2.1	2.5	1.2	2.6	2.0
August	0.9	3.0	1.9	2.7	0.4	1.8
September	1.7	4.1	1.1	0.4	1.0	1.5
<b>April-August</b>	<b>10.6</b>	<b>14.4</b>	<b>6.7</b>	<b>9.4</b>	<b>13.1</b>	<b>11.4</b>
<b>Total</b>	<b>13.9</b>	<b>21.9</b>	<b>11.2</b>	<b>10.6</b>	<b>19.4</b>	<b>16.3</b>

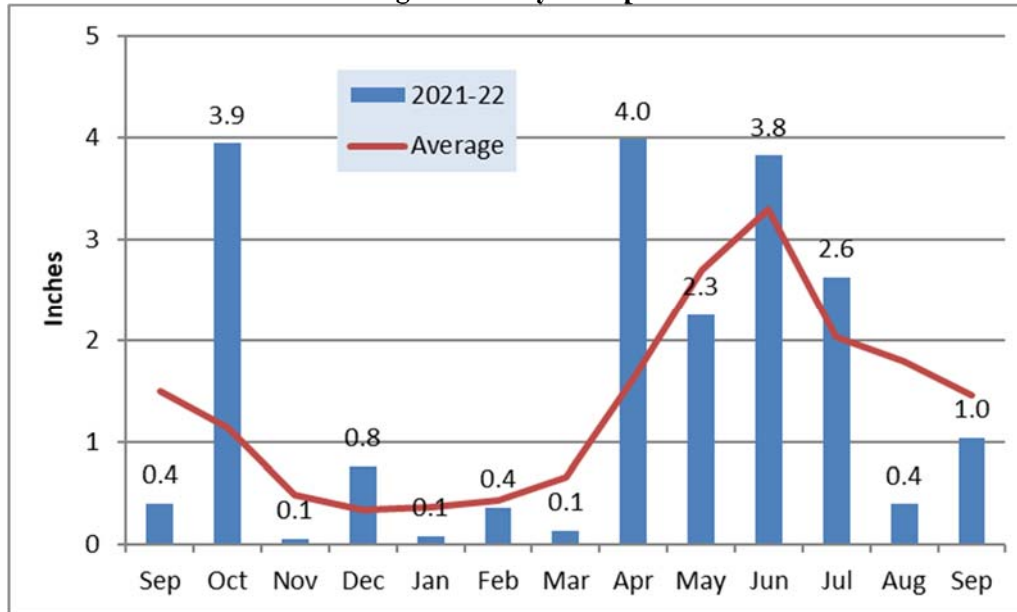
### Air Temperature (°F)

<b>Month</b>	<b>2017-18</b>	<b>2018-19</b>	<b>2019-20</b>	<b>2020-21</b>	<b>2021-22</b>	<b>67 Year Average</b>
October	44.9	40.5	36.3	37.0	48.0	45.2
November	32.4	27.7	27.9	36.1	35.2	30.1
December	19.0	24.0	21.6	27.3	19.6	19.7
January	17.1	17.8	19.5	24.7	18.5	15.7
February	6.0	-0.6	22.8	9.4	17.4	19.7
March	27.4	20.3	33.3	36.3	30.6	29.3
April	35.1	42.0	37.5	40.9	34.3	42.4
May	58.7	47.2	51.3	50.8	51.3	53.6
June	65.4	61.9	65.7	67.7	61.8	63.3
July	69.1	68.8	69.4	74.6	69.7	70.2
August	67.8	65.4	69.5	68.5	71.1	68.6
September	56.3	58.3	57.4	62.2	62.0	58.0
<b>Average</b>	<b>44.5</b>	<b>41.6</b>	<b>39.4</b>	<b>44.6</b>	<b>43.3</b>	<b>43.0</b>

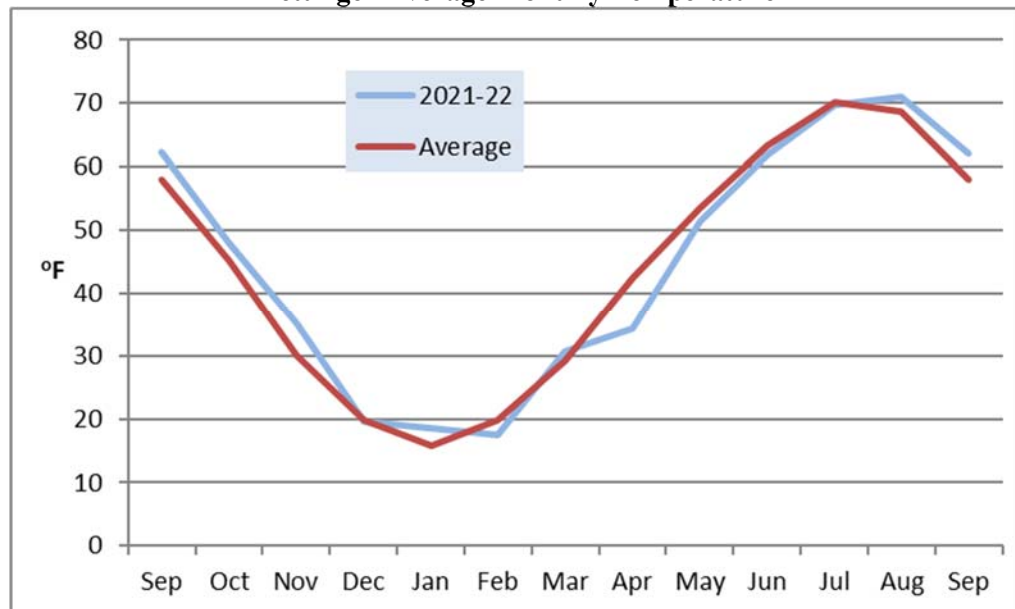
### Corn Growing Degree Days (GDD)

Month	2018	2019	2020	2021	2022	50 Year Average
May	371	154	218	215	221	258
June	467	409	505	534	393	426
July	579	556	593	682	601	589
August	511	529	586	543	604	539
September	321	393	336	437	417	331
<b>Total</b>	<b>2249</b>	<b>2041</b>	<b>2238</b>	<b>2411</b>	<b>2236</b>	<b>2142</b>

### Hettinger Monthly Precipitation



### Hettinger Average Monthly Temperature



**2022 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> -----	
	1983 - 2022	Current Year	1983 - 2022	Current Year	1983 - 2022	Current year	1983 - 2022	Current year	1983 - 2022	Current year
November - 21	39.8	46.0	19.0	22.4	0.55	0.40				
December - 21	27.1	26.6	7.9	3.3	0.43	0.13				
January	25.1	23.0	5.8	2.5	0.41	0.15				
February	28.2	27.9	8.2	3.5	0.44	0.22				
March	40.3	40.1	18.8	18.5	0.72	0.48				
April	54.0	42.7	28.9	25.2	1.45	4.16	335	330		
May	66.2	63.6	40.6	39.0	2.66	3.17	663	611	251	237
June	76.2	74.6	50.7	50.2	3.04	2.02	943	1054	411	510
July	83.8	84.0	55.8	57.3	2.31	3.71	1171	1273	613	650
August	82.8	85.1	54.0	56.3	1.96	0.28	1128	1113	570	539
September	71.7	78.2	44.1	48.9	1.64	0.93	778	932	327	443
October	56.0	56.4	31.3	34.3	1.23	1.84				
Mean	54.3	54.0	30.4	30.1						
Total					16.84	17.49	5018	5312	2172	2377

<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.

North Dakota hard red spring wheat variety descriptions, agronomic traits, 2022.

Variety	Agent or Origin <sup>1</sup>	Year Released	Height (inches) <sup>2</sup>	Straw Strength <sup>3</sup>	Days to Head <sup>4</sup>	Reaction to Disease <sup>5</sup>				
						Stem Rust <sup>6</sup>	Leaf Rust	Tan Spot	Bact. Leaf Streak	Head Scab
AAC Brandon	Canada	2012	31	4	49	4	6	NA	6	5
AAC Starbuck	Canada	2018	32	4	49	NA	6	NA	6	5
AAC Wheatland	Canada	2018	31	4	49	NA	4	NA	7	5
AP GunsSmoke CL2	Syngenta/AgriPro	2021	30	6	48	3	3	4	8	3
AP Murdock	Syngenta/AgriPro	2019	28	4	49	3	5	4	6	6
AP Smith	Syngenta/AgriPro	2021	28	2	50	NA	3	3	5	4
<b>Ascend-SD</b>	<b>SD</b>	<b>2022</b>	<b>34</b>	<b>4</b>	<b>50</b>	<b>NA</b>	<b>4</b>	<b>NA</b>	<b>5</b>	<b>4</b>
Bolles	MN	2015	30	4	51	5	2	4	6	5
CAG-Justify	Champions Alliance Grp	2021	31	6	51	3	2	5	6	3
CAG-Reckless	Champions Alliance Grp	2021	32	5	49	4	2	6	6	4
<b>CAG-Recoil</b>	<b>Champions Alliance Grp</b>	<b>2022</b>	<b>29</b>	<b>3</b>	<b>55</b>	<b>NA</b>	<b>1</b>	<b>NA</b>	<b>3</b>	<b>4</b>
CP3099A	Croplan	2020	32	5	52	7	3	4	6	4
CP3188	Croplan	2020	30	7	49	8	2	6	7	4
CP3530	Croplan	2015	33	7	50	4	5	6	6	5
Dagmar <sup>7</sup>	MT	2019	30	6	47	3	7	4	7	7
Driver	SD	2019	31	4	50	4	1	7	7	3
Faller	ND	2007	32	6	50	5	7	7	5	4
Glenn	ND	2005	33	4	47	5	6	6	5	4
Lanning	MT	2017	30	3	50	6	7	4	8	6
<b>LCS Ascent</b>	<b>Limagrain</b>	<b>2022</b>	<b>30</b>	<b>4</b>	<b>46</b>	<b>NA</b>	<b>6</b>	<b>NA</b>	<b>6</b>	<b>4</b>
LCS Buster	Limagrain	2020	32	5	53	3	4	4	4	5
LCS Cannon	Limagrain	2018	29	4	45	3	7	5	7	6
LCS Dual	Limagrain	2020	30	4	48	NA	6	NA	7	5
<b>LCS Hammer AX</b>	<b>Limagrain</b>	<b>2022</b>	<b>29</b>	<b>4</b>	<b>47</b>	<b>NA</b>	<b>6</b>	<b>NA</b>	<b>7</b>	<b>5</b>
LCS Rebel	Limagrain	2017	33	6	46	6	7	3	5	5
LCS Trigger	Limagrain	2016	33	5	54	7	1	4	4	3
<b>MN- Rothsay</b>	<b>MN</b>	<b>2022</b>	<b>29</b>	<b>3</b>	<b>51</b>	<b>NA</b>	<b>6</b>	<b>NA</b>	<b>6</b>	<b>4</b>
MN-Torgy	MN	2020	31	4	50	3	3	3	4	3
MN-Washburn	MN	2019	30	3	51	3	1	6	6	5
MS Barracuda	Meridian Seeds	2018	28	4	45	4	NA	7	7	6
<b>MS Charger</b>	<b>Meridian Seeds</b>	<b>2022</b>	<b>29</b>	<b>7</b>	<b>47</b>	<b>NA</b>	<b>2</b>	<b>NA</b>	<b>7</b>	<b>4</b>
MS Cobra	Meridian Seeds	2022	29	4	48	3	2	4	8	5
MS Ranchero	Meridian Seeds	2020	32	5	53	6	4	5	6	6
ND Frohberg	ND	2020	33	5	49	3	5	8	5	5
<b>ND Heron</b>	<b>ND</b>	<b>2021</b>	<b>31</b>	<b>6</b>	<b>46</b>	<b>NA</b>	<b>7</b>	<b>NA</b>	<b>7</b>	<b>3</b>
ND VitPro	ND	2016	31	4	48	7	4	6	6	4
Shelly	MN	2016	29	4	51	3	6	3	8	5
SK Rush	Canada	2016	33	4	50	4	2	NA	7	4
SY 611CL2	Syngenta/AgriPro	2019	28	3	48	3	6	4	6	5
SY Ingmar	Syngenta/AgriPro	2014	29	3	50	3	3	6	6	5
SY Longmire <sup>7</sup>	Syngenta/AgriPro	2019	29	5	49	4	6	4	6	7
SY McCloud	Syngenta/AgriPro	2019	30	4	48	3	5	7	8	5
SY Valda	Syngenta/AgriPro	2015	29	5	49	4	2	7	6	5
TCG-Heartland	21st Century Genetics	2019	28	3	47	3	3	4	7	6
TCG-Spitfire	21st Century Genetics	2015	30	3	51	4	5	6	5	6
TCG-Wildcat	21st Century Genetics	2020	30	3	49	3	5	6	7	6
WB9590	WestBred	2017	27	3	48	3	3	8	8	6

<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; Canada = Agri-Food Canada. Bold varieties are those recently released, so data are limited and rating values may change.

<sup>2</sup>Height data averaged from multiple locations in 2022.

<sup>3</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>4</sup>Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2022.

<sup>5</sup>Disease reaction scores from 1 to 9, with 1 = resistant and 9 = very susceptible, NA = not available.

<sup>6</sup>Stem rust screening done with *Puccinia graminis* f. sp. *tritici* races TPMK, TMLK, RTQQ, QFCQ and QTHJ

<sup>7</sup>Solid stemmed or semisolid stem, imparting resistance to sawfly.

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2022</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	2020	2021	2022	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	----- Bushels per acre -----				
AAC Brandon	80	32	0	63.0	13.2	--	49.8	73.1	61.5	--
AAC Concord	81	36	0	61.0	14.3	23.4	42.3	63.6	53.0	43.1
AAC Starbuck	80	33	0	63.4	14.1	--	46.6	76.1	61.4	--
AAC Wheatland	80	32	0	62.5	13.1	--	44.0	73.3	58.6	--
AP Gunsmoke CL2	80	32	0	62.7	12.6	24.2	48.4	78.8	63.6	50.5
AP Murdock	80	30	0	61.1	12.7	22.7	39.5	73.6	56.5	45.3
AP Smith	83	30	0	63.5	13.1	18.1	38.0	76.5	57.3	44.2
Asend-SD	82	36	0	62.5	13.1		40.9	74.4	57.6	--
Bolles	81	33	0	62.6	13.6	16.2	42.7	70.3	56.5	43.1
CAG-Justify	81	33	0	61.5	12.2	--	48.0	82.4	65.2	--
CAG-Reckless	81	34	0	63.8	12.7	--	49.9	75.2	62.6	--
CAG-Recoil	81	30	0	61.8	13.2	--	--	76.4	--	--
CP3099A	86	34	0	59.9	11.7	--	41.9	76.8	59.4	--
CP3119A	86	35	0	58.1	12.5	--	42.8	74.0	58.4	--
CP3188	81	33	0	61.2	11.9	--	43.7	77.2	60.4	--
CP3530	81	35	0	63.0	13.3	27.9	40.3	76.0	58.1	48.0
CP39120	88	35	0	58.8	12.1	--	--	71.9	--	--
Dagmar	79	33	0	63.2	12.4	24.3	48.4	82.6	65.5	51.7
Driver	81	33	0	64.2	12.5	28.5	45.9	76.9	61.4	50.4
Faller	81	35	0	62.3	12.2	28.1	45.1	79.2	62.1	50.8
Glenn	79	35	0	64.2	13.9	23.0	41.6	71.2	56.4	45.3
Lanning	79	31	0	62.3	13.4	20.9	48.6	77.3	62.9	48.9
LCS Ascent	80	33	0	64.0	12.0	--	--	80.9	--	--
LCS Buster	83	32	0	61.0	11.6	27.9	43.5	81.3	62.4	50.9
LCS Cannon	77	31	0	64.1	12.4	24.0	48.5	79.6	64.0	50.7
LCS Dual	80	32	0	62.3	12.0	--	--	80.2	--	--
LCS Hammer AX	80	30	0	62.9	12.2	--	--	77.6	--	--
LCS Rebel	79	35	0	64.2	12.5	25.5	49.4	78.2	63.8	51.0
LCS Trigger	83	33	0	63.3	11.3	30.9	43.1	77.1	60.1	50.3
MN Rothsay	81	29	0	63.6	12.5	18.0	43.1	74.2	58.7	45.1
MN Torgy	79	32	0	64.1	12.4	24.8	45.2	77.1	61.1	49.0
MN Washburn	81	32	0	62.7	12.9	26.6	39.8	76.1	58.0	47.5
MS Barracuda	77	30	0	63.2	12.1	20.2	45.0	82.8	63.9	49.3
MS Charger	79	31	0	62.3	11.1	--	--	86.5	--	--
MS Cobra	80	32	0	62.9	13.1	--	42.3	77.7	60.0	--
MS Ranchero	79	33	0	62.6	12.6	25.5	49.3	78.2	63.7	51.0
ND Frohberg	80	35	0	62.6	13.5	22.2	46.0	73.7	59.9	47.3
ND Heron	79	34	0	63.4	13.4	21.9	47.7	74.3	61.0	48.0
ND VitPro	80	33	0	63.6	14.4	21.1	39.4	71.6	55.5	44.0

*Table continued on next page*

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2022

Hettinger, ND

Variety	Days to	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Head	Height	Lodge	Weight	Protein	2020	2021	2022	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>										
Shelly	81	32	0	63.7	12.6	--	--	78.9	--	--
SK Rush	80	35	0	63.0	13.2	--	43.5	76.1	59.8	--
SY 611 CL2	80	30	0	63.7	13.0	24.9	44.6	81.4	63.0	50.3
SY Ingmar	83	30	0	62.5	14.2	18.2	42.6	65.1	53.8	42.0
SY Longmire	81	30	0	63.4	12.8	26.1	40.2	70.7	55.4	45.6
SY McCloud	80	32	0	64.4	13.9	20.4	46.5	76.9	61.7	47.9
SY Valda	81	30	0	62.9	12.9	26.4	43.3	74.8	59.0	48.1
TCG Heartland	79	30	0	62.9	14.3	20.7	45.7	73.2	59.4	46.5
TCG Spitfire	83	31	0	62.4	13.2	30.3	42.6	77.4	60.0	50.1
TCG Wildcat	81	32	0	63.0	13.7	19.1	44.9	75.5	60.2	46.5
WB9590	79	29	0	62.0	13.5		43.2	77.6	60.4	--
Trial Mean	80	32	0	62.6	12.8	23.6	44.2	76.6	60.0	47.8
C.V. %	0.8	3.1	--	0.7	3.5	9.2	7.4	3.1	--	--
LSD 5%	0.8	1.2	--	0.5	0.5	2.5	3.8	2.8	--	--
LSD 10%	0.6	0.9	--	0.4	0.4	2.0	3.0	2.2	--	--

<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 9

Harvest Date: August 14

Previous Crop: Soybean

## NDSU Hettinger Research Extension Center

<b>Hard Red Spring Wheat - 2022</b>	<b>Scranton, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
AAC Starbuck	29	0	55.1	15.8	--	--	32.0	--	--
AP Gunsmoke CL2	27	0	55.3	15.2	--	--	32.1	--	--
AP Murdock	27	0	56.9	14.7	35.7	19.2	32.4	25.8	29.1
AP Smith	25	0	56.7	15.3	--	20.8	34.3	27.5	--
Asend-SD	31	0	53.7	15.9	--	--	28.2	--	--
Bolles	29	0	55.3	17.4	39.6	23.2	28.7	26.0	30.5
CAG Reckless	29	0	57.2	15.0	--	--	36.3	--	--
CP3188	29	0	53.3	14.7	--	--	31.9	--	--
Dagmar	27	0	56.8	15.6	45.4	18.7	35.1	26.9	33.1
Driver	29	0	57.3	14.8	--	21.1	31.3	26.2	--
Glenn	30	0	55.7	15.4	40.2	19	28.6	23.8	29.3
Lanning	29	0	53.5	16.3	50.3	19.9	30.0	25.0	33.4
LCS Buster	29	0	51.9	14.7	--	20.6	31.0	25.8	--
LCS Cannon	27	0	59.5	14.4	44	21.8	33.9	27.8	33.2
LCS Trigger	29	0	53.9	14.5	50.6	18.4	32.9	25.7	34.0
MN Rothsay	26	0	57.9	15.3	--	--	35.4	--	--
MN Torgy	29	0	58.8	15.2	45.8	20.1	35.9	28.0	33.9
MN Washburn	27	0	54.9	15.0	43.0	18.4	33.0	25.7	31.5
MS Rancho	31	0	53.7	14.8	--	--	31.1	--	--
ND Frohberg	30	0	56.0	15.5	40.4	20.1	28.7	24.4	29.7
ND Heron	28	0	57.8	15.9	--	--	31.2	--	--
ND VitPro	29	0	56.0	15.5	43.6	20	29.3	24.7	31.0
SY Longmire	27	0	56.9	15.2	41.3	19.6	32.8	26.2	31.2
SY McCloud	29	0	59.3	15.0	42.7	21.8	33.3	27.5	32.6
TCG Heartland	26	0	56.0	15.5	40.2	23.5	28.0	25.7	30.6
WB9590	24	0	57.4	16.0	--	20.5	36.8	28.7	--
<b>Trial Mean</b>	<b>28</b>	<b>0</b>	<b>56.0</b>	<b>15.3</b>	<b>43.5</b>	<b>20.4</b>	<b>32.1</b>	<b>26.0</b>	<b>31.6</b>
C.V. %	4.1	--	2.3	4.1	9.6	13.8	7.6	--	--
LSD 5%	1.3	--	1.5	0.7	5.9	4.0	2.9	--	--
LSD 10%	1.0	--	1.2	0.6	4.9	3.3	2.2	--	--

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

Planting Date: May 17

Harvest Date: August 23

## NDSU Hettinger Research Extension Center

<b>Hard Red Spring Wheat - 2022</b>	<b>Regent, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
AAC Starbuck	29	0	62.9	15.1	--	--	51.5	--	--
AP Gunsmoke CL2	28	0	61.5	13.9	--	--	56.2	--	--
AP Murdock	27	0	61.3	13.0	21.3	39.3	52.9	46.1	37.8
AP Smith	25	0	62.4	14.0	--	37.4	51.2	44.3	--
Asend-SD	32	0	62.2	14.1	--	--	53.1	--	--
Bolles	28	0	61.6	15.0	16.4	36.3	46.2	41.3	33.0
CAG Reckless	31	0	63.0	14.5	--	--	57.4	--	--
CP3188	29	0	61.4	12.8	--	--	61.9	--	--
Dagmar	27	0	61.7	14.7	28.0	38.6	47.6	43.1	38.1
Driver	29	0	62.4	14.3	--	38.8	54.4	46.6	--
Glenn	31	0	63.3	15.7	21.6	39.4	51.3	45.4	37.4
Lanning	27	0	61.6	14.4	21.3	41.3	53.3	47.3	38.6
LCS Buster	30	0	60.8	11.6	--	45.0	71.6	58.3	--
LCS Cannon	25	0	62.6	14.0	19.6	48.7	43.6	46.2	37.3
LCS Trigger	29	0	62.0	12.1	38.2	44.2	59.0	51.6	47.1
MN Rothsay	26	0	62.7	14.2	--	--	53.3	--	--
MN Torgy	29	0	63.9	14.3	22.4	44.1	66.9	55.5	44.5
MN Washburn	27	0	63.4	13.7	26.9	41.2	55.7	48.4	41.3
MS Rancho	29	0	61.7	12.9	--	--	52.6	--	--
ND Frohberg	31	0	62.5	14.9	14.7	40.8	50.2	45.5	35.2
ND Heron	27	0	63.0	14.6	--	--	44.3	--	--
ND VitPro	30	0	63.6	15.0	24.5	42.6	50.1	46.3	39.1
SY Longmire	27	0	62.6	13.9	27.8	44.2	51.9	48.1	41.3
SY McCloud	28	0	63.1	16.0	20.9	37.5	45.7	41.6	34.7
TCG Heartland	26	0	63.0	15.2	18.4	41.5	52.4	46.9	37.4
WB9590	25	0	62.2	15.3	--	40.7	54.7	47.7	--
Trial Mean	28	0	62.4	14.2	23.2	41.2	53.4	47.2	38.8
C.V. %	5.9	--	1.2	4.7	16.7	12.7	10.0	--	--
LSD 5%	1.9	--	0.9	0.8	5.5	7.3	6.3	--	--
LSD 10%	1.5	--	0.7	0.6	4.6	6.2	4.9	--	--

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

Planting Date: May 17

Harvest Date: August 29



**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2022</b>						<b>Mandan, ND</b>			
Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
AAC Brandon	29	0	60.1	12.3	--	26.5	49.3	37.9	--
AAC Concord	35	0	59.3	12.5	45.5	21.4	54.3	37.8	40.4
AAC Starbuck	29	0	60.1	13.2	--	20.1	51.6	35.9	--
AAC Wheatland VB	30	0	59.3	12.0		22.5	51.2	36.9	--
AP Gunsmoke CL2	30	0	60.4	11.4	45.3	19.8	66.4	43.1	43.8
AP Murdock	28	0	59.2	11.4	44.7	16.7	65.2	41.0	42.2
AP Smith	27	0	59.8	12.1	43.9	23.7	58.5	41.1	42.0
Asend-SD	33	0	60.4	10.8	--	19.7	65.7	42.7	--
Bolles	31	0	60.1	13.4	40.7	18.4	56.5	37.4	38.5
CAG-Justify	31	0	59.2	10.6	--	20.8	67.2	44.0	--
CAG-Reckless	31	0	61.3	11.3	--	19.0	57.9	38.4	--
CAG-Recoil	29	0	60.3	11.2	--	--	66.6	--	--
CP3099A	34	0	59.6	10.8	--	15.1	62.8	38.9	--
CP3188	31	0	58.7	10.7	--	24.3	58.7	41.5	--
CP3530	32	0	60.9	11.4	45.9	19.1	58.4	38.7	41.1
Dagmar	30	0	60.1	11.5	40.5	18.8	57.7	38.2	39.0
Driver	31	0	61.0	11.7	50.7	23.3	57.0	40.1	43.7
Faller	32	0	59.5	11.1	48.3	23.4	61.2	42.3	44.3
Glenn	32	0	62.2	11.8	42.0	19.1	54.6	36.9	38.6
Lanning	29	0	59.4	12.0	47.4	22.4	56.0	39.2	41.9
LCS Ascent	29	0	60.4	11.0	--	--	54.9	--	--
LCS Buster	32	0	59.5	9.7	54.0	22.2	69.5	45.9	48.6
LCS Cannon	28	0	61.0	11.5	41.5	18.1	56.6	37.3	38.7
LCS Dual	29	0	60.3	11.1	--	--	55.1	--	--
LCS Hammer AX	29	0	60.0	11.4	--	--	62.8	--	--
LCS Rebel	33	0	61.4	12.7	46.8	17.1	58.5	37.8	40.8
LCS Trigger	32	0	61.7	9.4	50.2	22.2	70.4	46.3	47.6
MN Rothsay	27	0	59.9	11.0	50.5	20.5	63.5	42.0	44.8
MN Torgy	31	0	61.2	11.2	48.2	21.4	65.7	43.5	45.1
MN Washburn	30	0	60.2	11.6	40.4	20.8	58.1	39.5	39.8
MS Barracuda	28	0	60.2	11.8	43.6	12.1	57.3	34.7	37.7
MS Charger	29	0	59.7	10.6	--	--	61.6	--	--
MS Cobra	28	0	60.4	12.2	--	17.1	62.1	39.6	--
MS Ranchero	35	0	61.1	10.4	49.1	27.0	64.3	45.7	46.8
ND Frohberg	31	0	61.2	11.9	45.2	18.8	57.9	38.3	40.6
ND Heron	29	0	61.3	11.8	43.4	15.5	54.2	34.9	37.7
ND VitPro	30	0	61.3	12.3	46.1	16.8	51.1	33.9	38.0

*Table continued on next page*

**NDSU Hettinger Research Extension Center**

<b>Hard Red Spring Wheat - 2022</b>	<b>Mandan, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
<i>Table continues from previous page</i>									
Shelly	29	0	59.8	10.7	--	--	60.9	--	--
SK Rush	33	0	59.4	11.6	--	24.3	57.0	40.6	--
SY 611 CL2	28	0	60.6	11.7	44.3	20.0	60.7	40.4	41.7
SY Ingmar	28	0	60.7	12.6	39.9	21.5	54.3	37.9	38.6
SY Longmire	28	0	60.7	12.0	45.1	19.6	55.2	37.4	40.0
SY McCloud	30	0	61.6	12.4	41.5	17.5	59.8	38.7	39.6
SY Valda	28	0	60.4	11.0	51.5	21.4	60.8	41.1	44.6
TCG Heartland	27	0	60.2	12.0	42.1	15.4	51.0	33.2	36.2
TCG Sptifire	30	0	60.0	11.4	48.7	25.5	63.5	44.5	45.9
TCG Wildcat	30	0	60.8	11.6	38.9	21.6	63.9	42.8	41.5
WB9590	26	0	58.1	11.8	--	17.5	57.2	37.3	--
Trial Mean	30	0	60.2	11.5	44.8	20.3	59.4	39.6	41.6
C.V. %	3.4	--	0.7	4.0	14.0	7.2	6.5	--	--
LSD 5%	1.2	--	0.5	0.6	8.8	3.0	4.5	--	--
LSD 10%	0.9	--	0.4	0.5	7.4	2.5	3.5	--	--

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

Planting Date: May 18

Harvest Date: August 30

Previous Crop: Soybean

**NDSU Dickinson Research Extension Center**

<b>2022 Glen Ullin Spring Wheat - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Seeds per Pound	Test Weight KWT	Test Weight lbs/bu	Protein %	----- Grain Yield-----			----- Average Yield-----	
					2020	2021	2022	2	3
		g/1000			-----bu/ac-----			----bu/ac----	
Ascend-SD	16,667	27.3	60.6	11.5	--	--	43.7	--	--
CP3188	14,384	31.6	59.9	10.4	--	--	49.2	--	--
Dagmar	13,724	33.1	60.6	12.3	--	--	41.8	--	--
LCS Ascent	16,220	28.0	61.7	11.0	--	--	40.3	--	--
Lanning	13,764	33.0	59.8	12.6	46.1	41.2	40.3	40.8	42.5
MN Rothsay	14,258	31.8	61.4	11.9	--	--	48.3	--	--
MN-Torgy	14,953	30.4	61.2	11.7	57.7	39.2	40.6	39.9	45.8
MS Cobra	15,378	29.5	60.8	12.2	--	--	43.5	--	--
ND Frohberg	13,700	33.1	61.4	12.1	47.0	40.4	36.4	38.4	41.3
ND Heron	14,792	30.8	61.5	11.9	--	--	39.2	--	--
SY Longmire	13,492	33.6	61.6	12.3	48.9	44.7	39.7	42.2	44.4
Trial Mean	14,836	30.7	60.7	11.9	48.1	41.2	41.4	--	--
CV %	4.0	3.4	0.8	3.3	8.1	8.2	10.1	--	--
LSD 0.05	723	1.5	0.7	0.6	5.6	4.9	6.0	--	--
LSD 0.10	602	1.2	0.6	0.5	4.6	4.1	5.0	--	--

Planting Date: May 16, 2022  
Harvest Date: August 26, 2022  
Seeding Rate: 1.2 million live seeds/ac

2022 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	Tan Scab					
<b>AAC Vortex</b>	<b>AAFC</b>	<b>2021</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>4</b>	<b>8</b>	<b>2</b>	<b>NA</b>	<b>30</b>	<b>2</b>
AAC Wildfire	AAFC	2015	1	5	8	4	6	1	3	29	3
AC Emerson	Meridian	2011	1	6	1	3	5	1	2	30	4
<b>AP Bigfoot</b>	<b>Agripro</b>	<b>2020</b>	<b>NA</b>	<b>7</b>	<b>NA</b>	<b>5</b>	<b>2</b>	<b>-3</b>	<b>4</b>	<b>26</b>	<b>6</b>
Draper	SD	2019	4	7	4	4	5	-2	NA	27	NA
Jerry	ND	2001	8	3	1	8	8	0	5	32	3
Keldin	WB	2011	2	3	3	5	6	0	3	28	5
MS Iceman	Meridian	2021	7	8	5	6	8	0	NA	25	NA
<b>MS Maverick</b>	<b>Meridian</b>	<b>2020</b>	<b>NA</b>	<b>6</b>	<b>NA</b>	<b>8</b>	<b>4</b>	<b>-1</b>	<b>NA</b>	<b>25</b>	<b>4</b>
ND Noreen	ND	2020	3	3	1	3	4	0	4	31	3
Northern	MT	2015	1	8	1	8	6	2	4	27	5
Ray <sup>7</sup>	MT	2018	1	8	NA	6	6	4	NA	30	NA
SD Andes	SD	2020	2	6	NA	5	6	0	NA	29	NA
<b>SD Midland</b>	<b>SD</b>	<b>2021</b>	<b>1</b>	<b>8</b>	<b>7</b>	<b>NA</b>	<b>8</b>	<b>0</b>	<b>4</b>	<b>30</b>	<b>4</b>
SY Monument	Agripro	2014	3	3	1	8	8	-2	4	27	3
SY Wolverine	Agripro	2019	4	3	1	4	3	-5	4	25	4
WB 4309	WB	2019	4	6	4	7	4	-2	NA	26	NA
<b>WB4510CLP</b>	<b>WB</b>	<b>2020</b>	<b>2</b>	<b>NA</b>	<b>NA</b>	<b>6</b>	<b>8</b>	<b>1</b>	<b>4</b>	<b>28</b>	<b>5</b>
Winner	SD	2019	5	NA	3	4	8	-2	NA	27	NA

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

<sup>2</sup>MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University; TCG = Twenty-first Century Genetics; WB = WestBred; AAFC = Agriculture and Agri-Food Canada.

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

<sup>4</sup>Straw strength: 1 = strongest, 9 = weakest. Based on field observations from limited sites.

<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 = no survival. These values are subject to change as additional information becomes available.

<sup>7</sup>Developed primarily for use as a forage winter wheat.

Bold varieties are those recently released or the first time tested, so data are limited and rating values may change.

**NDSU Hettinger Research Extension Center**

<b>Hard Red Winter Wheat - 2022</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	%	2019	2021	2022	2 yr	3 yr
	----- Bushels per acre -----									
AAC Vortex	170	32	0	59.7	13.21	--	--	101.4	--	--
AAC Wildfire	172	29	0	58.9	13.4	--	26.6	93.8	60.2	--
AC Emerson	170	32	0	60.3	13.4	60.9	27.1	87.3	57.2	58.5
AP Bigfoot	167	32	0	59.3	12.23	--	--	93.7	--	--
CP7017AX	166	30	0	60.1	12.0	--	28.7	88.4	58.5	--
CP7050AX	165	30	0	61.4	13.3	--	28.5	75.2	51.9	--
CP7909	164	31	0	60.9	12.36	--	--	93.0	--	--
Draper	167	32	0	60.8	12.6	--	29.4	91.0	60.2	--
Jerry	170	39	0	58.8	13.1	64.8	28.0	88.3	58.2	60.4
Keldin	169	33	0	60.4	12.65	70.6	30.0	98.4	64.2	66.3
MS Iceman	168	30	0	60.0	14.3	--	28.7	81.7	55.2	--
MS Maverick	168	31	0	60.6	12.8	--	--	97.8	--	--
ND Noreen	170	34	0	60.6	13.19	65.1	27.5	94.1	60.8	62.2
Northern	171	29	0	58.5	13.3	74.5	31.6	94.5	63.0	66.9
Oahe	167	36	0	58.8	12.7	69.5	29.9	92.4	61.2	63.9
Ray	173	30	0	55.5	13.55	--	30.1	77.0	53.5	--
SD Andes	169	33	0	61.3	12.5	--	30.3	99.2	64.7	--
SD Midland	169	34	0	61.2	12.4	--	--	96.8	--	--
SY Monument	169	32	0	58.4	12.5	71.6	30.4	89.7	60.0	63.9
SY Wolverine	167	30	0	59.2	13.0	62.1	28.2	84.8	56.5	58.4
WB4309	167	32	0	61.1	13.0	--	32.7	81.3	57.0	--
WB4510CLP	169	30	0	59.2	12.59	--	--	81.4	--	--
Winner	167	31	0	60.4	12.8	--	30.8	95.1	62.9	--
Trial Mean	169	32	0.0	59.7	12.8	65.4	29.1	90.1	59.1	62.6
C.V. %	0.3	4.7	--	1.8	1.6	6.0	7.5	6.6	--	--
LSD 0.05	0.7	1.8	NS	1.3	0.2	5.6	2.6	7.0	--	--
LSD 0.10	0.5	1.4	NS	1.0	0.2	4.7	2.0	5.4	--	--

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

Previous Crop: Cover Crop Mix

Planting Date: September 14

Harvest Date: August 5

**NDSU Hettinger Research Extension Center**

**Winter Rye - 2022** **Hettinger, ND**

Variety	Spring Stand	Heading Date	Plant Height	Plant Lodge	Test Weight	----- Grain Yield -----			Average Yield	
	%		inches	0-9 <sup>1</sup>	lbs/bu	2020	2021	2022	2 yr	3 yr
						----- Bushels per acre -----				
Aroostok	90	6/1	52	2	49.0	36.6	28.4	66.5	47.5	43.8
Danko	90	6/6	47	0	52.2	45.5	31.8	90.1	60.9	55.8
Hazlet	90	6/6	51	0	52.9	50.1	29.7	98.5	64.1	59.4
ND Dylan	90	6/7	51	3	50.5	50.5	28.4	82.8	55.6	53.9
ND Gardner	90	5/31	51	3	50.8	38.3	32.1	80.2	56.1	50.2
Receptor (hybrid)	90	6/6	46	0	53.1	--	--	123.1	--	--
Rymin	90	6/6	50	0	51.2	44.6	29.7	79.3	54.5	51.2
Serfanio (hybrid)	90	6/6	47	0	51.3	--	43.0	116.9	79.9	--
Spooner	90	6/4	54	1	51.7	42.2	29.9	76.3	53.1	49.5
Tayo (hybrid)	90	6/6	47	0	51.5	--	37.3	127.8	82.5	--
Trial Mean	90	6/5	49	1	51.4	47.9	32.7	94.1	61.6	52.0
C.V. %	--	0.4	3.0	48.1	2.4	15.0	9.0	7.4	--	--
LSD 0.05	--	0.8	1.8	0.6	1.5	10.5	3.5	8.8	--	--
LSD 0.10	--	0.6	1.4	0.4	1.1	8.7	2.7	6.7	--	--

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

Planting Date: September 14

Harvest Date: August 2

Previous Crop: Cover Crop Mix

**Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2022.**

	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
<b>AAC Spitfire</b>	<b>Can.</b>	<b>2014</b>	<b>35</b>	<b>4</b>	<b>51</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>AAC Stronghold</b>	<b>Can.</b>	<b>2016</b>	<b>36</b>	<b>3</b>	<b>52</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
Alkabo	ND	2005	37	2	52	1	1	5	7	6
Carpio	ND	2012	38	5	54	1	1	5	6	5
CDC Defy	Can.	2019	38	3	51	NA	NA	NA	NA	NA
<b>CDC Vantta</b>	<b>Can.</b>	<b>2021</b>	<b>32</b>	<b>3</b>	<b>58</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
Divide	ND	2005	39	5	55	1	1	5	7	5
Joppa	ND	2013	38	5	52	1	1	5	7	5
Maier	ND	1998	36	4	53	1	1	5	NA	8
Mountrail	ND	1998	38	5	53	1	1	5	7	8
ND Grano <sup>6</sup>	ND	2017	37	5	52	1	1	8	7	6
ND Riveland <sup>6</sup>	ND	2017	38	4	53	1	1	5	6	5
<b>ND Stanley<sup>6</sup></b>	<b>ND</b>	<b>2021</b>	<b>37</b>	<b>4</b>	<b>53</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>6</b>	<b>5</b>
Rugby	ND	1973	40	5	53	1	1	4	NA	8
Strongfield <sup>6</sup>	Can.	2004	36	6	52	1	1	6	NA	8
Tioga	ND	2010	41	5	53	1	1	5	7	6

<sup>1</sup>Refers to agent or developer: Can. = Agriculture Canada, ND = North Dakota State University. Bold varieties are those recently released, so data are limited and rating values may change.

<sup>2</sup>Plant height was obtained from the average of four locations in 2022.

<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 three locations in 2022.

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

NDSU Hettinger Research Extension Center

**Durum Wheat - 2022** **Hettinger, ND**

Variety	Days to	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Head	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	----- Bushels per acre -----				
AAC Grainland	84	38	0	62.1	13.4	--	25.5	65.3	45.4	--
AAC Spitfire	82	35	0	62.5	12.3	--	31.0	71.0	51.0	--
AAC Stronghold	84	37	0	62.7	12.9	--	27.8	64.5	46.2	--
Alkabo	82	37	0	63.5	11.6	22.1	25.7	72.3	49.0	40.0
Carpio	82	38	0	63.0	11.6	20.5	23.3	71.9	47.6	38.6
CDC Defy	82	38	0	63.8	11.9	--	33.5	72.1	52.8	--
CDC Vantta	87	30	0	61.7	12.6	--	--	61.1	--	--
Divide	82	38	0	63.1	11.9	19.5	24.0	68.1	46.1	37.2
Joppa	82	38	0	63.1	11.3	21.6	25.8	75.3	50.5	40.9
Maier	82	36	0	63.3	12.7	18.2	30.4	71.2	50.8	40.0
Mountrail	82	37	0	62.9	10.8	23.7	26.6	72.7	49.7	41.0
ND Grano	82	38	0	63.7	12.2	24.1	25.2	71.2	48.2	40.1
ND Riveland	82	39	0	62.8	11.4	22.5	30.3	69.2	49.7	40.6
ND Stanley	82	36	0	63.8	12.0	24.2	30.1	73.9	52.0	42.7
Rugby	83	39	0	63.7	11.9	23.1	25.5	70.5	48.0	39.7
Strongfield	83	38	0	63.1	12.3	21.1	25.7	68.9	47.3	38.6
Tioga	83	39	0	62.8	12.1	20.5	27.9	63.5	45.7	37.3
Trial Mean	82	37	0	11.8	11.8	22.0	27.6	70.8	49.4	40.2
C.V. %	0.5	3.1	--	5.4	5.4	10.6	13.3	3.7	--	--
LSD 5%	0.5	1.4	--	0.7	0.7	3.3	4.3	3.1	--	--
LSD 10%	0.4	1.1	--	0.6	0.6	2.7	3.3	2.4	--	--

<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 9

Harvest Date: August 15

Previous Crop: Soybean



**NDSU Hettinger Research Extension Center**

<b>Durum Wheat - 2022</b>	<b>Scranton, ND</b>
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Variety	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge	Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	lbs/bu	%	----- Bushels per acre -----				
Carpio	29	0	56.1	15.0	38.4	16.6	30.0	23.3	28.3
Joppa	30	0	55.9	14.3	36.4	17.9	28.8	23.3	27.7
ND Grano	29	0	56.3	15.2	37.0	18.5	30.9	24.7	28.8
ND Riveland	31	0	56.7	14.6	42.0	16.5	30.3	23.4	29.6
ND Stanley	29	0	57.7	15.0	--	17.4	29.1	23.3	--
Tioga	30	0	57.8	14.7	35.9	17.1	27.2	22.2	26.7
Trial Mean	29	0	56.7	14.8	38.5	17.4	29.4	23.4	28.2
C.V. %	4.7	--	1.5	3.4	6.3	5.5	10.4	--	--
LSD 5%	1.7	--	1.0	0.6	3.6	1.5	3.8	--	--
LSD 10%	1.3	--	0.8	0.5	3.0	1.2	2.9	--	--

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

Planting Date: May 17

Harvest Date: August 23

**2022 North Dakota barley variety descriptions.**

Variety	Use <sup>1</sup>	Origin <sup>2</sup>	Year Released	Awn <sup>3</sup> Type	Rachilla		Height (inch)	Days to Head	Straw <sup>5</sup> Strength	Reaction to Disease <sup>6</sup>			
					Hair <sup>4</sup> Length	Aleurone Color				Stem Rust	Spot-form Net Blotch	Spot Blotch	Net Blotch
<b>Six-rowed</b>													
Tradition	M/F	BARI	2003	S	L	White	30	48	3	8	6	3	7
<b>Two-rowed</b>													
AAC Connect	M/F	Can.	2017	R	L	White	27	55	4	4	5	4	5
AAC Synergy	M/F	Syngenta	2015	R	L	White	29	55	4	4	3	4	4
ABI Cardinal	M/F	BARI	2019	R	S	White	28	56	4	NA	NA	4	6
Brewski	M	ND	2021	S	L	White	28	54	4	NA	NA	4	4
CDC Austenson	F	CDC	2009	R	S	White	29	57	2	NA	NA	2	2
CDC Churchill	M/F	CDC	2019	R	L	White	NA	NA	3	NA	3	3	NA
CDC Fraser	M/F	CDC	2016	R	L	White	27	56	2	NA	NA	4	4
Conlon <sup>7</sup>	M/F	ND	1996	S	L	White	28	49	5	8	4	6	3
Explorer	M	Secobra	NA	R	L	White	24	55	3	NA	NA	8	4
ND Genesis	M/F	ND	2015	S	L	White	30	52	4	8	4	4	6
Pinnacle	M/F	ND	2006	S	L	White	29	50	3	8	8	5	6

Bolded varieties were tested for the first time this year, so some ratings may change as new data become available.

<sup>1</sup>M = malting; F = feed.

<sup>2</sup>BARI = Busch Agricultural Resources Inc.; CDC = Crop Development Centre, University of Saskatchewan; ND = North Dakota State University  
Can. = Agriculture and Agri-Food Canada

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

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

<sup>5</sup>Straw Strength scores from 1-9, with 1 = strongest and 9 = weakest.

<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.

**NDSU Hettinger Research Extension Center**

<b>Barley - 2022</b>	<b>Hettinger, ND</b>
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Variety	Days to	Plant	Plant		Test	Grain	----- Grain Yield -----			Average Yield	
	Head	Height	Lodge	Plump	Weight	Protein	2020	2021	2022	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	80	31	0	85	47.0	12.9	43.0	46.4	94.6	70.5	61.3
AAC Synergy	81	31	0	92	47.8	12.4	41.3	47.5	103.4	75.4	64.1
ABI Cardinal	81	31	0	90	47.7	12.4	44.4	50.3	93.9	72.1	62.9
Brewski	80	30	0	90	47.1	11.7	44.9	60.1	105.1	82.6	70.0
CDC Austenson	81	31	0	89	50.1	12.3	--	44.7	111.9	78.3	--
CDC Fraser	82	32	0	91	46.9	12.4	--	45.9	101.2	73.6	--
Conlon	74	32	0	95	48.5	13.1	26.5	43.9	95.2	69.6	55.2
Explorer	80	26	0	86	46.6	13.6	43.1	54.3	105.3	79.8	67.6
ND Genesis	79	32	0	92	47.9	11.2	47.6	57.5	95.6	76.5	66.9
Pinnacle	79	31	0	85	46.2	11.7	39.2	54.8	85.7	70.2	59.9
<b>SIX ROW</b>											
Tradition	79	34	0	91	47.5	13.9	34.4	50.4	101.6	76.0	62.1
Trial Mean	79	31	0	88	46.9	12.2	42.1	53.1	98.0	74.7	63.7
C.V. %	0.7	4.5	--	3.1	1.6	5.8	11.5	9.4	5.2	--	--
LSD 5%	0.6	1.6	--	3.2	0.9	0.8	6.8	5.9	6.1	--	--
LSD 10%	0.5	1.3	--	2.5	0.7	0.7	5.7	4.6	4.7	--	--

<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 9

Harvest Date: August 14

Previous Crop: Soybean

**NDSU Hettinger Research Extension Center**

**Barley - 2022** **Scranton, ND**

Variety	Plant	Plant	Plump	Test	Grain	----- Grain Yield -----			Average Yield	
	Height	Lodge		Weight	Protein	2020	2021	2022	2 yr	3 yr
	inches	0-9*	%	lbs/bu	%	----- Bushels per acre -----				
<b>TWO ROW</b>										
AAC Connect	28	0	34	41.5	16.2	78.5	17.5	67.4	42.5	54.5
AAC Synergy	29	0	68	38.8	13.8	81.9	22.5	55.5	39.0	53.3
ABI Cardinal	29	0	49	43.0	16.1	--	17.2	61.8	39.5	--
Brewski	29	0	76	40.8	13.1	--	21.3	63.5	42.4	--
ND Genesis	32	0	79	40.5	12.6	72.9	20.9	60.3	40.6	51.4
Trial Mean	29	0	64	41.4	14.2	74.6	19.7	62.3	40.8	53.0
C.V. %	3.3	--	10.3	3.0	7.9	11.1	22.9	12.6	--	--
LSD 5%	1.2	NS	8.1	1.5	1.4	12.8	6.8	9.7	--	--
LSD 10%	0.9	NS	6.2	1.2	1.1	0.3	5.6	7.4	--	--

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

Planting Date: May 17

Harvest Date: August 29

**NDSU Dickinson Research Extension Center**

<b>2022 Glen Ullin Barley - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Seeds per Pound	Test KWT g/1000	Test Weight lbs/bu	% Plump >6/64	Protein %	-----Grain Yield-----			Average Yield	
						2020	2021	2022	2	3
						-----bu/ac-----			----bu/ac----	
<b><i>Six Row</i></b>										
Tradition	11,397	39.9	45.8	95	11.7	76.1	65.5	41.0	53.3	60.9
<b><i>Two Row</i></b>										
AAC Connect	10,427	43.6	44.4	88	11.3	--	--	62.1	--	--
AAC Synergy	9,748	46.7	46.0	93	10.6	106.8	74.6	56.9	65.7	79.4
ABI Cardinal	10,098	45.0	47.1	95	11.2	--	80.6	68.3	74.4	--
Brewski	10,177	44.6	45.4	95	9.8	--	69.6	74.0	71.8	--
CDC Fraser	10,150	44.7	45.8	96	11.5	--	--	63.8	--	--
ND Genesis	10,187	44.6	45.4	94	9.6	102.8	72.0	67.6	69.8	80.8
Trial Mean	10,232	44.5	45.7	94	10.7	95.4	69.1	60.7	--	--
CV %	4.0	3.8	1.3	2.0	4.0	7.6	11.3	8.3	--	--
LSD 0.05	602	2.5	0.9	3	0.6	10.8	11.5	7.4	--	--
LSD 0.10	498	2.1	0.7	2	0.5	9.9	9.5	6.1	--	--

Planting Date: May 16, 2022

Harvest Date: August 26, 2022

Seeding Rate: 1.2 million live seeds/ac

Grain protein percentages reported on a 0% moisture basis

**2022 North Dakota oat variety descriptions.**

Variety	Origin <sup>1</sup>	Year Released	Grain Color	Height (inch)	Straw Strength	Days to Heading <sup>2</sup>	Reaction to Diseases <sup>3</sup>			Test Weight	Protein <sup>4</sup>
							Stem Rust	Crown Rust <sup>3</sup>	Barley Y.Dwf		
<b>AAC Douglas</b>	AAFC	<b>2019</b>	<b>White</b>	<b>39</b>	<b>NA</b>	<b>52</b>	<b>NA</b>	<b>4</b>	<b>5</b>	<b>Good</b>	<b>M</b>
Beach	ND	2004	White	39	M.strg.	52	8	4	6	V.good	M
CDC Minstrel	Sask.	2006	White	37	M.strg.	53	8	8	8	Good	M
CS Camden	Meridian	2016	White	36	Strong	54	8	6	NA	Good	M
Deon	MN	2013	Yellow	40	Strong	55	8	2	2	V.good	M
HiFi	ND	2001	White	40	Strong	55	4	8	2	Good	M
Jury	ND	2012	White	43	M.strg.	54	1	8	4	V.good	M
Killdeer	ND	2000	White	35	Strong	52	8	6	4	Good	M
Leggett	AAFC	2005	White	38	Strong	54	3	1	8	Good	M
<b>MN-Pearl</b>	<b>MN</b>	<b>2019</b>	<b>White</b>	<b>39</b>	<b>NA</b>	<b>54</b>	<b>NA</b>	<b>7</b>	<b>4</b>	<b>Good</b>	<b>M/L</b>
ND Heart	ND	2020	White	40	Strong	53	3	6	4	Good	H
Newburg	ND	2011	White	39	Med.	56	1	8	4	Good	M
Otana	MT	1977	White	41	M.weak	55	8	8	8	V.good	M/L
Paul <sup>5</sup>	ND	1994	Hull-less	41	Strong	56	1	4	2	V.good	H
Rockford	ND	2008	White	41	Strong	55	8	8	4	V.good	M
<b>SD Buffalo</b>	<b>SD</b>	<b>2022</b>	<b>White</b>	<b>41</b>	<b>Strong</b>	<b>52</b>	<b>NA</b>	<b>6</b>	<b>NA</b>	<b>V.good</b>	<b>M</b>
Warrior	SD	2018	White	37	Strong	52	6	1	NA	V.good	M

Bolded varieties were tested for the first time this year, so some ratings may change as new data become available.

<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. NA - not available.

<sup>4</sup>H = high; M = medium; L = low.

<sup>5</sup>Hull-less variety.

## NDSU Hettinger Research Extension Center

**Oat - 2022** **Hettinger, ND**

Variety	Days to	Plant	Plant	Test	----- Grain Yield -----			----- Average Yield -----	
	Head	Height	Lodge	Weight	2020	2021	2022	2 yr	3 yr
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	----- Bushels per acre -----				
AAC Douglas	61	41	0	34.6	--	96.0	179.5	137.8	--
Beach	61	41	0	37.2	44.9	63.0	153.3	108.1	87.1
CDC Minstrel	62	38	0	33.3	47.8	72.6	175.5	124.0	98.6
CS Camden	64	39	0	31.2	56.4	88.1	165.3	126.7	103.3
Deon	64	42	0	35.0	40.0	81.0	165.8	123.4	95.6
HiFi	63	42	0	34.7	50.6	68.7	165.5	117.1	94.9
Jury	62	44	0	34.1	48.2	80.5	165.1	122.8	97.9
Killdeer	61	37	0	35.3	48.6	78.4	180.1	129.2	102.4
Leggett	64	40	0	34.7	49.9	67.2	165.3	116.2	94.1
MN Pearl	63	41		34.0	--	--	176.6	--	--
ND Heart	62	42	0	35.4	42.9	67.6	163.2	115.4	91.2
Newburg	65	39	0	32.8	40.5	78.2	164.5	121.4	94.4
ORE3541M	61	39	0	34.9	46.1	75.5	184.0	129.7	101.9
Otana	63	43	0	35.0	42.9	81.9	168.0	124.9	97.6
Rockford	63	42	0	36.3	55.9	86.7	162.9	124.8	101.8
SD Buffalo	60	43	0	36.5	--	--	176.1	--	--
Warrior	61	40	0	35.4	47.4	91.1	171.3	131.2	103.3
Paul (hull-less)	64	43	0	43.0	32.9	44.3	121.9	83.1	66.4
<b>Trial Mean</b>	<b>62.669</b>	<b>41</b>	<b>0</b>	<b>35.3</b>	<b>46.8</b>	<b>77.1</b>	<b>163.4</b>	<b>118.8</b>	<b>94.7</b>
<b>C.V. %</b>	<b>0.8</b>	<b>3.8</b>	<b>--</b>	<b>2.0</b>	<b>7.5</b>	<b>7.9</b>	<b>4.3</b>	<b>--</b>	<b>--</b>
<b>LSD 5%</b>	<b>0.6</b>	<b>1.8</b>	<b>--</b>	<b>0.8</b>	<b>4.9</b>	<b>7.2</b>	<b>8.2</b>	<b>--</b>	<b>--</b>
<b>LSD 10%</b>	<b>0.4</b>	<b>1.4</b>	<b>--</b>	<b>0.7</b>	<b>4.1</b>	<b>5.6</b>	<b>6.4</b>	<b>--</b>	<b>--</b>

<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: May 2

Harvest Date: August 15

Previous Crop: Cover Crop Mix

**NDSU Dickinson Research Extension Center**

<b>2022 Organic Hard Red Spring Wheat - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days to Head	Seeds per Pound	KWT  g/1000	Plant Height  in	Test Weight  lbs/bu	Protein  %	Grain Yield  bu/ac
Barlow	53	16,450	27.7	31	61.1	14.6	58.4
Bolles	56	16,853	27.3	31	57.1	16.2	48.8
Ceres	55	16,292	27.9	39	59.6	15.1	52.9
Dagmar	53	15,943	28.5	30	60.2	14.9	66.8
Dapps	54	16,101	28.3	36	58.6	15.6	54.9
Driver	55	17,372	26.1	30	58.8	14.6	51.9
Elgin-ND	53	17,901	25.4	33	58.6	14.5	52.8
FBC Dylan	54	15,113	30.3	31	59.4	14.5	59.2
Faller	55	16,318	28.0	31	58.4	13.8	59.9
Glenn	53	16,125	28.3	32	62.4	15.0	56.3
Lang-MN	55	16,714	27.2	31	61.1	14.6	62.1
Lanning	55	15,808	28.8	30	58.2	14.4	61.7
Linkert	53	15,734	28.9	28	59.6	15.4	55.2
MN Washburn	55	16,848	27.0	30	59.1	14.3	54.2
MN-Torgy	55	15,990	28.5	31	61.0	14.2	69.0
Mida	55	13,483	34.0	40	59.7	15.3	45.8
ND Frohberg	53	16,346	27.8	31	58.7	15.2	51.6
ND Heron	52	15,675	29.1	30	61.8	14.2	63.3
ND VitPro	53	15,946	28.5	30	62.3	14.9	62.2
Prosper	53	14,499	31.3	31	60.6	14.4	68.0
Red Fife	58	13,357	34.1	42	59.7	14.9	51.6
Shelly	55	17,590	25.8	30	59.1	13.7	59.6
Trial Mean	54	16,020	28.6	32	59.8	14.7	57.5
CV %	0.8	7.3	7.4	3.1	2.2	3.5	14.1
LSD 0.05	1	1,663	3.0	1	1.8	0.7	11.5
LSD 0.10	1	1,389	2.5	1	1.5	0.6	9.6

Planting Date: May 17, 2022  
Harvest Date: August 22, 2022  
Protein adjusted to 12% moisture  
Previous Crop: Oat Hay  
Seeding Rate: 1.5 million live seeds/ac



**NDSU Dickinson Research Extension Center**

<b>2022 Organic Ancient Grains - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days to Head	Plant Height in	Test Weight lbs/bu	Grain Yield lbs/ac
CDC Aixe einkorn	55	34	29.6	2061
CDC Marvel einkorn	56	33	28.6	1892
CDC Silex spelt	61	38	29.3	2291
Jim spelt	66	38	29.7	3005
CDC Tatra emmer	59	34	32.2	2559
CDC Yon emmer	58	36	32.0	2495
Lucille emmer	59	37	35.1	2889
Trial Mean	59	36	30.9	2456
CV %	0.3	4.1	3.4	12.6
LSD 0.05	0	2	1.6	459
LSD 0.10	0	2	1.3	379

Planting Date: May 17, 2022  
 Harvest Date: August 22, 2022  
 Previous Crop: Oat Hay

**NDSU Hettinger Research Extension Center**

<b>Corn - 2022</b>	<b>Hettinger, ND</b>
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Brand	Hybrid	Relative	Days	Plant	Ear	Stalk	Moisture	Test	Grain Yield	
		Maturity <sup>1</sup>	to Silk	Height	Height	Lodge	Content	Weight	2022	2-Yr
		days	DAP <sup>2</sup>	inches	inches	%	%	lbs/bu	-----bu/ac-----	
Proseed	1974	74	76	83	30	0	14.4	60.8	73.1	--
Integra	3009	80	76	85	35	0	14.2	59.3	71.3	54.6
Proseed	1882	82	81	90	36	0	15.6	59.2	64.7	51.9
Proseed	1984	84	81	89	35	0	15.1	57.9	73.2	56.4
Trial Mean			79	87	34	0.0	14.8	59.3	70.6	54.3
C.V. %			1.3	1.7	6.3	--	3.7	1.2	8.3	--
LSD 5%			1.1	2.4	3.4	--	0.6	0.7	6.1	--
LSD 10%			0.9	2.0	2.8	--	0.5	0.6	5.0	--

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

<sup>2</sup> Days after planting

Planting Date: May 11

Harvest Date: October 28

Previous Crop: Winter Wheat

**NDSU Hettinger Research Extension Center**

Oil Type Sunflower - 2022							Hettinger, ND		
Company/Brand	Hybrid	Oil Type & Traits <sup>1</sup>	Days to Bloom	Plant Height inches	Test Weight lbs/bu	Oil Content %	Grain Yield		
							2022	2-Year	3-Year
			DAP <sup>2</sup>				-----lbs/ac-----		
CROPLAN	CP3845	HO	68	65	30.7	44.1	2899	3190	2576
CROPLAN	CP432E	NS, EX	65	66	30.2	38.3	2540	2074	1955
CROPLAN	CP450E	HO, EX	70	71	29.4	39.8	2869	3067	2737
CROPLAN	CP455E	HO, EX	68	66	30.4	43.4	3175	3366	2984
CROPLAN	CP4909E	NS, EX	69	61	31.8	42.8	2585	2775	2517
Dyna-Gro	H42HO18CL	HO, CL	67	64	28.8	43.2	2073	2384	2165
Dyna-Gro	H44HO12CL	HO, CL	70	75	30.8	44.5	2755	2668	2448
Dyna-Gro	H45HO10EX	HO, EX	68	69	27.8	44.2	2437	2673	2343
Dyna-Gro	H45NS16CL	NS, CL	66	67	31.2	43.7	2677	2715	2466
Dyna-Gro	H47HO11EX	HO, EX	69	79	31.5	42.8	2744	2879	--
Dyna-Gro	H49HO19CL	HO, CL	71	73	29.0	40.4	3061	3277	2853
Dyna-Gro	H49NS14CL	NS, CL	70	64	30.2	43.2	2717	3097	2642
Dyna-Gro	XH22H66EX	HO, EX	67	71	30.7	42.2	3116	--	--
Dyna-Gro	XH82H65EX	HO, EX	67	74	29.4	43.1	2266	--	--
Nuseed	Falcon	NS, EX	69	64	31.3	44.4	2450	2717	2472
Nuseed	N4H302 E	HO, EX	67	67	27.5	42.5	2431	2737	2431
Nuseed	N4H422 CL	HO, CL	68	77	30.0	42.0	2699	3084	2645
Nuseed	N4H470 CLP	HO, CP	71	72	31.3	44.8	3008	3430	2894
Nuseed	N4H521 CL	HO, CL	70	70	28.5	45.2	3019	3192	2899
Nuseed	NHKE04490		72	73	30.5	44.1	2615	--	--
Proseed	12G25 CL	HO, CL	68	65	32.4	42.8	2585	2902	2650
Proseed	E-50016 CL	HO, CL	69	66	28.1	42.3	2413	2833	2515
Proseed	E-91 E	HO, EX	70	75	30.1	39.4	2847	2852	2476
Proseed	EXP 2300CLP	HO, CP	69	77	29.1	41.9	2345	--	--
Proseed	EXP 2346-E	HO, EX	72	75	28.3	42.6	2475	--	--
RAGT	AC2101	HO, CP	68	72	27.1	39.6	2159	2726	--
RAGT	AC2201	HO, CL	70	73	30.5	41.5	2445	--	--
Sunrich	4415	HO, CP	68	75	28.1	40.5	2581	2766	2433
Sunrich	4425 CL	MO, CL	68	74	29.0	36.9	2808	3322	2814
Sunrich	GP25 CL	MO, CL	68	74	27.9	38.4	2913	3224	2772
USDA	894	TR	68	69	29.5	43.7	2239	2538	2131
CROPLAN	559CL	NS, CL	69	75	30.4	42.6	3271	3368	2508
AAFC/USDA	Honeycomb NS	NS	62	61	26.9	36.5	1443	1107	1250
Mycogen Seeds	8N270CLDM	NS, CL	64	62	31.4	42.9	2245	2049	1896
Trial Mean			69	70	29.6	41.9	2588	2841	2480
C.V. %			1.0	5.1	2.7	2.6	9.4	--	--
LSD 5%			0.8	4.1	0.9	1.3	330	--	--
LSD 10%			0.6	3.2	0.7	1.0	256	--	--

<sup>1</sup> Type: TR-Traditonal, NS-NuSun, MO-Mid Oleic, HO-High Oleic, CL=Clearfield, CP=Clearfield Plus, EX=ExpressSun.

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

Planting Date: June 1

Harvest Date: October 21

Previous Crop: Wheat

**Sunflower - Confectionary - 2022**

**Hettinger, ND**

Company/Brand	Hybrid	Days to Bloom	Plant Height	Test Weight	Seed Over Screen			Grain Yield		
					22/64	20/64	18/64	2022	2-Year	3-Year
		DAP <sup>1</sup>	inches	lbs/bu	------(%)-----			-----lbs/ac-----		
Sunrich	SS90	64	71	23.4	34.0	75.0	97.0	1531	2056	1818
Sunrich	SS91	66	72	22.3	42.0	80.0	97.0	1670	2215	--
Trial Mean		65	71	22.8	38.0	77.0	97.0	1600	2135	1818
C.V. %		0.5	5.7	4.0	15.7	2.0	0.8	9.1	--	--
LSD 5%		0.8	NS	NS	NS	3.6	1.7	NS	--	--
LSD 10%		0.6	NS	NS	10.0	2.6	1.3	NS	--	--

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

Planting Date: June 1

Harvest Date: October 21

Previous Crop: Wheat

**NDSU Hettinger Research Extension Center**

<b>Dry Bean - 2022</b>	<b>Hettinger, ND</b>
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Variety	Type	Plant	Plant	Test	----- Grain Yield -----			----- Average Yield -----	
		Height	Lodge	Weight	2020	2021	2022	2 yr	3 yr
		inches	0-9 <sup>1</sup>	lbs/bu	----- lbs per acre -----				
LaPaz	Pinto	17	0	56.9	1139	819	965	892	974
Lariat	Pinto	21	0	55.6	1159	690	1177	934	1009
Monterrey	Pinto	17	0	56.5	1036	809	1129	969	991
ND Falcon	Pinto	18	0	55.2	1105	746	1115	930	989
ND Palomino	Pinto	20	0	55.1	1019	801	1072	936	964
Stampede	Pinto	18	0	55.8	1207	714	1218	966	1046
Torreón	Pinto	20	0	57.7	1031	895	1250	1073	1059
Vibrant	Pinto	18	0	56.0	1150	569	908	739	876
Windbreaker	Pinto	18	0	55.0	1070	640	560	600	757
Cowboy	Pinto	18	0	56.0		586	1230	908	--
Blizzard	Navy	20	0	59.6	787	448	894	671	710
HMS Medalist	Navy	20	0	59.8	962	474	868	671	768
T9905	Navy	22	0	61.5	878	580	1078	829	845
ND Polar	Navy	17	0	60.7	819	709	964	836	831
Armada	Navy	19	0	59.8			915	--	--
Merlot	Sm Red	22	0	56.3	794	654	782	718	743
Viper	Sm Red	18	0	59.3	1257	1042	1236	1139	1178
Rosetta	Pink	19	0	56.5		738	736	737	--
Black Tails	Black	17	0	60.8	1151	730	946	838	942
Eclipse	Black	20	0	59.8	1250	457	983	720	897
ND Twilight	Black	16	0	62.9	1073	663	1018	840	918
Zorro		20	0	57.0		753	768	760	--
ND Pegasus	Great Northern	21	0	57.8	1342	740	1404	1072	1162
Trial Mean		19	0	57.9	1063	709	1016	859	929
C.V. %		9.9	--	1.7	12.2	18.7	12.8	--	--
LSD 5%		3.1	--	1.4	184	187	178	--	--
LSD 10%		2.5	--	1.1	154	156	138	--	--

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

Planting Date: May 27

Harvest Date: September 19

Previous Crop: Spring Wheat

**NDSU Hettinger Research Extension Center**

**Chickpea - 2022** **Hettinger, ND**

Variety	Days to		Lodging	Seed Size		Seed Size	Seed Weight	Grain Yield			Average Yield	
	Flower	Height		>22/64	<22/64			2020	2021	2022	2 yr	3 yr
	DAP <sup>1</sup>	inches	0 - 9 <sup>2</sup>	%		seed/lb	lb/bu	lbs/ac				
<b>Kabuli Type</b>												
CDC Frontier	59	21	0	23	77	1392	59.6	761	571	2694	1632	1342
CDC Orion	55	22	0	61	39	1130	57.1	624	840	3022	1931	1495
Kasin	59	28		1	99	1646	58.8	--	--	2137	--	--
ND Crown	57	22	0	68	33	1114	58.8	487	539	2649	1594	1225
New Hope	58	24	0	65	35	1128	57.7	--	581	2170	1376	--
Royal	59	23	0	63	37	1146	55.9	340	411	1842	1127	864
Sawyer	56	21	0	44	56	1231	57.9	347	722	2204	1463	1091
Sierra	58	19	0	74	26	1097	54.3	271	339	1661	1000	757
MS-22CP1	55	21		60	40	1168	57.0	--	--	2929	--	--
Mean	57	22	0	51	49	1228	57.4	539	640	2368	1446	1129
C.V. %	1.0	6.7	--	14.9	15.5	4.0	2.0	10.3	20.5	8.1	--	--
LSD 5%	0.7	1.9	--	9	9	60	1.4	82	191	231	--	--
LSD 10%	0.5	1.4	--	7	7	46	1.1	68	158	178	--	--

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

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

Planting Date: May 4

Harvest Date: September 1

Previous Crop: Pea

**NDSU Dickinson Research Extension Center**

**2022 Chickpea - Recrop**

**Dickinson, ND**

Variety	Days to Flower	Days to Mature	Plant Height in	1000 seed weight gm	Seeds per Pound	Test Weight lbs/bu	Seed Size >22/64 %	Yield lbs/ac
CDC Frontier	55	121	13	404	1,122	61.7	67	1,177
CDC Orion	53	122	12	451	1,006	61.4	83	1,188
ND Crown	55	121	13	439	1,036	62.0	80	1,106
Royal	60	121	11	578	786	61.1	95	516
Sawyer	58	121	11	447	1,014	61.5	81	535
Sierra	57	121	10	500	907	60.5	92	470
Trial Mean	56	121	12	470	979	61.4	83	832
CV %	3.6	1.0	13.8	3.0	2.8	0.9	3.4	14
LSD 0.05	3	2	2	21	41	0.9	4	171
LSD 0.10	2	1	2	18	34	0.7	3	141

Planting Date: May 10, 2022

Harvest Date: September 26, 2022

Previous Crop: Cover Crop

**NDSU Hettinger Research Extension Center**

Field Pea - 2022										Hettinger, ND	
Variety	Days to Flower	Days to Mature	Canopy Height	Lodging	Seed Protein	1,000 Seed Wt.	Seeds Lb	Test Weight	Seed Yield		
	DAP <sup>1</sup>	DAP <sup>1</sup>	inches	0 - 9 <sup>2</sup>	%	gm	seeds	lb/bu	2022	2-Yr. Avg.	3-Yr. Avg.
-----Bushels per acre-----											
<b>Yellow Cotyledon Type</b>											
AAC Asher	55	80	25	5	27.4	216	2100	62.3	34.0	31.1	32.9
AAC Chrome	57	81	25	4	26.9	206	2223	62.5	38.1	30.9	31.2
AAC Julius	57	81	25	4	28.4	168	2693	61.6	41.7	--	--
AAC Profit	58	82	26	5	29.0	194	2350	62.1	42.7	33.7	34.4
Agassiz	56	80	24	7	28.9	192	2365	62.1	39.1	31.6	31.7
CDC Amarillo	58	82	27	3	27.2	195	2328	61.0	38.5	31.1	32.2
CDC Inca	58	82	29	3	28.0	208	2188	62.8	45.2	35.7	35.6
CDC Spectrum	57	81	25	4	28.3	195	2331	61.6	45.2	36.1	35.2
CP5222Y	55	78	23	6	29.1	223	2034	61.4	41.3	--	--
CP5244Y	55	79	24	7	27.4	206	2227	61.8	38.4	--	--
DL Apollo	56	80	25	5	29.2	178	2561	57.6	36.0	30.5	28.7
DS Admiral	57	82	27	2	27.6	194	2342	63.0	48.6	35.8	32.6
Durwood	57	81	27	6	28.5	207	2209	61.6	40.9	33.0	31.7
Goldenwood	61	84	21	3	28.7	162	2828	59.3	31.4	--	--
Korando	54	79	25	7	28.6	225	2023	60.8	39.1	31.6	29.1
LG Stunner	55	79	25	5	30.1	183	2477	62.4	32.3	27.2	27.3
MS GrowPro	58	82	27	7	29.9	252	1808	60.3	38.2	32.1	--
ND Dawn	57	80	23	7	26.8	194	2335	62.4	44.6	34.9	32.4
Orchestra	56	80	26	7	30.2	225	2020	62.2	38.4	31.3	29.6
Pizzazz	54	79	24	7	28.2	229	1982	62.7	42.9	--	--
Salamanca	56	80	27	6	29.1	215	2113	61.9	46.6	36.1	33.1
MS-20Y1	57	82	26	7	28.4	208	2180	61.5	41.9	--	--
MS-20Y3	57	81	27	7	29.2	225	2015	61.9	44.1	--	--
MS-22YP6	57	81	22	7	28.3	167	2724	62.1	39.2	--	--
PRO 143-6230	56	81	25	7	28.2	167	2733	62.9	40.9	--	--
PRO 174-7148	57	81	23	8	28.2	168	2700	61.1	43.9	--	--
<b>Green Cotyledon Type</b>											
Aragorn	54	78	21	8	27.9	162	2802	61.7	32.4	26.1	24.9
Arcadia	56	82	22	8	27.2	159	2856	62.4	36.3	29.9	30.5
CDC Striker	56	80	24	5	29.0	212	2153	62.0	36.9	30.5	29.0
ND Victory	59	82	26	7	29.2	156	2905	63.1	40.1	--	--
Shamrock	58	82	24	6	28.3	189	2411	61.9	36.6	30.2	28.6
MS-20G1	59	83	28	6	27.6	216	2107	61.4	39.0	--	--
Mean	57	78	25	6	28.4	197	2348	61.7	39.9	32.0	31.1
C.V. %	0.9	1.2	8.1	19.4	2.2	6.0	6.2	1.2	8.6	--	--
LSD 5%	0.6	0.7	2.4	1.3	0.8	14	172	0.9	4.0	--	--
LSD 10%	0.5	0.6	1.8	1.0	0.6	11	133	0.7	3.1	--	--

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

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

Planting Date: May 4

Harvest Date: August 8



**NDSU Dickinson Research Extension Center**

<b>2022 Field Pea - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days	Days	1000	Seeds	Plant	Test	Protein	--Grain Yield--			Average Yield	
	to	to	Seed	per				Height	Weight	2020	2021	2022
	Flower	Mature	Weight	Pound	in	lbs/bu	%	-----bu/ac-----			--bu/ac--	
<b><i>Yellow Types</i></b>												
AAC Chrome	52	85	272	1,676	23	65.7	25.9	26.1	13.8	42.3	28.0	27.4
AAC Julius	53	81	225	2,024	23	65.0	26.9	--	15.5	45.2	30.3	--
Agassiz	49	83	275	1,664	23	64.6	27.1	24.4	14.8	41.8	28.3	27.0
CDC Amarillo	52	84	240	1,892	24	65.7	26.9	34.5	14.0	39.1	26.6	29.2
CDC Inca	51	84	272	1,711	23	66.4	27.3	29.23	16.3	41.4	28.8	28.97
CDC Spectrum	52	84	259	1,751	21	65.3	27.7	29.5	15.1	39.3	27.2	28.0
CP5222Y	49	80	293	1,552	18	64.3	29.2	--	--	41.2	--	--
CP5244Y	49	84	248	1,832	22	65.8	26.3	--	--	39.6	--	--
DS Admiral	50	82	245	1,857	24	65.6	27.5	30.4	16.3	43.8	30.1	30.2
MS GrowPro	50	84	323	1,418	22	65.3	29.1	--	14.6	31.9	23.3	--
ND Dawn	50	74	244	1,865	21	64.5	26.1	25.79	16.1	39.9	28.0	27.28
Salamanca	50	81	277	1,643	23	64.0	29.1	25.7	15.1	39.1	27.1	26.7
<b><i>Green Types</i></b>												
Aragorn	49	79	237	1,937	18	62.8	28.1	23.4	11.4	34.6	23.0	23.1
Arcadia	50	80	230	1,994	17	64.3	26.0	33.59	14.8	40.6	27.7	29.66
CDC Striker	50	83	263	1,728	20	65.1	29.7	23.2	14.8	43.7	29.2	27.2
MS-20G1	54	86	278	1,631	25	66.4	26.8	--	--	39.9	--	--
ND Victory	54	88	204	2,222	25	64.1	27.0	--	--	32.0	--	--
Shamrock	51	83	235	1,931	21	65.7	26.9	32.8	13.0	32.2	22.6	26.0
Trial Mean	51	82	257	1,796	22	65.0	27.4	28.4	14.3	39.3	--	--
CV %	2.4	5.0	9.1	8.0	7.9	1.3	1.7	17.1	17.6	9.8	--	--
LSD 0.05	2	6	33	203	2	1.2	0.7	6.8	3.5	5.5	--	--
LSD 0.10	1	5	28	170	2	1.0	0.5	5.7	2.9	4.6	--	--

Planting Date: May 12, 2022

Harvest Date: August 12, 2022

Previous Crop: cover crop forage

Seeding Rate: 325,000 live seeds/ac

Grain protein percentages reported on 0% moisture basis

**NDSU Hettinger Reserach Extension Center**

**Lentil - 2022** **Hettinger, ND**

Variety	Days to	Height	Lodging	1,000	Seeds	Test	Grain	----- Grain Yield -----			----- Average Yield -----	
	Flower			Seed Wt.	Lb	Weight	Protein	2020	2021	2022	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 Grandora	58	21	0	71	6449	57.1	25.5	--	1192	1258	1225	--
CDC Greenstar	58	20	0	70	6525	60.6	24.8	1893	1591	2203	1897	1896
<b>Medium Green Type</b>												
Avondale	55	20	0	51	8908	62.1	24.8	1852	1725	2191	1958	1923
CDC Richlea	56	19	0	51	8897	62.2	25.1	1700	1618	2336	1977	1885
<b>Small Green Type</b>												
CDC Kermit	58	17	0	36	12563	64.2	25.8	1688	1564	2168	1866	1807
ND Eagle	55	18	0	41	11273	63.4	25.6	1671	1536	2406	1971	1871
Trial Mean	57	19	0	53	9103	61.7	25.2	1687	1537	2094	1816	1876
C.V. %	1.2	8.9	--	4.8	5.7	0.9	1.7	12.4	6.3	9.2	--	--
LSD 5%	0.8	2.1	--	3.1	639	0.7	0.5	310	176	238	--	--
LSD 10%	0.6	1.6	--	2.4	488	0.6	0.4	256	143	181.7	--	--

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

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

Planting Date: May 4

Harvest Date: August 14

Previous Crop: Field Peas

**NDSU Dickinson Research Extension Center**

<b>2022 Lentil - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days	Days	1000	Seeds	Plant	Test	Protein	---Grain Yield---			Average Yield	
	to	to	Seed	per				Height	Weight	2019	2020	2022
	Flower	Mature	Weight	Pound	in	lbs/bu	%	-----lbs/ac-----			---lbs/ac---	
Avondale	51	120	40	11,503	13	51.8	28.9	--	1034	1381	1207	--
CDC	49	122	53	8,549	15	48.4	30.7	--	--	974	--	--
CDC	52	122	51	8,923	14	47.5	30.0	--	1276	1101	1189	--
CDC Kermit	59	120	32	14,293	14	57.0	31.3	--	1386	1531	1459	--
CDC Richlea	59	120	42	10,894	14	53.9	29.7	1,400	1269	1527	1398	1399
ND Eagle	49	120	34	13,521	13	54.5	29.5	1,226	1332	1465	1398	1341
Trial Mean	53	121	42	11,281	14	52.2	30.0	1,400	1,310	1,330	--	--
CV %	14.8	0.0	4.1	4.4	5.6	2.0	2.1	12.7	13.8	12.2	--	--
LSD 0.05	12	0	3	747	1	1.6	1.0	257	316	245	--	--
LSD 0.10	10	0	2	614	1	1.3	0.8	214	260	201	--	--

Planting Date: May 10, 2022

Harvest Date: September 26, 2022

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>Lupin - 2022</b>	<b>Hettinger, ND</b>
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Variety	Days to Canopy		Seed Lodging	Seed Protein %	1,000 Seed Wt. gm	Seeds Lb	Test Weight lb/bu	Seed Yield	
	Flower DAP <sup>1</sup>	Height inches						0 - 9 <sup>2</sup>	2022 lb/ac
LND0127	52	20	0		296	1533	56.7	1361	976
LND0212	53	19	0		296	1530	57.2	1393	--
LND0228	54	18	0		264	1725	57.7	1304	--
LND0229	53	20	0		255	1775	57.9	1286	--
LND0431	54	21	0		282	1614	55.6	1105	--
LND0603	54	19	0		271	1680	57.3	1876	1241
LND0605	53	20	0		259	1752	55.2	1175	863
LND0614	54	20	0		274	1661	56.5	1513	--
LND0617	54	18	0		268	1700	56.8	925	707
LND0619	54	19	0		259	1756	57.0	1285	945
LND0621	54	19	0		263	1724	55.4	1229	888
LND0705	54	20	0		265	1711	56.4	1328	--
LND0727	54	18	0		270	1678	58.1	1380	--
LNDA210	54	18	0		259	1754	57.2	1391	--
LUPRO 2085	54	22	0		272	1669	56.6	1255	881
NR55-BAER	53	23	0		290	1560	56.3	1356	--
BLU 25	69	21	0		311	1461	55.9	1265	--
BLU 31	55	22	0		356	1259	56.3	1290	--
<b>Trial Mean</b>	<b>55</b>	<b>20</b>	<b>0</b>		<b>278</b>	<b>1641</b>	<b>56.7</b>	<b>1318</b>	<b>929</b>
<b>C.V. %</b>	<b>1.0</b>	<b>9.1</b>	<b>--</b>		<b>3.2</b>	<b>3.5</b>	<b>1.9</b>	<b>21.1</b>	<b>--</b>
<b>LSD 5%</b>	<b>0.8</b>	<b>2.5</b>	<b>--</b>		<b>13</b>	<b>81</b>	<b>1.5</b>	<b>393</b>	<b>--</b>
<b>LSD 10%</b>	<b>0.6</b>	<b>1.9</b>	<b>--</b>		<b>10</b>	<b>62</b>	<b>1.1</b>	<b>302</b>	<b>--</b>

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

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

Planting Date: May 4

Harvest Date: August 29

**NDSU Dickinson Research Extension Center**

<b>2022 Lupin - Recrop</b>	<b>Dickinson, ND</b>
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Variety	Days to Flower	Days to Mature	Plant Height in	1000 seed weight gm	Seeds per Pound	Test Weight lbs/bu	Yield lbs/ac
Blu 25	60	115	20	415	1,094	55.9	697
Blu 31	52	114	25	443	1,026	55.9	1,261
LND0127	46	105	19	375	1,214	55.3	1,105
LND0212	47	106	19	383	1,191	54.7	1,001
LND0228	48	105	19	350	1,299	56.2	1,301
LND0229	48	105	19	353	1,289	55.5	1,329
LND0431	47	107	20	379	1,198	55.6	1,309
LND0603	48	105	19	346	1,315	54.8	1,602
LND0605	48	107	19	376	1,208	54.6	1,653
LND0614	48	105	19	356	1,279	55.0	1,412
LND0617	48	103	19	360	1,261	55.2	1,237
LND0619	48	103	19	352	1,294	55.6	1,333
LND0621	47	103	19	362	1,256	54.8	1,360
LND0705	48	106	20	367	1,244	55.3	1,592
LND0727	48	105	19	348	1,304	55.1	1,350
LNDa210	47	107	20	361	1,255	54.4	1,263
Lupro 2085	48	105	18	368	1,233	55.0	1,703
NR55-Baer	48	107	22	417	1,092	53.8	1,574
<b>Trial Mean</b>	49	107	20	373	1,225	55.1	1338
<b>CV %</b>	1.1	2.0	7.3	4.4	4.4	1.2	14.5
<b>LSD 0.05</b>	1	4	2	27	90	1.1	322
<b>LSD 0.10</b>	1	3	2	23	75	0.9	268

Planting Date: May 16, 2022  
Harvest Date: September 26, 2022  
Previous Crop: Cover Crop

## NDSU Hettinger Research Extension Center

**Soybean - Roundup Ready - 2022**

**Hettinger, ND**

Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield		
								2022	2-Yr	3-Yr
				inches	lbs/bu	%	%			
NDSU	ND21008GT20	00.8	9/6	29	53.0	16.8	34.4	26.0	--	--
NDSU	ND17009GT	00.9	9/11	28	56.6	17.0	35.8	27.0	24.0	23.9
Xitavo	XO 0101E	0.1	9/15	23	54.3	16.8	34.5	26.2	--	--
Proseed	XF 30-12	0.1	9/15	25	53.0	16.9	33.6	30.0	--	--
Xitavo	XO 0213E	0.2	9/17	27	53.8	17.7	33.2	30.5	--	--
Proseed	XT 80-20N	0.2	9/15	29	54.9	16.5	33.6	31.8	--	--
Xitavo	XO 0311E	0.3	9/18	24	53.9	16.7	33.7	30.4	--	--
Proseed	EL 30-33	0.3	9/19	26	53.6	18.3	32.5	30.6	--	--
Proseed	XT 60-40N	0.4	9/15	25	54.4	17.9	33.7	29.3	25.8	24.5
Proseed	XF 30-42N	0.4	9/18	27	53.6	18.1	33.7	31.8	--	--
Xitavo	XO 0573E	0.5	9/20	23	55.9	17.5	33.5	27.9	--	--
Xitavo	XO 0602E	0.6	9/21	25	57.5	16.0	34.3	31.2	--	--
Xitavo	XO 0731E	0.7	9/25	25	56.2	16.4	33.9	28.7	--	--
NDSU	ND2108GT73	0.8	9/19	26	57.3	17.3	33.4	28.1	25.9	24.6
Trial Mean			9/16	26.0	54.8	17.1	33.8	29.7	24.9	24.2
C.V. %			0.4	4.5	1.2	1.8	1.0	6.4	--	--
LSD 5%			1.6	1.4	0.8	0.4	0.4	2.3	--	--
LSD 10%			1.3	1.1	0.6	0.3	0.3	1.7	--	--

Planting Date: May 25

Harvest Date: September 28

Previous Crop: Spring Wheat

**NDSU Hettinger Research Extension Center**

**Soybean - Roundup Ready - 2022** **Mandan, ND**

Company/Bra Variety		Maturity	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield		
							2022	2-Yr	3-Yr
			inches	lbs/bu	%	%			
NDSU	ND21008GT20	00.8	22	53.6	17.9	32.3	42.0	--	--
NDSU	ND17009GT	00.9	21	56.4	17.8	35.2	40.7	34.2	35.7
Xitavo	XO 0101E	0.1	19	53.0	17.2	33.3	42.2	--	--
Proseed	XF 30-12	0.1	22	53.8	17.2	32.4	46.9	--	--
Xitavo	XO 0213E	0.2	22	53.8	17.7	32.7	42.7	--	--
Proseed	XT 80-20N	0.2	23	55.1	16.8	32.9	48.3	--	--
Xitavo	XO 0311E	0.3	21	54.1	17.2	32.5	46.2	--	--
Proseed	EL 30-33	0.3	22	53.3	18.0	32.1	41.9	--	--
Proseed	XT 60-40N	0.4	21	55.4	17.9	32.6	44.7	35.1	34.1
Proseed	XF 30-42N	0.4	22	55.0	17.8	33.4	49.8	--	--
Xitavo	XO 0573E	0.5	19	55.2	17.0	34.2	40.2	--	--
Xitavo	XO 0602E	0.6	20	57.0	16.1	34.3	43.8	--	--
Xitavo	XO 0731E	0.7	21	56.7	16.9	33.7	48.2	--	--
NDSU	ND2108GT73	0.8	21	56.1	17.6	32.2	48.4	40.1	39.4
Trial Mean			21	54.9	17.3	33.2	44.9	36.5	36.4
C.V. %			6.4	1.0	1.9	1.4	8.1	--	--
LSD 5%			2.7	0.6	0.4	0.5	4.4	--	--
LSD 10%			1.9	0.5	0.3	0.4	3.4	--	--

Planting Date: May 18

Harvest Date: October 6

Previous Crop: Spring Wheat

**Soybean - Conventional - 2022**

**Hettinger, ND**

Company/Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Yield	Average Yield	
							2-Yr	3-Yr
				inches	lbs/bu			
NDSU	ND Rolette	00.9	9/15	27	55.7	30.4	--	--
NDSU	ND Benson	0.4	9/22	26	56.4	30.3	--	--
NDSU	ND Dickey	0.7	9/20	25	56.4	28.2	25.9	23.6
NDSU (RR Check)	ND17009GT	00.9	9/12	28	56.3	24.8	26.3	25.4
Trial Mean			9/17	27	56.2	28.4	26.1	24.5
C.V. %			1.3	2.2	0.8	10.4	--	--
LSD 5%			2.5	1.2	0.8	4.9	--	--
LSD 10%			2.0	0.9	0.6	3.9	--	--

Planting Date: May 25

Harvest Date: September 28

Previous Crop: Spring Wheat



**NDSU Hettinger Research Extension Center**

<b>HRSW Fungicide - 2022</b>	<b>Hettinger, ND</b>
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Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	bu/ac
<i>Variety</i>						
ND VitPro	79	32	0	62.7	15.8	75.0
SY Valda	81	30	0	62.5	14.9	82.6
Shelly	80	30	0	61.1	14.4	83.0
LSD 5%	NS	NS	--	0.3	0.3	1.6
<i>Fungicide</i>						
CONTROL	80	31	0	62.1	15.0	79.2
TILT Feekes 2-3	80	31	0	61.9	15.1	80.0
PROSARO Feekes 10.51	80	31	0	62.3	15.1	81.4
TILT Feeks 2-3 + PROSARO Feeks 10.51	80	31	0	62.2	14.9	80.8
LSD 5%	NS	NS	--	NS	NS	NS
<i>Variety x Fungicide</i>						
<b>ND Vitpro</b>						
CONTROL	79	32	0	62.7	15.7	73.2
TILT Feekes 2-3	79	32	0	62.5	15.7	74.7
PROSARO Feekes 10.51	79	32	0	62.9	15.9	75.4
TILT Feekes 2-3 + PROSARO Feekes 10.51	79	33	0	62.8	15.8	76.6
<b>SY Valda</b>						
CONTROL	81	30	0	62.4	14.9	80.7
TILT Feekes 2-3	81	30	0	62.3	15.1	82.6
PROSARO Feekes 10.51	81	30	0	62.6	14.9	83.7
TILT Feekes 2-3 + PROSARO Feekes 10.51	81	30	0	62.6	14.8	83.5
<b>Shelly</b>						
CONTROL	80	31	0	61.2	14.5	83.9
TILT Feekes 2-3	80	30	0	61.0	14.4	82.7
PROSARO Feekes 10.51	80	30	0	61.3	14.4	85.1
TILT Feekes 2-3 + PROSARO Feekes 10.51	80	29	0	61.1	14.2	82.5
LSD 5%	NS	NS	--	NS	NS	NS
Average	80	31	0.0	62.1	15.0	80.4
CV	0.1	3.2	--	0.6	2.5	2.1

<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 11

Harvest Date: August 15

Feeks 2-3 Application: June 3

Feeks 10.51 Application: July 1

**NDSU Hettinger Research Extension Center**

<b>Durum Fugicide - 2022</b>	<b>Hettinger, ND</b>
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Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield
	DAP <sup>1</sup>	inches	0-9 <sup>2</sup>	lbs/bu	%	
CONTROL	82	38	0	60.1	14.5	68.6
TILT @ Feeks 2-3	82	37	0	60.3	14.4	68.9
PROSARO @ Feeks 10.51	82	37	0	60.7	14.6	73.2
TILT @ Feeks 2-3 + PROSARO @ Feeks 10.51	82	38	0	60.4	14.2	73.3
Trial Mean	82	38	0	60.3	14.4	71.0
C.V. %	--	1.8	--	0.9	1.8	4.2
LSD 5%	--	NS	--	NS	NS	3.9
LSD 10%	--	NS	--	NS	NS	2.9

<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.

Variety: ND Riveland  
 Planting Date: April 11  
 Harvest Date: August 15  
 Feeks 2-3 Application: June 3  
 Feeks 10.51 Application: July 5

**NDSU Hettinger Research Extension Center**

<b>Chickpea Planting Date Study - 2022</b>				<b>Hettinger, ND</b>
	Plant Height	Moisture	Test Weight	Grain Yield
	inches	%	lbs/bu	lbs/ac
<b>Planting Date</b>				
May 3	23	10.5	57.8	3590
May 20	20	10.3	57.7	2879
May 27	19	10.6	57.7	2668
LSD 5%	1	NS	NS	327
<b>Fungicide</b>				
Fungicide	21	10.5	57.9	3068
No Fungicide	20	10.4	57.6	3024
LSD 5%	NS	NS	NS	NS
<b>Planting Date X Fungicide</b>				
May 3 - Fungicide	23	10.6	57.7	3547
May 3 - No Fungicide	23	10.5	57.8	3633
May 20 - Fungicide	20	10.3	58.4	3002
May 20 - No Fungicide	19	10.3	57.1	2756
May 27 - Fungicide	19	10.6	57.6	2654
May 27 - No Fungicide	20	10.6	57.9	2682
LSD 5%	NS	NS	NS	NS
Trial Mean	20	10.5	57.7	3046
C.V. %	7.6	2.8	1.2	10.1

First fungicide application was made at bloom initiation.  
 Subsequent application were made on a 10-14 day interval.

*Fungicide Applications*

May 3 - June 29, July 13

May 20 - July 5, July 22

May 27 - July 8, July 22

Harvest Date: September 5

## Hettinger Soybean Seeding Rate Study

John Rickertsen & Michael Wells, Hettinger Research Extension Center, 2018 - 2022

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 in 2018 with nine seeding rates, 20,000 to 180,000 in 20,000 increments in both drilled (7") and row (30") configurations at Hettinger, North Dakota. In 2018 and 2019 the variety Proseed 30-20 was used and in 2020-2022 ND17009GT was used. The trials were planted with an 8 row 7" inch spacing plot drill equipped with John Deere 90 ProSeries openers (2022) or a 9 row 7" inch spacing plot drill equipped with Acra Plant ADU double disk openers (2018-2021). The 30" rows were planted with a two-row plot planter equipped with John Deere 1700 row units. Weed control was obtained by a pre-emergence herbicide application of BroadAxe and post-emergence application of glyphosate. The trial was harvested with a Kincaid 8XP small plot combine. Data was recorded on flowering, height, maturity date, yield, test weight, seed size seed protein and seed oil content.

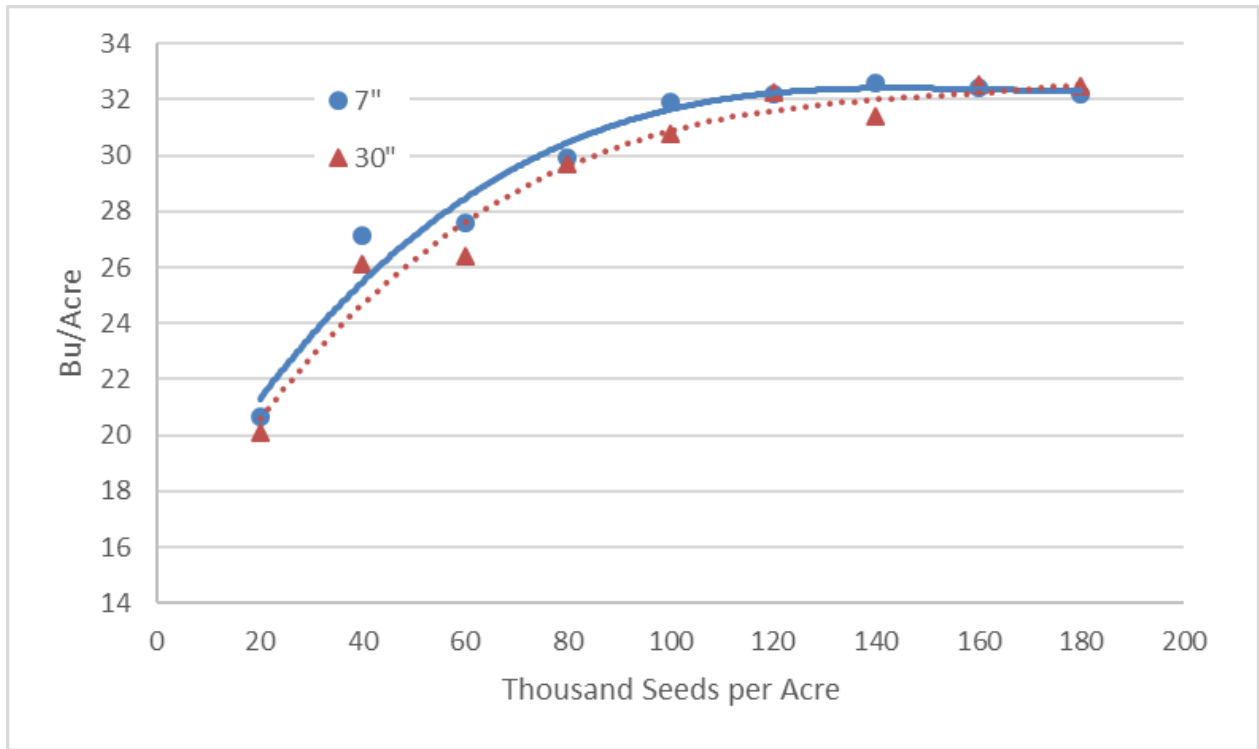
The following charts and table present the results of this study averaged over the past five years.

Comparing row spacings the only significant difference in traits in the five-year summary was 30" rows were 3" taller and .3% higher in seed oil content. In 2018, 2020 and 2021, there was no difference in yield between 7" and 30" rows, while in 2019, 7" rows yielded 5.5 Bu/Acre higher than 30" rows and in 2022 30" rows yielded 2.9 Bu/Acre more than 7".

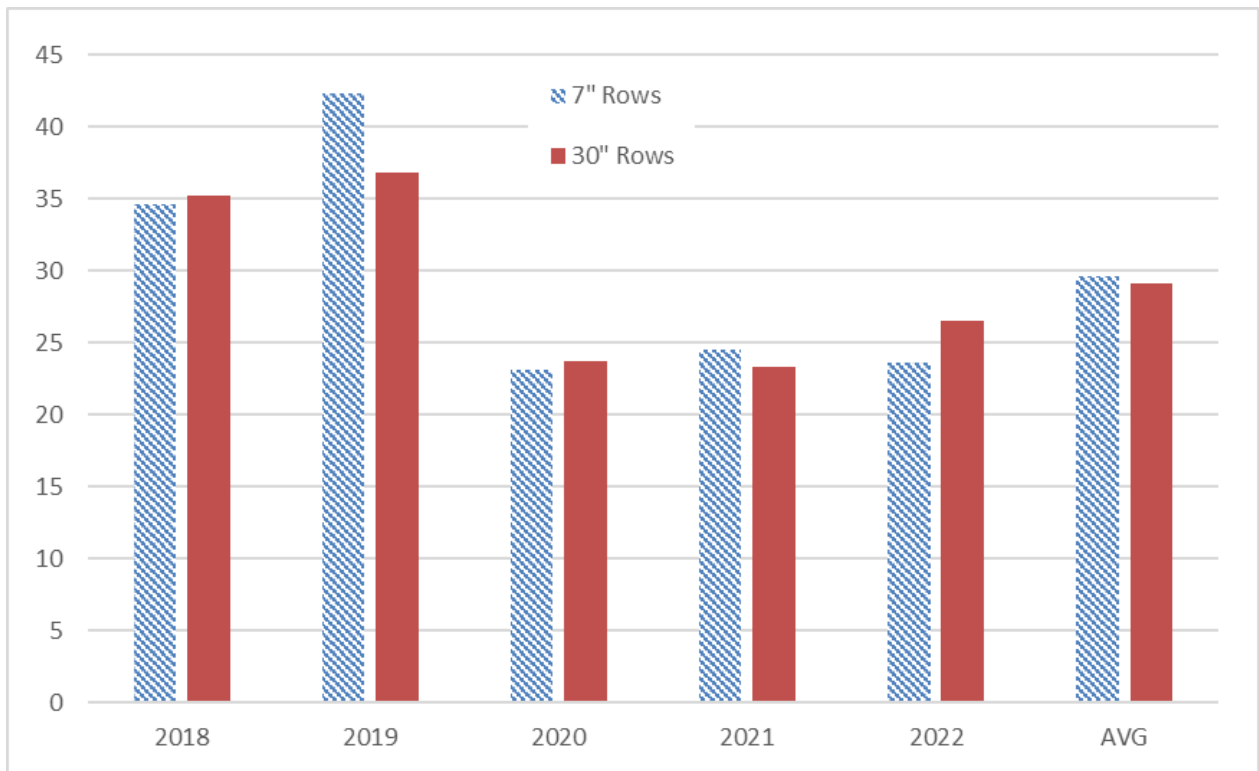
When looking at population averaged over row spacing, very low populations were slightly taller, lower in test weight and larger in seed size than 60,000 and higher rates. For seed protein and oil content, as seeding rate increased, oil content decreased and protein increased in 2018, 2019 & 2020. In 2021 and 2022 oil and protein were similar across populations.

The results for yield showed that seeding rates of 100,000 – 180,000 were not significantly different in yield and even the extremely low rate of 20,000 yielded 64% of the 100,000 - 180,000 seeding rates. Over the past five years the 120,000 seeding rate has looked like the best rate at Hettinger. It gives the same yields as the higher rates while still allowing a cushion if there are stand establishment problems.

Yields by Seeding Rate 2018 - 2022.



Yield by Row Spacing, 2018 - 2022.



Soybean Seeding Rate Study - 2018 - 2022								Hettinger, ND
30" Rows vs 7" Rows								
Row Spacing	Mature Date	Plant Height	Moisture	Test Weight	Seed Size	Seed Oil	Seed Protein	Grain Yield
		inches	%	lbs/bu	seeds/lb	%	%	bu/ac
7" Rows	9/15	27	11.3	56.2	3483	29.6	35.4	16.4
30" Rows	9/15	30	11.2	56.1	3342	29.3	35.5	16.6
LSD 5%	NS	1	NS	NS	NS	0.1	NS	NS
Population								
20,000	9/18	29	12.5	55.6	3132	35.4	16.6	20.4
40,000	9/16	29	11.6	56.1	3375	35.2	16.7	26.7
60,000	9/15	28	11.4	56.1	3394	35.1	16.6	27.1
80,000	9/15	28	11.1	56.4	3417	35.3	16.6	29.9
100,000	9/15	28	10.9	56.4	3488	35.7	16.5	31.4
120,000	9/15	28	11.0	56.3	3443	35.5	16.5	32.2
140,000	9/15	28	10.9	56.3	3474	35.5	16.4	31.9
160,000	9/14	28	10.9	56.1	3500	35.3	16.5	32.8
180,000	9/14	28	10.7	56.1	3488	35.9	16.3	32.5
LSD 5%	1	1	0.1	0.1	28	0.1	0.1	0.7
Row Spacing X Population								
7" - 20,000	9/18	28	12.9	55.4	2994	35.5	16.5	20.6
7" - 40,000	9/16	27	11.7	56.0	3432	35.4	16.6	27.2
7" - 60,000	9/16	27	11.3	56.0	3478	35.0	16.6	27.6
7" - 80,000	9/16	27	11.2	56.3	3774	35.4	16.6	29.9
7" - 100,000	9/15	26	10.9	56.5	3603	35.6	16.3	31.9
7" - 120,000	9/15	26	11.0	56.5	3541	35.4	16.5	32.0
7" - 140,000	9/15	26	10.9	56.5	3577	35.6	16.3	32.3
7" - 160,000	9/15	26	11.0	56.1	3657	35.2	16.4	32.9
7" - 180,000	9/14	26	10.7	56.2	3589	35.8	16.2	32.2
30" - 20,000	9/18	29	12.1	55.7	3270	35.3	16.8	20.2
30" - 40,000	9/16	30	11.5	56.2	3318	35.0	16.8	26.2
30" - 60,000	9/15	29	11.5	56.2	3309	35.2	16.6	26.5
30" - 80,000	9/15	29	11.1	56.4	3361	35.3	16.6	29.8
30" - 100,000	9/15	30	10.8	56.2	3373	35.8	16.7	30.9
30" - 120,000	9/15	30	11.1	56.1	3345	35.7	16.5	32.4
30" - 140,000	9/14	30	10.9	56.2	3370	35.5	16.5	31.5
30" - 160,000	9/14	30	10.7	56.0	3343	35.3	16.6	32.7
30" - 180,000	9/15	29	10.7	55.9	3387	36.0	16.5	32.9
Trial Mean	9/15	28	11.2	56.3	3412	35.4	16.5	29.4
LSD 5%	1	1	0.4	0.3	83	0.2	0.4	2.0
C.V. %	1.6	7.6	4.7	0.9	1.7	1.7	1.9	9.6

# Surface Lime Impacts on No-Till North Dakota Soils

Chris Augustin, Dickinson Research Extension Center

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## Objective

Soils become acidic from the mineralization of ammonium-based fertilizers. No-till soils are particularly susceptible to acidification from the lack of mixing subsurface alkaline products and the tendency to apply ammonium-based fertilizers at or near the soil surface. As a result, the zone of acidification is at the depth of fertilizer placement (Blevins et al., 1982; Dick, 1983).

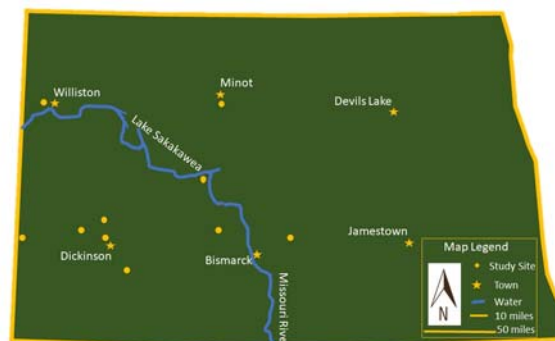
Soil pH controls chemical weathering and soil solution chemical activity. Phosphorus (P) and aluminum (Al) are two elements that greatly impact crop production and are dependent on soil pH. Phosphorus is most readily plant available when the soil pH is approximately six to seven. When soil pH is less than 5.5, Al becomes soluble, binds to P, and renders P unavailable to plants. Additionally, Al can have a toxic effect to plants that stunt and deform root growth and reduces seed germination. Free Al in the soil solution hydrolyzes water which further acidifies the soil (Lindsay, 2001). Soil pH less than 5.5 can reduce bacteria activity and cause crop nitrogen deficiencies (Graham, 1992).

Calcium-carbonate (lime) neutralizes acidity and is a common liming amendment (Sims and Lamb, 2010). Agriculture lime is not readily available in North Dakota. However, a waste product of the sugarbeet refining process (SBWL) is comprised of lime (Sims, 1996).

Lime requirement recommendations have not been developed for North Dakota (Sims, 1996). Soil acidity is new and growing issue to North Dakota soils. This project investigated the impacts of surface applied SBWL on acidic no-till soils in North Dakota.

## Methodology

Eleven sites (Figure 1) were established in April/May of 2021 after planting. Soil pH at the 0-3 in depth was less than 5.5. Collaborating producers planted and managed their crop. Experimental design was a randomized complete block design.



**Figure 1.** Locations of experimental sites in North Dakota (Google LLC, 2022).

Plastic hoops with a 36 in diameter were placed in the field and spaced at least 10 ft away from adjacent hoops. Soils were collected within 1 ft outside of the hoop. Soil was sampled by a hand probe at the 0-3, 3-6, and 0-6 in depths. Sugarbeet waste lime treatments were hand applied within the hoop after initial soil sampling. Treatments were 0, 2, 4, 8, and 16 tons lime/ac. The SBWL contained 0.6 lbs nitrate/ton, 5.2 lbs P/ton, 0.9 lbs potassium/ton, 75.5 % calcium carbonate equivalence, and 14% moisture.

Post harvest, October/November, soil samples were collected by a hand probe within the hoop at the 0-3, 3-6, and 0-6 in depths.

Soils were analyzed for nitrate, Olsen P, potassium, calcium carbonate equivalent, pH, buffer pH, salinity, organic matter, cation exchange capacity, zinc, sodium, manganese, magnesium, aluminum. Soil analysis was completed by AGVISE LABORATORIES (2022). Comparison of means and regression analysis was conducted by Statistical Analysis Software (SAS Institute Incorporated, 2019).

### Results

Sugarbeet waste lime treatments increased the soil pH of the 0-3 and 0-6 in depths. Lime applications of 4, 8, and 16 tons/ac increased the 3-6 in soil depth (Table 1). The regression analysis procedure produced statistically significant polynomial regressions from all, except the 6.3 and 7.1 buffer pH soil environments (Table 2). Sugarbeet waste lime treatments impacted salinity, P, Ca, Mn, Al, and calcium-carbonate-equivalent (Table 3). However, SBWL treatments did not impact soil organic matter (p-value 0.955), nitrate (p-value 0.703), potassium (p-value 0.983), magnesium (p-value 0.799), zinc (p-value 0.888), sodium (p-value 0.698), and cation exchange capacity (p-value 0.995). The 4, 8, and 16 tons lime/ac treatments increased soil salinity (Table 3).

Table 1. Beet lime impacts on soil pH at various depths.

Lime tons/ac*	0-3in	3-6in	0-6in
	-----pH-----		
0	5.4e	6.0d	5.7e
2 (2.6)	6.0d	6.0d	5.9d
4 (5.3)	6.4c	6.2c	6.3c
8 (10.6)	6.7b	6.4b	6.7b
16 (21.2)	7.0a	6.7a	6.9a
P-value	<0.001	<0.001	<0.001
Variance	0.609	0.461	0.528
C.V.	4.28	6.5	5.3

\*Applied as tons of lime/ac.

Parentheses values are tons of SBWL/ac.



Table 2. Regression analysis and predicted lime needed to raise soil pH at the 0-3 inch depth.

Buffer pH <sup>‡</sup>	Desired pH (0-3 in depth)			Equation**	r <sup>2</sup>
	5.5	6	6.5		
Tons of Calcium Carbonate/Acre					
6.2 n=5 <sup>†</sup>	5.6	9.5	14	$y = 1.271x^2 - 6.8828x + 5.0276$	0.99*
6.3 n=7	10	11	8.5	$y = -7.0431x^2 + 82.954x - 233.15$	0.6
6.4 n=20	0.7	3.4	8.6	$y = 5.1047x^2 - 53.374x + 139.86$	0.81*
6.5 n=24	2.7	5.2	8.6	$y = 1.5829x^2 - 13.1x + 26.826$	0.60*
6.6 n=29	2	4.5	8.1	$y = 2.0756x^2 - 18.833x + 26.826$	0.67*
6.7 n=19	1.5	5.5	9.2	$y = -0.6377x^2 + 15.394x - 63.884$	0.57*
6.8 n=27	0.9	2.4	5.1	$y = 2.3551x^2 - 24.025x + 61.806$	0.54*
6.9 n=22	0.1	1.2	3.8	$y = 2.9871x^2 - 32.222x + 86.998$	0.61*
7.0 n=16	-0.1	0.5	2.5	$y = 2.9062x^2 - 32.259x + 89.428$	0.59*
7.1 n=5	1.1	4.2	7.3	$y = -0.1207x^2 + 7.6291x - 37.184$	0.56

\*r<sup>2</sup> was significant at the 0.05 level.

\*\*x variable is desired soil pH at the 0-3 in depth. y variable is tons of lime/ac.

<sup>†</sup>n is the number of samples from each soil environment.

<sup>‡</sup>Sikora, 2006.

Table 3. Beet lime impacts on soil nutrients at the 0-6 inch depth.

Lime	Salts	Phosphorus (Olsen)	Calcium	Manganese	Aluminum	Calcium Carbonate Equivalence
tons/ac*	mmhos/cm		ppm			%
0	0.3b**	18d	1781c	18a	5a	0.6c
2(2.6)	0.3b	19d	1999c	14ab	2b	0.6c
4 (5.3)	0.4ab	20c	2286c	11ab	2b	0.8b
8 (10.6)	0.5a	23b	3096b	9b	2b	1.0b
16 (21.2)	0.5a	26a	4143a	9b	1b	1.5a
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Variance	1.18	56.7	1,480,729	54.56	15.1	0.28
C.V.	39.4	33	32.8	54.5	157.3	44.5

\*Applied as tons of lime/ac. Parentheses values are tons of SBWL lime/ac.

\*\*Different letters indicate statistical differences at the 0.05 level.

### Conclusions & Implications

- Surface applied SBWL could improve crop yields from by increasing the soil pH and by reducing Al and Mn.
- The regression equations (Table 2) based on the initial buffer pH (Sims, 1996) can be used to guide producers on lime recommendations. Soil buffer pH values of 6.1 or less and 7.2 or greater were not collected in this study.
- All pH buffer tests were greater than 6.3 and indicates that the reserve acidity pool is relatively small (Sims, 1996). Liming these soils to desirable pH levels (i.e. pH 6) could be required once a decade or more. Saskatchewan research suggests that similarly cropped, fertilized, and limed soils acidify in 18 years (Curtin and Ukrainetz, 1997).
- Olsen P soil tests increased from SBWL applications (Table 3). Sugarbeet waste lime in an acid soil environment might serve as P fertilizer.
- Soil salinity increased from SBWL (Table 3). However all treatments were less than 0.5 mmhos/cm and likely would not negatively impact North Dakota crop yields (Franzen et al., 2019).
- Calcium increased from SBWL applications (Table 3). Manganese and soil extractable Al levels decreased from SBWL treatments. Lime increased the soil pH and likely rendered Mn and Al insoluble (Lindsay, 2001).
- Two and 0 tons of lime/ac treatments both had 0.6% calcium-carbonate equivalence (Table 3). This suggests that the 2 tons of lime/ac reacted with the soil in one growing season.

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## Acid soil management update

Ryan Buetow, Dickinson Research Extension Center

No-till practices paired with heavy nitrogen (N) use have acidified the soil surface on many acres in the Northern Great Plains. Acid soil where the pH drops below 5.5 has an impact on nutrient availability, soil microbial activity, herbicide efficacy, stunted roots from aluminum (Al) toxicity and other plant/soil interactions. These areas can be improved from surface liming or lime incorporation; however, liming can be costly. We are continuing efforts to collect data on surface applications of lime at different rates in different environments and soil types. With incorporation of lime we can see a faster and deeper reaction of lime, however this tillage can negate the hard built efforts of no-till management. In a trial we have in Hettinger county, ND it was shown early in the growing season that our tillage pass was looking nice and green with all of the moisture we had, but as drought set in the tilled area dried out much faster and yield was greatly impacted. There are many factors that will go into decisions on how to manage these acid areas of fields and in some cases whole fields. Each management system is different and with each system comes different challenges. All management systems have trade-offs and you will need to decide what is best for your operation, but without lime application the acidity issue will continue to worsen. For many producers facing this issue, especially those working rented land, there is a search for alternative options to reduce yield loss on acid ground. Research has been conducted in western North Dakota on adaptive management strategies for mitigating the symptoms of aluminum toxicity and soil acidity including variety selection, in-furrow fertilizer application, and seed treatments. Variety selection showed a significant difference in yield (Table 1). Calcium in-furrow did not have an impact on yield (Table 2). Across HRSW varieties a yield bump of 1.5 bushel in 2021 and 9.3 bushels in 2022 was shown from seed placed P (0-45-0) applied at high rates (60 lb P<sub>2</sub>O<sub>5</sub>/ac) (Table 3). In 2021 we tried a wide range of seed treatments and foliar applications on wheat in acid soils including PGR's and biologicals that showed no response across 2 locations. The data suggests use of tolerant varieties along with in-furrow P fertilizer can be used to alleviate yield reduction of small grains on an acid soil. Ideally producers should be applying tons of lime to bring the pH above 5.5 because the variety and fertilizer may fix the yield loss but does not fix issues with pesticide breakdown and carryover, soil microbiological activity, and nutrient tie-up; all issues caused by acid soil. The implications of soil acidity reach much farther than an impact on yield but an overall attack on the ability to profitably manage your inputs. There are 3 main components in yield; plants per acre, seeds per plant, and seed size. Acidity in one way or another has an impact on all three of those components. The impacts on stand can be great as seen by many facing this issue. As seen in Figure 1 stand loss is often found in acid soils. The area to the left of the photo had an average pH of 4.8 with some spots showing a pH of 3.9 and the right side of the photo had an average pH of 5.1. A tissue analysis showed that the plants on the right had much less stress from aluminum toxicity with less than half the accumulated Al than the plants with reduced stand on the left with ppm of Al of 40.8 and 98.0 respectively. Not only did this show on the tissue samples but also manifested with shorter stressed plants with smaller heads. With each passing year more N is added to the system further acidifying the soil. As pH drops, Al becomes more soluble in soil solution. To fix this we need to add tons of lime and potentially reevaluate our fertilizer management.

**Table 1. HRSW variety across fertilizer treatments, Dickinson 2021 and 2022.**

Variety	Yield	
	2021	2022
SY Soren (susceptible)	19.6b	47.5b
Lanning (tolerant)	22.3a	65.4a
LSD (0.05)	1.2	3.2

**Table 2. Calcium fertilizer yields of HRSW across other treatments, Dickinson 2021 and 2022.**

Treatment	Yield	
	2021	2022
Control	21.4	54.3
Lime in furrow	20.3	56.3
Gypsum in furrow	20.8	57.4
Calcium nitrate in furrow	N/A	57.8
LSD (0.05)	ns	ns

**Table 3. P fertilizer across HRSW varieties, Dickinson 2021 and 2022.**

Treatment	Yield	
	2021	2022
Control	20.1b	51.8b
60 lbs additional P	21.6a	61.1a
LSD (0.05)	1.2	3.2

*Figure 1. Sunflower stand greatly reduced by soil acidity.*

## Assessment of early planting and early-maturing hybrids as tools in management of the red sunflower seed weevil

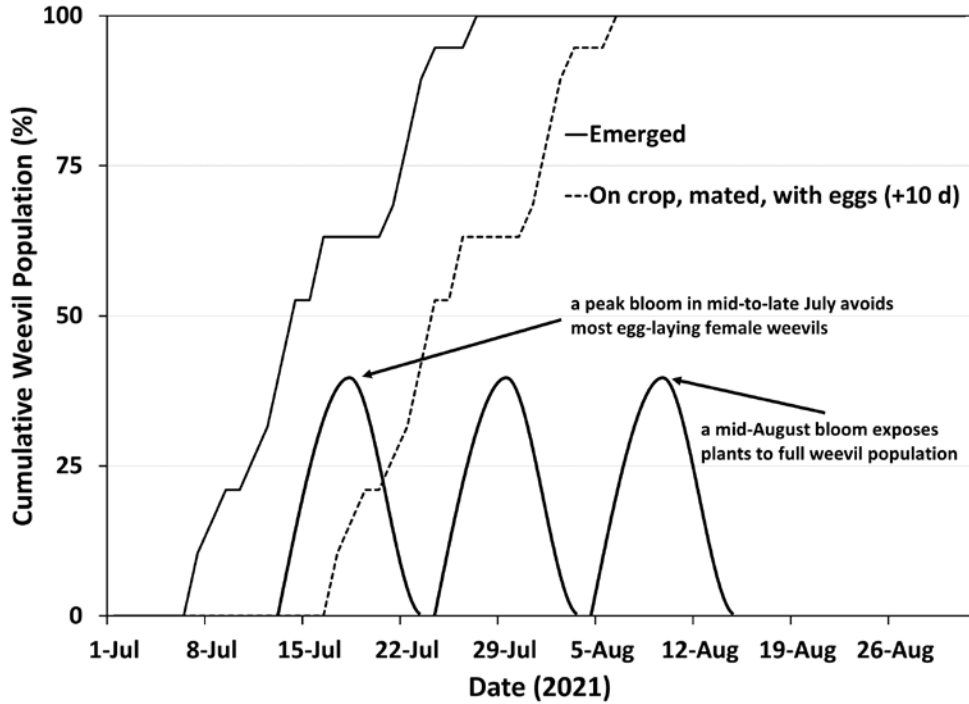
Jarrad Prasifka: USDA-ARS, Fargo  
Ryan Buetow: NDSU Dickinson REC

The red sunflower seed weevil has long been considered a key pest of sunflowers in North Dakota. The weevil has one generation per year, with adults emerging from the soil during early summer (Figure 1). Because females need to feed on pollen to complete development of their eggs (Korman & Oseto 1989), adult weevils move among plants within an area, leaving plants on which pollen shed is complete and landing on plants still in bloom. Female weevils lay eggs through the sunflower hull onto developing seeds, where larvae remain until they are mature. At maturity, larvae chew through the hull and drop, burrowing into the soil to overwinter. Though feeding of each weevil larva damages only a single seed, it reduces seed weight and oil (Oseto & Branness 1980). National Sunflower Association sunflower production survey data from 2017–2021 suggest red seed weevil is currently the most serious insect pest of sunflowers. Specifically, damage from the red seed weevil was detected in 46% of the 164 samples submitted in 2021, with damage as high as 76% of seeds in a sample. In some counties, damage has been bad enough that reportedly no confection contracts were offered in 2023.

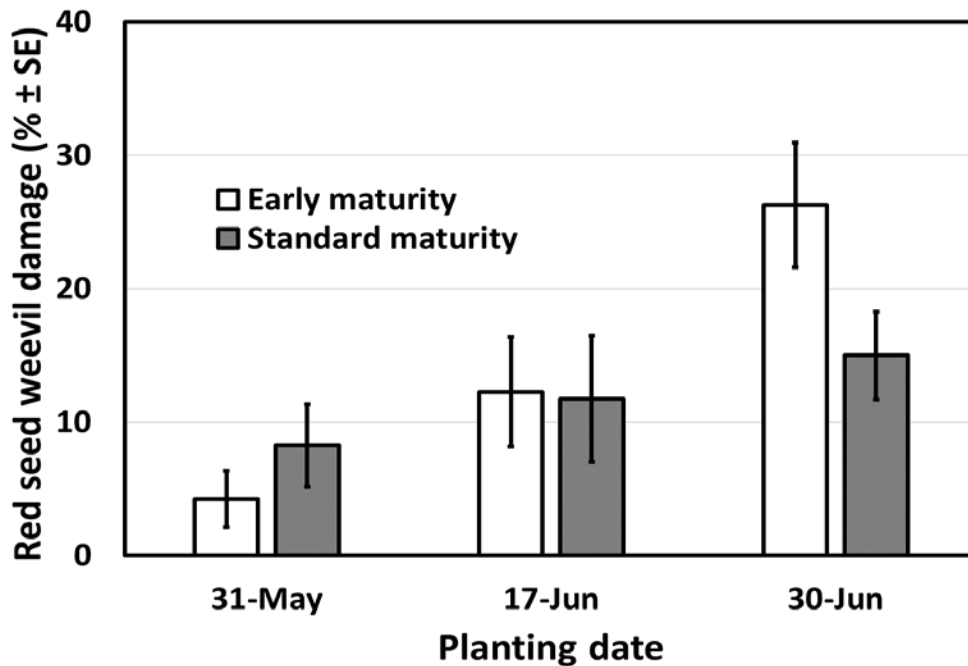
Chemical management alone has not been shown to be effective in some regions so it is important to use all of the tools in the pest management toolbox. By utilizing cultivar maturity and earlier planting dates we can add a layer of avoidance to our pest management strategy. Previous research in both South Dakota (Gednalske and Walgenbach 1983) and North Dakota (Oseto et al. 1987, Prasifka et al. 2016) show that early planting can prevent much of the damage by red sunflower seed weevils. This was repeated in Dickinson in 2022 even with weather conditions delaying the earliest planting dates. Across planting dates a clear trend emerged of increasing damage with later plantings and evidence that the use of early-maturity hybrids can have an additional benefit for avoiding seed weevil damage (Figure 2). This research is under consideration to be repeated in 2023 at multiple locations with an emphasis on impact of planting date and cultivar maturity on weevil damage and yield.

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**Figure 1.** Emergence of red sunflower seed weevil adults in Fargo, ND during summer 2021 from plots planted to spring wheat in April 2021. Emerged weevils (or those mated and ready to lay eggs) can be compared to three potential crop bloom periods shown in ‘bell-shaped’ curves.



**Figure 2.** Red sunflower seed weevil damage in 2022 trial near Dickinson, ND. Plots varied for planting dates and hybrid maturities. No insecticides or other insect management used.

Table 1. Buckwheat Response to Preemergence Herbicides applied at 1x and 2x rates.

Treatment	Rate oz/A	Injury			Stand		Height		Yield LB/A
		2 DAE	9 DAE	25 DAE	21 DAE	36 DAE			
		%			# m <sup>2</sup>		cm		
Untreated		0	0 e	0 g	148 ab	56 a-e	681	-	
Metribuzin	5.3	9 fg	75 b	70 b	82 d	45 g	672	-	
Metribuzin	10.7	18.5 de	89.5 a	85.3 a	56 e	32 h	501	-	
Metolachlor	26	9.5 fg	9.5 e	0 g	154 a	58 a-d	498	-	
Metolachlor	52	38.8 c	32.5 d	9.5 ef	139 ab	53 def	517	-	
Dimethenamid	16	33.8 c	32 d	10 e	140 ab	52 ef	555	-	
Dimethenamid	32	68.8 a	63.8 b	61.3 c	104 c	43 g	482	-	
Pyroxasulfone	2.5	22.5 d	23.8 d	1.3 fg	149 a	59 abc	618	-	
Pyroxasulfone	5	52.0 b	50 c	10 e	129 b	53 def	591	-	
Mesotrione	2.5	5 gh	6.8 e	3 efg	155 a	54 cde	610	-	
Mesotrione	5	16.3 def	25 d	26.3 d	143 ab	48 fg	546	-	
Isoxaflutole	3	10.5 fg	0.8 e	0 g	148 ab	56 a-e	725	-	
Isoxaflutole	6	14.5 ef	4.5 e	0 g	151 a	55 b-e	712	-	
Topramezone	1	1.3 h	0 e	0 g	150 a	59 ab	543	-	
Topramezone	2	3.8 gh	0 e	0 g	152 a	60 a	533	-	
LSD P=.10		7.4	11.5	8.6	20	5	NS		
CV		30.7	35.0	39.3	12.7	8.7	24.2		
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.2428		

Application Description		Application Equipment	
Application Date	Jun-3-2022	Equipment Type	SPTRMO
Appl. Start Time	8:00 AM	Operation Pressure	35 PSI
Appl. Stop Time	9:45 AM	Nozzle Model	11002
Application Method	SPRAY	Nozzle Type	DRIRED
Application Timing	PRE	Nozzle Tip Size, Color	11002, Yellow
Application Placement	BROADC	Nozzle Spacing	20 IN
Applied By	CDD	% Coverage	100
Appl. Entry Date	Jun-8-2022	Boom Length	100 IN
Air Temperature Start, Stop	64.7, 67.4 F	Boom Height	20 IN
% Relative Humidity Start, Stop	30.4, 24.6	Ground Speed	3.3 MPH
Wind Velocity+Dir. Start	6.6 MPH, SW	Carrier	WATER
Wind Velocity+Dir. Stop	6.8 MPH, SW	Application Amount	10 GAL/AC
Wind Velocity+Dir. Max	13.4 MPH, SSW	Mix Size	2 L
Wet Leaves (Y/N)	N, no	Propellant	CO2
Soil Temperature	52 F	Tank Mix (Y/N)	N, No
Soil Moisture	GOOD		
% Cloud Cover	10		
Next Moisture Occurred On	Jun-5-2022		
Time to Next Moisture	2.0 DAY		
Moisture 6 Hours after Appl.	0 IN		
Moisture 1 Week after Appl.	1.79 IN		

\*Abbreviations: PREPRE, preemergence; BROADC, broadcast; SPTRMO, tractor mounted sprayer; DRIRED, drift reduction



Table 2. Comparison of preemergence herbicide treatments for weed control in chickpea. No significant injury was observed in any of the herbicide treatments.

Treatment	Rate oz/A	Kochia	lmsqtr	gfox	woat	Stand #/m <sup>2</sup>	Hgt cm	Yield LB/A
		%						
Untreated		0	0	0	0	28 -	49 -	1910 -
Authority Supreme	5	86 bc	98 a	78 d	68 cd	30 -	51 -	2063 -
Authority Supreme	10	99 a	100 a	93 a	87 ab	34 -	48 -	2054 -
BroadAxe	20	82 c	100 a	85 bc	71 cd	38 -	47 -	2095 -
BroadAxe	32	85 bc	100 a	94 a	57 d	30 -	47 -	1805 -
Spartan Charge	3.75	84 bc	100 a	0 e	0 f	33 -	50 -	2027 -
Spartan Charge	5	85 bc	100 a	0 e	0 f	28 -	46 -	1877 -
Spartan Charge	7.75	82 c	100 a	0 e	0 f	28 -	49 -	1740 -
Anthem Flex	3	88 bc	92 b	81 cd	73 c	35 -	48 -	2235 -
Anthem Flex	4	87 bc	89 b	85 bc	71 cd	35 -	48 -	1922 -
Anthem Flex	5	98 a	98 a	89 ab	88 a	32 -	48 -	2068 -
Dual II Magnum Sharpen	2 2	75 d	100 a	87 b	19 e	29 -	50 -	1717 -
Dual II Magnum Sharpen	2 2	89 b	100 a	94 a	82 abc	31 -	47 -	1845 -
Zidua	3.25							
BroadAxe	20	85 bc	100 a	89 ab	74 bc	37 -	51 -	1829 -
LSD P=.10		6.1	4	5.6	13.3	6.24	2.75	296.3
CV		5.92	3.38	7.02	20.9	16.42	4.81	12.74
Treatment Prob(F)		0.0001	0.0002	0.0001	0.0001	0.1087	0.6180	0.1535

\*All treatment were tank-mixed with Roundup PowerMax (22 oz/A), AMS (8.5 LB/gal), MSO (1%v/v)

\*\*Abbreviations: lmsqtr, common lambsquarters; gfox, green foxtail; woat, wild oat, Hgt, height

Application Description		Application Equipment	
Application Date	May-11-2022	Equipment Type	SPTRMO
Appl. Start Time	3:35 PM	Operation Pressure	35 PSI
Appl. Stop Time	4:09 PM	Nozzle Model	11002
Application Method	SPRAY	Nozzle Type	DRURED
Application Timing	PRE	Nozzle Spacing	20.0 IN
Application Placement	BROADCAST	% Coverage	100
Applied By	CDD	Boom Length	100 IN
Appl. Entry Date	May-12-2022	Boom Height	20.0 IN
Air Temperature Start, Stop	60.4, 58.5 F	Ground Speed	3.3 MPH
% Relative Humidity Start, Stop	59.9, 61.4	Carrier	WATER
Wind Velocity+Dir. Start	10.8 MPH, N	Application Amount	10 GAL/AC
Wind Velocity+Dir. Stop	9.6 MPH, N	Mix Size	2 L
Wind Velocity+Dir. Max	16.1 MPH, N	Propellant	CO2
Wet Leaves (Y/N)	N, no	Tank Mix (Y/N)	Y, yes
Soil Temperature	53 F		
Soil Moisture	GOOD		
% Cloud Cover	100		
Next Moisture Occurred On	May-12-2022		
Time to Next Moisture	1 DAY		
Moisture 1 Week after Appl.	0.92 IN		

\*Abbreviations: PRE, preemergence; SPTRMO, tractor mounted sprayer; DRURED, drift reduction

Table 3. Fall herbicide application for weed control in spring wheat at Hettinger, ND 2021-22.

Treatment	Rate oz/A	Kochia	Wbkwht	C mallow	J brome	Yield BU/A
		%				
Untreated Check	22	0 c	0 d	0 d	0 d	30.1 b
Roundup PowerMax	3.5	0 c	0 d	0 d	30 c	38.2 b
Anthem Flex+	22	92 a	56.3 b	87.5 b	81.3 b	52.1 a
Roundup PowerMax	4					
Anthem Flex+	22	88.3 a	64.5 a	92.5 a	91.3 a	52.6 a
Roundup PowerMax	4.5					
Anthem Flex+	22	88.3 a	50 bc	90 ab	91 a	49.1 a
Roundup PowerMax	0.2					
Olympus+	22	78.8 b	46.3 c	75 c	92.5 a	53.7 a
Roundup PowerMax fb	0.2					
Olympus (Spring POST)	7.5					
Authority Supreme	22	90.8 a	65 a	90 ab	73 b	56.5 a
Roundup PowerMax	4					
Anthem Flex+	22	93.5 a	68.3 a	92 a	90.8 a	52.8 a
Roundup PowerMax fb	0.2					
Olympus (Spring POST)	22					

LSD P=.10

CV

Treatment Prob(F)

\*Treatment timing were 10/18/2021 (Fall PRE) and 5/27/2022 (Spring POST)

Abbreviations: Wbkwht , wild buckwheat; C mallow, common mallow; J brome, Japanese brome; BU/A, bushels per acre.

Application Description	Timing		Application Equipment	
	Fall PRE	Spring POST		
Application Date	10/18/2021	5/27/2022	Equipment Type	SPTRMO
Appl. Start Time	1:34 PM	8:35 AM	Operation Pressure	40 PSI
Appl. Stop Time	1:52 PM	8:42 AM	Nozzle Model	11002
Application Method	SPRAY	SPRAY	Nozzle Type	FLAFAN
Application Timing	FALPRE	POSPOS	Nozzle Spacing	20.0 IN
Application Placement	BROADCAST	BROADCAST	% Coverage	100
Applied By	CDD	CDD	Boom Length	100 IN
Appl. Entry Date	10/20/2021	6/6/2022	Boom Height	19 IN
Air Temperature Start, Stop	73.4, 73.5 F	68.3, 66.3 F	Ground Speed	3.9 MPH
% Relative Humidity Start, Stop	32.5, 29.1	42.9, 41.1	Carrier	WATER
Wind Velocity+Dir. Start	2.7 MPH, SW	1.2 MPH, NNE	Application Amount	10 GAL/AC
Wind Velocity+Dir. Stop	4.2 MPH, SW	2.9 MPH, SSE	Mix Size	2 L
Wind Velocity+Dir. Max	6.6 MPH, SW	8.9 MPH, NNW	Propellant	CO2
Wet Leaves (Y/N)	N, no	N, no	Tank Mix (Y/N)	Yes
Soil Temperature	47 F	56 F		
Soil Moisture	EXCELLENT	EXCELLENT		
% Cloud Cover	30	100		
Next Moisture Occurred On	10/24/2021	5/27/2022		
Time to Next Moisture	6.0 D	8.0 HR		
Moisture 6 Hours after Appl.	0 IN	0 IN		
Moisture 1 Week after Appl.	0.11 IN	0.51 IN		

\*Abbreviations: FALPRE, fall preemergence; Spring POST, spring postemergence; SPTRMO, tractor mounted sprayer.

Table 4. Fall application timing of pyroxasulfone for weed control in dry peas at Hettinger, ND 2021-22.

Treatment	Rate oz/A	Timing	Kochia %	C mallow %	Stand # m <sup>-2</sup>	Height cm	Yield LB/A
Untreated			0 d	0 e	57 -	46 -	2953 c
Pyroxasulfone	2	A	78 c	74 d	52 -	48 -	3680 ab
Pyroxasulfone	2.25	A	81 c	78 cd	56 -	44 -	3435 b
Pyroxasulfone	2.5	A	84 bc	79 cd	58 -	45 -	3541 b
Pyroxasulfone	2	B	93 a	87 ab	56 -	45 -	3810 ab
Pyroxasulfone	2.25	B	91 a	83 bc	59 -	47 -	3604 ab
Pyroxasulfone	2.5	B	90 ab	85 b	55 -	46 -	3651 ab
Pyroxasulfone	2	C	94 a	89 ab	52 -	45 -	3609 ab
Pyroxasulfone	2.25	C	95 a	92 a	55 -	46 -	4007 a
Pyroxasulfone	2.5	C	97 a	91 a	54 -	42 -	3655 ab
LSD P=.10			6.96	5.77	6.88	3.088	435.5
CV			7.21	6.33	10.35	5.66	10.06
Treatment Prob(F)			0.0001	0.0001	0.6557	0.214	0.0473

\*Treatment timing were 10/18/2021, 11/3/2021, and 11/15/2021

Abbreviations: C mallow, common mallow; # m<sup>-2</sup>, number of plants per square meter; LB/A, pounds per acre.

Application Description	Timing			Application Equipment	
	A	B	C		
Application Date	10/18/2021	11/3/2021	11/15/2021	Equipment Type	SPTRMO
Appl. Start Time	2:50 PM	2:10 PM	2:13 PM	Operation Pressure	40 PSI
Application Method	SPRAY	SRPAY	SPRAY	Nozzle Type	FLAFAN
Application Timing	FALPRE	FALPRE	FALPRE	Nozzle Tip Size	11002
Application Placement	BROADC	BROADC	BROADC	Nozzle Spacing	20 IN
Applied By	CDD	CDD	CDD	Boom Length	100 IN
Appl. Entry Date	10/21/2021	11/16/2021	11/16/2021	Boom Height	19 IN
Air Temp Start, Stop	74.9, 76.9 F	62.9, 63.2 F	62.9, 62.3 F	Ground Speed	3.9 MPH
% RH Start, Stop	23.9, 23.3	39.7, 40.4	41.2, 40.3	Carrier	WATER
Wind Velocity+Dir. Start	2.1 MPH, WNW	5.8 MPH, WNW	4 MPH, WSW	Application Amount	10 GAL/AC
Wind Velocity+Dir. Stop	1 MPH, WNW	2.7 MPH, SW	3.8 MPH, WSW	Mix Size	2 L
Wind Velocity+Dir. Max	2.4 MPH, WNW	5.9 MPH, SW	6.5 MPH, WSW	Propellant	CO2
Wet Leaves (Y/N)	N, no	N, no	N, no	Tank Mix (Y/N)	Yes
Soil Temperature	40 F	33 F	41 F		
Soil Moisture	GOOD	DRY	GOOD		
% Cloud Cover	10	0	30		
Next Moisture	10/24/2021	11/10/2021	12/2/2021		
Time to Next Moisture	6.0 D	7.0 D	17.0 D		
Moisture 6 Hours after	0 IN	0 IN	0 IN		
Moisture 1 Week after	0.11 IN	0.01 IN	0 IN		

\*Abbreviations: FALPREPRE, fall preemergence; BROADC, broadcast; SPTRMO, tractor mounted sprayer.

Table 5. Flax response to preemergence herbicide treatments at Hettinger, ND 2022.

Treatment	Rate oz/A	Injury		Stand 21 DAE # m <sup>-2</sup>	Height 36 DAE cm	Yield LB/A
		16 DAE %	21 DAE %			
Untreated		0 c	0 d	172 -	55 bc	1487 cd
Pyroxysulfone+ Carfentrazone	2.5	1.3 bc	2 cd	160 -	55 abc	1670 ab
Pyroxysulfone+ Carfentrazone	0.5	1.8 bc	8.8 ab	160 -	54 cd	1520 cd
Pyroxysulfone+ Carfentrazone	4.9	17.5 a	15.3 a	145 -	53 d	1557 bcd
Sulfentrazone+ Carfentrazone+ Pyroxysulfone	0.5	3.3 b	6.3 b	157 -	54 cd	1758 a
Sulfentrazone+ Carfentrazone+ Pyroxysulfone	7.5	13 a	15 a	151 -	54 cd	1611 bc
Metolachlor	0.5	1.3 bc	9 ab	144 -	57 a	1471 cd
Metolachlor	5	1.3 bc	5.3 b	162 -	56 ab	1484 cd
Sulfentrazone+ Carfentrazone+ Metolachlor	2.5	0.8 bc	5 bc	159 -	56 abc	1535 bcd
Sulfentrazone+ Carfentrazone+ Metolachlor	10	4 b	8 ab	151 -	54 cd	1574 bcd
Pendimethalin	4.9	0 c	6.8 b	164 -	57 ab	1429 d
LSD P=.10		3.81	6.63	NS	2.07	146.8
CV		79.4	74.76	14.25	3.15	7.87
Treatment Prob(F)		0.0001	0.0119	0.8206	0.0071	0.0276

\*Abbreviations: DAE, days after emergence, # m<sup>-2</sup>, pounds per square meter

Application Description		Application Equipment	
Application Date	5/17/2022	Equipment Type	SPTRMO
Appl. Start Time	2:56 PM	Operation Pressure	35 PSI
Appl. Stop Time	3:29 PM	Nozzle Model	11002
Application Method	SPRAY	Nozzle Type	DRINED
Application Timing	PREPRE	Nozzle Tip Size, Color	11002, Yellow
Application Placement	BROADC	Nozzle Spacing	20 IN
Applied By	CDC	% Coverage	100
Air Temperature Start, Stop	75.3, 75.3 F	Boom Length	100 IN
% Relative Humidity Start, Stop	43.1, 38.7	Boom Height	20 IN
Wind Velocity+Dir. Start	4.9 MPH, NW	Ground Speed	3.3 MPH
Wind Velocity+Dir. Stop	7.2 MPH, NNW	Carrier	WATER
Wind Velocity+Dir. Max	7.3 MPH, NW	Application Amount	10 GAL/AC
Wet Leaves (Y/N)	N, no	Mix Size	2 L
Soil Temperature	60.5 F	Propellant	CO2
Soil Moisture	GOOD	Tank Mix (Y/N)	Yes
% Cloud Cover	95		
Next Moisture Occurred On	5/19/2022		
Moisture 1 Week after Appl.	0.49 IN		

\*Abbreviations: PREPRE, preemergence; BROADC, broadcast; SPTRMO, tractor mounted sprayer; DRINED, drift reduction

Table 6. Comparison of postemergence herbicide combinations for weed control in spring wheat at Hettinger, ND 2022.

Treatment	Rate oz/A	Kochia		Wild buckwheat		Common mallow		Yield BU/A LB/A
		15 DAT	30 DAT	15 DAT	30 DAT	15 DAT	30 DAT	
Untreated		0 h	0 g	0 h	0 g	0 f	0 d	66 -
Starane Ultra	0.33	75 g	82 f	71 g	86 def	55 e	58 c	71 -
OpenSky	16	78 fg	86 ef	77 fg	95 abc	85 d	90 b	64 -
Quelex	0.75	80 d-g	92 a-e	79 def	90 b-e	93 a-d	100 a	62 -
Starane Ultra	5.3							
Quelex	0.75	80 efg	92 a-e	77 efg	86 def	93 a-d	100 a	67 -
OpenSky	16							
WideMatch	21.3	84 a-e	93 a-d	84 cd	94 abc	93 a-d	93 ab	59 -
WideMatch	21.3	84 b-e	88 def	88 bc	98 a	88 cd	100 a	49 -
MCPE	8							
WideMatch	21.3	85 a-d	91 a-e	83 c-f	98 a	91 bcd	96 ab	59 -
Quelex	0.75							
PerfectMatch	16	82 c-f	87 def	82 c-f	96 ab	91 bcd	95 ab	64 -
Supremacy	4	85 a-e	89 c-f	83 c-f	86 ef	96 abc	100 a	54 -
Talinor	13.7	85 a-d	87 def	88 bc	87 c-f	94 abc	98 ab	68 -
Huskie Complete	13.7	89 a	92 a-e	92 ab	89 b-e	98 ab	100 a	70 -
Huskie FX	18	88 ab	98 a	97 a	98 a	99 ab	100 a	63 -
Carnivore	1	89 ab	95 ab	91 ab	95 abc	97 ab	100 a	65 -
Bison	5.3	87 abc	95 abc	84 cde	81 f	100 a	100 a	54 -
Bison	5.3	84 b-e	90 b-e	83 c-f	93 a-d	99 ab	100 a	59 -
Starane Ultra	0.33							
LSD P=.10		5.53	6.53	6.54	7.46	8.35	9.72	12.42
CV		5.94	6.49	7	7.33	8.21	9.17	16.81
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.1863

\*Abbreviations: BU/A, bushels per acre.

Application Description	Application Equipment
Application Date	6/13/2022
Equipment Type	SPRBAC
Appl. Start Time	2:10 PM
Operation Pressure	30 PSI
Appl. Stop Time	2:55 PM
Nozzle Model	XR8001
Application Method	SPRAY
Nozzle Type	FLAFAN
Application Timing	POSPOS
Nozzle Spacing	19 IN
Application Placement	BROADC
% Coverage	100
Applied By	DGA, CDD
Boom Length	76 IN
Appl. Entry Date	6/15/2022
Boom Height	25.0 IN
Air Temperature Start, Stop	69.1, 68 F
Ground Speed	2.56 MPH
% Relative Humidity Start, Stop	81.2, 86.1
Carrier	WATER
Wind Velocity+Dir. Start	0.7 MPH, NNW
Application Amount	10 GAL/AC
Wind Velocity+Dir. Stop	3.7 MPH, N
Mix Size	2.0 L
Wind Velocity+Dir. Max	6.9 MPH, N
Propellant	CO2
Wet Leaves (Y/N)	N, no
Tank Mix (Y/N)	Yes
Soil Temperature	66 F
Soil Moisture	EXCELL
% Cloud Cover	100
Next Moisture Occurred On	6/13/2022
Moisture 6 Hours after Appl.	0.15
Moisture 1 Week after Appl.	0.89 IN
Appl. Stop Time	2:55 PM

\*Abbreviations: SPTRMO, tractor mounted sprayer.

Table 7. Safflower response to preemergence herbicides at Hettinger, ND 2022.

Treatment	Rate	Injury 19 DAE	Stand 24 DAE	Height 51 DAE	Yield
	oz/A	— % —	— # m <sup>-2</sup> —	— cm —	— LB/A —
Spartan Charge	2.5	0 -	64.3 ab	65.8 abc	1992 -
Spartan Charge	3.75	0 -	48.8 ef	64.78 a-e	1832 -
Spartan Charge	5	2 -	56 b-f	66.6 a	2079 -
Authority Supreme	3.75	2 -	50.8 def	66.6 a	2057 -
Authority Supreme	7.5	0 -	58.8 a-f	63 de	2438 -
BroadAxe	18	2 -	63.8 ab	65.85 ab	1843 -
BroadAxe	22	0 -	68.5 a	64.48 a-e	2089 -
Anthem Flex	3.75	0 -	56.5 b-f	62.6 e	2146 -
Anthem Flex	4.5	0 -	60.3 a-d	62.83 de	2178 -
Anthem Flex	5.5	0 -	51.8 c-f	63.58 cde	2306 -
Spartan Charge+ Zidua SC	3.75 2.5	0 -	48 f	63.6 cde	2338 -
Spartan Charge+ Zidua SC	3.75 3.75	0 -	62.8 abc	65.05 a-d	2322 -
Spartan Charge+ Zidua SC	3.75 5	0 -	59.8 a-e	66.18 ab	2039 -
Spartan Charge+ Outlook	3.75 16	0 -	63.3 ab	65.25 abc	2363 -
Spartan Charge+ Outlook	3.75 21	0 -	63.5 ab	64.83 a-e	2092 -
Spartan Charge+ Prowl H2O	3.75 32	0 -	50.8 def	64 b-e	2048 -
Spartan Charge+ Prowl H2O	3.75 48	3.3 - 0 -	49.8 def 64.3 ab	65.73 abc 65.8 abc	2001 - 1992 -
LSD P=.10		NS	11.31	2.24	NS
CV		347.66	16.59	2.92	12.33
Treatment Prob(F)		0.2848	0.0522	0.0433	0.1111

\*Abbreviations: DAE, days after emergence; LB/A, pounds per acre

Application Description	Application Equipment
Application Date	5/17/2022
Application Date	Equipment Type
Appl. Start Time	11:01 AM
Appl. Start Time	Operation Pressure
Appl. Stop Time	12:35 PM
Appl. Stop Time	Nozzle Model
Application Method	SPRAY
Application Method	Nozzle Type
Application Timing	PREPRE
Application Timing	Nozzle Tip Size
Application Placement	BROADCAST
Application Placement	Nozzle Spacing
Air Temp Start, Stop	66, 71.3 F
Air Temp Start, Stop	% Coverage
% RH Start, Stop	53.3, 49.4
% RH Start, Stop	Boom Length
Wind Velocity+Dir. Start	6.4 MPH, SW
Wind Velocity+Dir. Start	Boom Height
Wind Velocity+Dir. Stop	5.5 MPH, WSW
Wind Velocity+Dir. Stop	Ground Speed
Wind Velocity+Dir. Max	11.1 MPH, SW
Wind Velocity+Dir. Max	Carrier
Wet Leaves (Y/N)	No
Wet Leaves (Y/N)	Application Amount
Soil Temperature	55 F
Soil Temperature	Mix Size
Soil Moisture	SLIGHTLY WET
Soil Moisture	Propellant
% Cloud Cover	80
% Cloud Cover	Tank Mix (Y/N)
Next Moisture Occurred On	5/19/2022
Moisture 1 Week after Appl.	0.49

\*Abbreviations: SPTRMO, tractor mounted sprayer; DRIRED, drift reduction.

Table 8. Timing of preplant herbicide application for weed control in soybean at Hettinger, ND 2021-22.

Treatment	Rate oz/A	Timing	Kochia	C mallow %	Angrass	P lettuce	Yield BU/A
Untreated			0 j	0 g	0 f	0 d	15 f
Valor	3	A	48 hi	56 ef	21 f	60 bc	22 b-e
Roundup PowerMax3	20	A					
Valor	3	B	49 ghi	85 abc	65 cde	100 a	18 ef
Roundup PowerMax3	20	B					
Valor	3	C	43 i	61 def	85 a-d	96 a	22 b-e
Roundup PowerMax3	20	C					
Valor	3	A	57 e-i	72 b-e	83 a-d	81 ab	23 bcd
Zidua SC	5	A					
Roundup PowerMax3	20	A					
Valor	3	B	67 b-g	94 a	85 a-d	100 a	24 a-d
Zidua SC	5	B					
Roundup PowerMax3	20	B					
Valor	3	C	53 f-i	84 a-d	97 ab	100 a	22 b-e
Zidua SC	5	C					
Roundup PowerMax3	20	C					
BroadAxe	32	A	64 c-h	66 c-f	48 e	20 d	22 b-e
Roundup PowerMax3	20	A					
BroadAxe	32	B	62 d-h	70 cde	52 e	96 a	23 bcd
Roundup PowerMax3	20	B					
BroadAxe	32	C	54 f-i	57 ef	53 e	0 d	23 bcd
Roundup PowerMax3	20	C					
Authority Supreme	9.8	A	77 a-d	83 a-d	86 a-d	91 a	20 de
Roundup PowerMax3	20	A					
Authority Supreme	9.8	B	73 a-f	86 abc	61 de	94 a	25 abc
Roundup PowerMax3	20	B					
Authority Supreme	9.8	C	77 a-d	80 a-d	90 abc	81 ab	23 bcd
Roundup PowerMax3	20	C					
Authority MTZ	18	A	76 a-e	78 a-e	84 a-d	100 a	25 ab
Roundup PowerMax3	20	A					
Authority MTZ	18	B	85 ab	92 ab	73 b-e	100 a	25 abc
Roundup PowerMax3	20	B					
Authority MTZ	18	C	82 abc	87 abc	98 ab	98 a	27 a
Roundup PowerMax3	20	C					
Xtendimax	22	C	63 d-h	48 f	15 f	56 c	22 b-e
Roundup PowerMax3	20	C					
Xtendimax	22	D	83 abc	80 a-d	93 ab	93 a	21 cde
Roundup PowerMax3	20	D					
Roundup PowerMax3	20	C	78 a-d	97 a	94 ab	100 a	25 abc
Roundup PowerMax3	20	D					
Roundup PowerMax3	20	C	87 a	97 a	100 a	100 a	22 b-e
BroadAxe	32	C					
Roundup PowerMax3	20	D					
LSD P=.10			18.62	21.7	26.75	22.18	4.14
CV			24.68	24.92	32.6	24.12	15.61
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0045

\*Treatment timings were: A, 5/6/2022; B, 5/16/2022; C, 5/28/2022; D, 6/23/2022

Abbreviations: C mallow, common mallow; Angrass, annual grass (barnyardgrass, green foxtail); BU/A, bushels per acre.

Application Description	Timing			
	A	B	C	D
Application Date	5/6/2022	5/16/2022	5/28/2022	6/23/2022
Appl. Start Time	4:37 PM	11:20 AM	9:36 AM	2:56 PM
Appl. Stop Time	5:10 PM	11:50 AM	10:10 AM	3:07 PM
Application Method	SPRAY	SPRAY	SPRAY	SPRAY
Application Timing	PPL 2WBP	PPL 1WBP	PRE	POST
Application Placement	BROADC	BROADC	BROADC	BROADC
Applied By	CDD	CDD	CDD	CDD
Appl. Entry Date	6/6/2022	6/6/2022	5/31/2022	7/25/2022
Air Temp Start, Stop	75, 71 F	70.7, - 71.5 F	74.7, 74.7 F	87, - F
% RH Start, Stop	29, 43	36.5, -	43.8, 46.2	37, -
Wind Velocity+Dir. Start	8.0 MPH, W	9 MPH, SE	1.9 MPH, NNW	6 MPH, SSE
Wind Velocity+Dir. Stop	7.5 MPH, ESE	9 MPH, SE	2.1 MPH, E	
Wind Velocity+Dir. Max	16 MPH, W	17.3 MPH, SE	5.6 MPH, ENE	10 MPH, SSE
Wet Leaves (Y/N)	N, no	N, no	N, no	N, no
Soil Temperature	63 F	57 F	58 F	81 F
Soil Moisture	GOOD	GOOD	GOOD	GOOD
% Cloud Cover	70	10	95	20
Next Moisture	5/9/2022	5/19/2022	5/30/2022	6/25/2022
Moisture 1 Week after App	1.24 IN	0.50 IN	0.36 IN	0.02

\*Abbreviations: PPL 2WBP/1WBP, preplant 2/1 weeks before planting; PRE, preemergence at planting; POST, postemergence to crop and weeds (V1 soybeans)

Application Equipment	Timing			
	A	B	C	D
Equipment Type	SPTRMO	SPTRMO	SPTRMO	SPTRMO
Operation Pressure	35 PSI	35 PSI	35 PSI	32 PSI
Nozzle Model	11002	11002	11002	11002
Nozzle Type	DRINED	DRINED	DRINED	DRINED
Nozzle Spacing	20 IN	20 IN	20.0 IN	20 IN
% Coverage	100	100	100	100
Boom Length	100 IN	100 IN	100 IN	100 IN
Boom Height	20.0 IN	20.0 IN	22.0 IN	22.0 IN
Ground Speed	3.3 MPH	3.3 MPH	3.3 MPH	2.6 MPH
Carrier	WATER	WATER	WATER	WATER
Application Amount	10 GAL/AC	10 GAL/AC	10 GAL/AC	15 GAL/AC
Mix Size	2 L	2 L	2 L	2 L
Propellant	CO2	CO2	CO2	CO2
Tank Mix (Y/N)	Yes	Yes	Yes	Yes

\*Xtendimax treatments were applied using TTI (air induction) drift reducing nozzles.

\*\*Abbreviations: SPTRMO, tractor mounted sprayer; DRINED, drift reduction.



Table 9. Tame oat response to preemergence and early postemergence applied herbicides applied at 1x and 2x rates at Hettinger, ND 2022.

Treatment	Rate oz/A	Timing	Injury			Height		Yield LB/A
			14 DAE	24 DAE	42 DAE	40 DAE		
			%			cm		
Untreated			0 f	0 i	0 g	68 a		1525 a-d
Dual II Magnum	26.8	PRE	0 f	0 i	0 g	66 a-d		1683 a
Dual II Magnum	53.6	PRE	0 f	15 ef	5 ef	66 a-d		1365 cd
Prowl	48	PRE	0 f	1 hi	0 g	67 abc		1480 a-d
Prowl	96	PRE	0 f	12 ef	3 efg	65 bcd		1603 abc
Zidua	3	EPOST	3 e	74 b	61 b	55 e		878 e
Zidua	6	EPOST	7 d	85 a	73 a	52 f		411 f
Dual II Magnum	26.8	EPOST	0 f	3 hi	0 g	68 a		1633 ab
Dual II Magnum	53.6	EPOST	0 f	16 e	6 e	65 cd		1529 a-d
Prowl	48	EPOST	0 f	6 gh	1 fg	68 a		1609 ab
Prowl	96	EPOST	0 f	10 fg	4 efg	67 abc		1416 bcd
Outlook	18	EPOST	0 f	24 d	12 d	64 d		1622 ab
Outlook	36	EPOST	0 f	63 c	48 c	57 e		1303 d
Armezon	1	EPOST	10 c	7 gh	3 efg	67 abc		1424 bcd
Armezon	2	EPOST	14 a	4 hi	1 fg	67 a-d		1516 a-d
Laudis	3	EPOST	4 e	4 hi	0 g	68 ab		1642 ab
Laudis	6	EPOST	12 b	5 ghi	0 g	66 a-d		1587 abc
LSD P=.10			2.1	5.68	4.568	2.69		240.8
CV			60.15	24.94	30.25	3.52		14.25
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001		0.0001

\*Application timings were PRE, at planting, and EPOST, postemergence to 1-2 leaf oats

\*\*Abbreviations: PRE, preemergence, EPOST, early postemergence, DAE, days after emergence; LB/A, pounds per acre

Application Description	Application Equipment			
	PRE	EPOST		
Application Date	5/23/2022	6/3/2022	Equipment Type	SPTRMO
Appl. Start Time	10:00 AM	9:55 AM	Operation Pressure	35 PSI
Appl. Stop Time	10:30 AM	10:31 AM	Nozzle Model	11002
Application Method	SPRAY	SPRAY	Nozzle Type	DRINED
Application Timing	PRE	EAPOCR	Nozzle Tip Size	11002
Application Placement	BROADCAST	BROADCAST	Nozzle Spacing	20 IN
Appl. Entry Date	6/15/2022	6/15/2022	% Coverage	100
Air Temp Start, Stop	53, 55 F	66, 67 F	Boom Length	100 IN
% RH Start, Stop	54, 52	27, 29	Boom Height	20 IN
Wind Velocity+Dir. Start	3 MPH, E	9.5 MPH, NNE	Ground Speed	3.3 MPH
Wind Velocity+Dir. Stop	1.8 MPH, ESE	9 MPH, NNE	Carrier	WATER
Wind Velocity+Dir. Max	9.8 MPH, E	16 MPH, NNE	Application Amount	10 GAL/AC
Wet Leaves (Y/N)	N, no	N, no	Mix Size	2 L
Soil Temperature	51 F	54 F	Propellant	CO2
Soil Moisture	SLIWET	SLIWET	Tank Mix (Y/N)	No
% Cloud Cover	25	25		
Next Moisture Occurred On	5/23/2022	6/5/2022		
Time to Next Moisture	7 Hours	2 Days		
Moisture 1 Week after Appl.	0.83 IN	1.79 IN		

\*Abbreviations: PRE, preemergence; EAPOCR, early postemergence to crop; BROADCAST, broadcast; SPTRMO, tractor mounted sprayer; DRINED, drift reduction.

Table 10. Weed control and lentil response to preemergence herbicide treatments in Hettinger, ND 2022.

Treatment	Rate oz/A	Lentil injury	Kochia	lmsqtr	Stand	Height	Yield LB/A
		29 DAE	29 DAE	29 DAE	33 DAE	33 DAE	
		%		# m <sup>2</sup>		cm	
Untreated		0 e	0	0	198 a-e	32 -	1522 e
Sharpen	0.75	1.8 de	71 de	78 d	192 b-e	30 -	1731 de
Sharpen+	0.75	16.3 a	78 cde	79 cd	171 e	29 -	1483 e
Outlook	21						
Anthem Flex	3	0 e	74 cde	79 d	202 a-d	30 -	1762 de
Anthem Flex	4	2.5 de	63 e	76 d	211 ab	32 -	1784 cde
Anthem Flex	5	8.5 bc	80 bcd	81 cd	210 ab	30 -	1845 bcd
Anthem Flex+	3	3.8 cde	97 a	95 ab	212 ab	31 -	2246 a
Metribuzin	4						
Anthem Flex+	4	1.8 de	86 a-d	89 bc	221 a	31 -	2095 abc
Metribuzin	4						
Anthem Flex+	5	4.8 cd	90 abc	94 ab	205 abc	30 -	2106 ab
Metribuzin	4						
Sharpen+	0.75	15.8 ab	92 ab	98 a	176 de	30 -	1855 bcd
Dual II Magnum+	2						
Metribuzin	4						
Dual II Magnum fb	2	0 e	70 de	78 d	178 cde	31 -	1953 a-d
Beyond (POST)	6						
LSD P=.10		5.66	16.48	8.75	28.9	NS	320.4
CV		85.49	17.1	8.48	11.43	6.18	12.92
Treatment Prob(F)		0.0001	0.0287	0.001	0.0396	0.5848	0.0077

\*All treatment were tank-mixed with Roundup PowerMax (22 oz/A), AMS (8.5 LB/gal), MSO (1%v/v); Beyond was applied postemergence on 6/16/2022; Clearfield lentil were planted in this trial.

\*\*Abbreviations: lmsqtr, common lambsquarters; # m<sup>2</sup>, number of plants per square meter; LB/A, pounds per acre.

Application Description		Application Equipment	
Application Date	5/6/2022	Equipment Type	SPTRMO
Appl. Start Time	3:50 PM	Operation Pressure	35 PSI
Appl. Stop Time	4:26 PM	Nozzle Model	11002
Application Method	SPRAY	Nozzle Type	DRIRED
Application Timing	PREPRE	Nozzle Spacing	20.0 IN
Application Placement	BROADC	% Coverage	100
Applied By	CDD	Boom Length	100 IN
Air Temperature Start, Stop	73.4, 73 F	Boom Height	20.0 IN
% Relative Humidity Start, Stop	34.7, 32.6	Ground Speed	3.3 MPH
Wind Velocity+Dir. Start	8.1 MPH, WSW	Carrier	WATER
Wind Velocity+Dir. Stop	8 MPH, WSW	Application Amount	10 GAL/AC
Wind Velocity+Dir. Max	11.9 MPH, WSW	Mix Size	2 L
Wet Leaves (Y/N)	No	Propellant	CO2
Soil Temperature	63 F	Tank Mix (Y/N)	Yes
Soil Moisture	GOOD		
% Cloud Cover	50		
Next Moisture Occurred On	5/9/2022		
Moisture 1 Week after Appl.	1.24 IN		

\*Abbreviations: PRE, preemergence; SPTRMO, tractor mounted sprayer; DRIRED, drift reduction

Table 11. Canada thistle control with various herbicide treatments. Treatments were applied in mid-July when Canada thistle was in the flower budding stage.

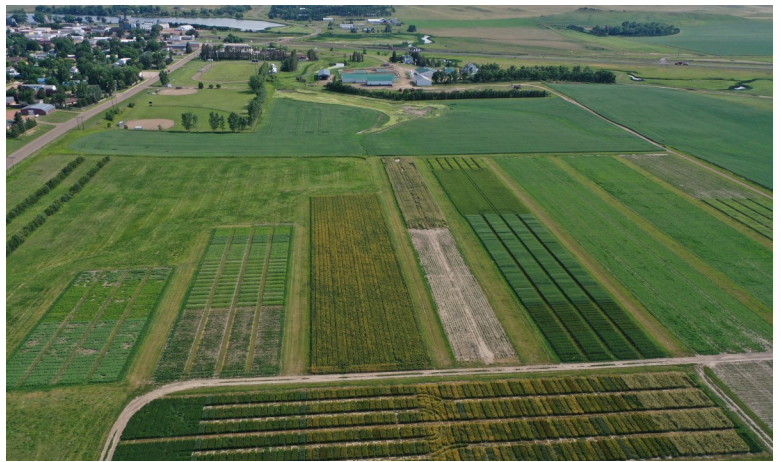
Treatment*	Rate oz/A	Control (%)									
		8 DAT		15 DAT		22 DAT		35 DAT		57 DAT	
Roundup PowerMax 3	26.7	73	ab	89	bc	93	bc	97	ab	99	a
Roundup PowerMax 3	26.7	65	bcd	88	bc	94	ab	99	ab	100	a
Roundup PowerMax 3	26.7	72	b	92	ab	99	a	99	a	99	a
Milestone	7	55	d	80	de	80	de	91	cd	97	ab
Tordon	32	67	bc	78	def	81	de	90	d	97	ab
Method	8	55	d	75	f	80	de	89	d	97	ab
Method	12	67	bc	81	de	82	d	95	bc	100	a
Dicamba	32	57	cd	77	ef	76	e	83	e	88	c
Roundup PowerMax 3+ Method	26.7 8	84	a	94	a	95	ab	99	a	97	ab
Roundup PowerMax 3+ Method+	26.7 8	75	ab	88	c	88	c	98	ab	100	a
2,4-D LV6	16										
Roundup PowerMax 3+ Milestone	26.7 7	83	a	91	abc	96	ab	99	ab	99	a
Tordon	16	58	cd	79	def	79	de	89	d	94	b
Dicamba	16										
Method	8	58	cd	82	d	82	d	90	d	95	b
Dicamba	16										
LSD P=.10		10.87		4.41		5.10		4.15		4.17	
CV		11.63		3.75		4.22		3.18		3.08	
Treatment Prob(F)		0.0004		0.0001		0.0001		0.0001		0.0018	

\*AMS (8.5 lb/100 gal) was included with all Roundup PowerMAX 3 treatments.

\*\*Abbreviations: DAT, days after treatment

Application Description		Application Equipment	
Application Date	Jul-14-2022	Equipment Type	SPRBAC
Appl. Start Time	10:30 AM	Operation Pressure	25 PSI
Appl. Stop Time	11:30 AM	Nozzle Model	11015
Application Method	SPRAY	Nozzle Type	FLATFAN
Application Timing	POST	Nozzle Tip Size, Color	19 IN
Application Placement	BROADC	% Coverage	100
Applied By	DGA/CDD	Boom Length	76 IN
Appl. Entry Date	Jul-20-2022	Boom Height	43 IN
Air Temperature Start, Stop	79, 81 F	Ground Speed	2.56 MPH
% Relative Humidity Start, Stop	73, 70	Carrier	WATER
Wind Velocity+Dir. Start	3.9 MPH, NW	Application Amount	20 GAL/AC
Wind Velocity+Dir. Stop	4.2 MPH, NW	Mix Size	3 L
Wind Velocity+Dir. Max	11 MPH, NW	Propellant	CO2
Wet Leaves (Y/N)	N, no	Tank Mix (Y/N)	Y, yes
Soil Temperature	70 F		
Soil Moisture	GOOD		
% Cloud Cover	0		

\*Abbreviations: POST, postemergence; BROADC, broadcast; SPRBAC, backpack sprayer



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