Ag. Report No. 40

Fortieth Annual Western Dakota Crops Day Research Report 2023

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NDSU HETTINGER RESEARCH EXTENSION CENTER

NDSU AGRICULTURE EXPERIMENTAL

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NDSU DICKINSON RESEARCH EXTENSION CENTER

40th Annual Western Dakota Crops Day

December 14, 2023

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

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 research.

11:00 Fall and Spring Strategies for Weed Control

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

11:50 Adams County Commodity Elections

12:00 Lunch

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

1:00 NDAWN weather network

Cassidy Holth, Meteorologist and Research Specialist for NDAWN

1:45 Highlights of Ongoing Regional Crop Production Research (cont.)

Patrick Wagner, SDSU Extension Entomology Field Specialist, Rapid City, SD.
- Entomology Update, Sunflower Survey.

Chris Augustin, Director & Soil Scientist, NDSU Dickinson Research Extension Center.
- Acid Soil Management.

3:00 Conclusion

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

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.

2023 Western Dakota Crops Day Sponsors

Hettinger Area Chamber of Commerce
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North Dakota Soybean Council
Proseed
Southwest Grain
Stone Mill LLC

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2023 Table of Contents

Grain Legumes

Fungicide Trials

Special Reports

Weed Control

Trials Not Published

The following trials were not published in this report because significant plot variation.

Trial	Average Yield
Hettinger Lentil Variety Trial	Not harvested due to poor stands and weed pressure
Hettinger Sunflower Variety Trial	Not harvested due to herbicide carryover

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 2023 Hettinger HRSW variety trial was 5.5% meaning that there was a 5.5 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 in 2023, the variety “ND Thresher” averaged 82.0 bu/ac compared to “Glenn” at 73.3 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 8.7 bu/ac between the varieties (82.0 – 73.3) to the LSD 5% value of 5.2 bu/ac. Since the 8.7 bu/ac difference is more than the LSD value of 5.2 bu/a, the varieties do differ significantly in yield. If the difference between these two varieties would have been 4.5 bu/ac, their difference would have been less than 5.2 bu/ac; therefore, the yield difference between these varieties would not have been statiscally significant.

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

Weather Summary – Hettinger

Frost Free Days

	28ºF	32ºF	50% Probability 32ºF
Date of Last Frost	May 3	May 3	May 20
Date of First Frost	October 10	October 8	September 16
Frost Free Days	**158**	**160**	**119**

Precipitation (inches)

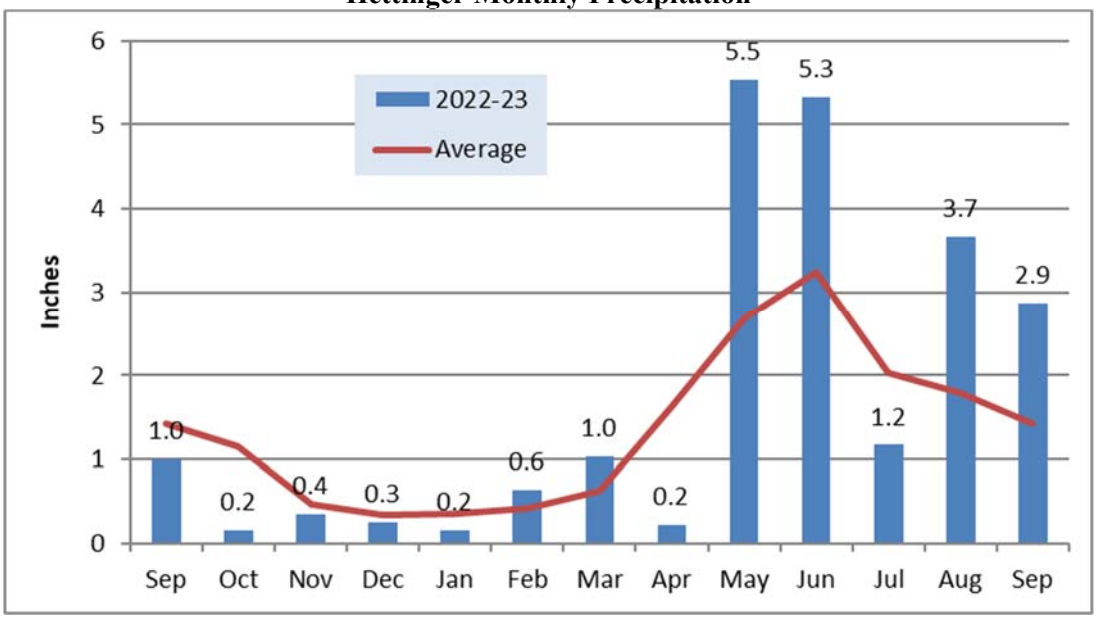
Month	2018-19	2019-20	2020-21	2021-22	2022-23	68 Year Average
October	0.6	2.2	0.6	3.9	0.2	1.1
November	0.7	0.6	0.0	0.1	0.4	0.5
December	0.4	0.3	0.0	0.8	0.3	0.3
January	0.4	0.1	0.0	0.1	0.2	0.4
February	1.1	0.2	0.0	0.4	0.6	0.4
March	0.3	0.1	0.1	0.1	1.0	0.7
April	1.3	0.2	0.6	4.0	0.2	1.6
May	4.0	0.5	4.5	2.3	5.5	2.7
June	3.9	1.7	0.5	3.8	5.3	3.3
July	2.1	2.5	1.2	2.6	1.2	2.0
August	3.0	1.9	2.7	0.4	3.7	1.8
September	4.1	1.1	0.4	1.0	2.9	1.5
April-August	**14.4**	**6.7**	**9.4**	**13.1**	**15.9**	**11.4**
Total	**21.9**	**11.2**	**10.6**	**19.4**	**21.4**	**16.3**

Air Temperature (°F)

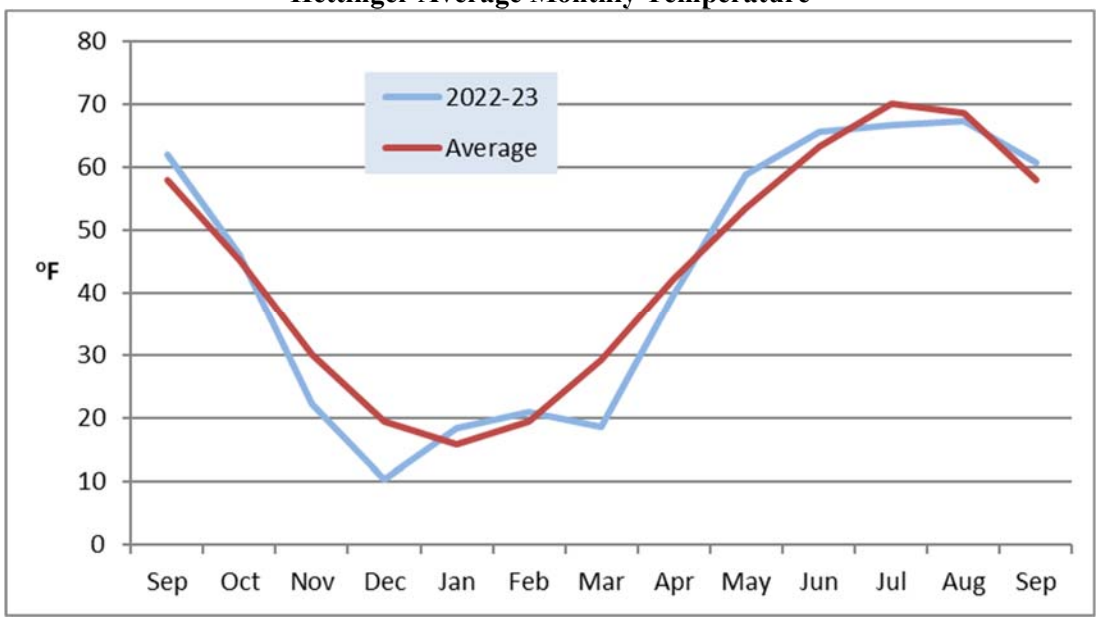
Month	2018-19	2019-20	2020-21	2021-22	2022-23	68 Year Average
October	40.5	36.3	37.0	48.0	46.2	45.2
November	27.7	27.9	36.1	35.2	22.4	30.1
December	24.0	21.6	27.3	19.6	10.4	19.7
January	17.8	19.5	24.7	18.5	18.4	15.7
February	-0.6	22.8	9.4	17.4	21.0	19.7
March	20.3	33.3	36.3	30.6	18.6	29.3
April	42.0	37.5	40.9	34.3	39.8	42.4
May	47.2	51.3	50.8	51.3	58.9	53.6
June	61.9	65.7	67.7	61.8	65.8	63.3
July	68.8	69.4	74.6	69.7	66.7	70.2
August	65.4	69.5	68.5	71.1	67.5	68.6
September	58.3	57.4	62.2	62.0	60.8	58.0
Average	**41.6**	**39.4**	**44.6**	**43.3**	**41.4**	**43.0**

Corn Growing Degree Days (GDD)						
Month	2019	2020	2021	2022	2023	51 Year Average
May	154	218	215	221	444	266
June	409	505	534	393	586	437
July	556	593	682	601	527	600
August	529	586	543	604	529	549
September	393	336	437	417	477	340
Total	**2041**	**2238**	**2411**	**2236**	**2563**	**2193**

Hettinger Monthly Precipitation



Hettinger Average Monthly Temperature



2023 Weather Summary for the Dickinson Research Extension Center Ranch Headquarters, Manning, ND.

Month	-----Maximum temp.----- Long Term 1983 - 2022	Current Year	-----Minimum temp.----- Long Term 1983 - 2022	Current Year	-----Precipitation ----- Long Term 1983 - 2022	Current year	-----Small grains GDD[1]----- Long Term 1983 - 2022	Current year	-----Corn GDD[2] ----- Long Term 1983 - 2022	Current year
	----------°F ----------		---------- °F ----------		----- inches -----					
November - 22	39.6	30.9	18.9	13.5	0.57	1.51				
December - 22	26.8	16.0	7.7	-1.0	0.43	0.39				
January	25.1	26.9	5.9	11.2	0.41	0.33				
February	28.3	30.2	8.3	11.1	0.43	0.25				
March	39.9	25.2	18.5	8.2	0.75	1.78				
April	53.8	48.2	28.8	26.6	1.42	0.30	333	279		
May	66.3	71.6	40.6	43.9	2.66	2.69	666	809	253	360
June	76.3	80.8	50.8	54.2	3.01	1.91	946	1065	413	523
July	83.7	81.5	55.8	55.4	2.31	2.21	1170	1130	612	556
August	82.7	81.0	54.0	55.4	1.99	3.25	1131	1122	572	551
September	71.8	75.8	44.2	48.1	1.63	1.32	781	900	328	404
October	56.0	53.6	31.4	31.5	1.23	1.24				
Mean	54.2	51.8	30.4	29.9						
Total					16.85	17.18	5027	5303	2179	2393

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

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

Source: Dickinson Research Extension Center. Data compiled by Garry Ottmar, Ranch Manager; and Sheri Schneider, Information Processing Specialist.

North Dakota hard red spring wheat variety descriptions, agronomic traits, 2023.

Variety	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Head[4]	Reaction to Disease[5]				
						Stem Rust[6]	Leaf Rust	Tan Spot	Bact. Leaf Streak	Head Scab
AAC Starbuck	Canada	2018	30	4	47	1	6	NA	6	5
AP Gunsmoke CL2	Syngenta/AgriPro	2021	27	6	47	2	3	4	8	5
AP Murdock	Syngenta/AgriPro	2019	26	4	47	2	5	4	6	6
AP Smith	Syngenta/AgriPro	2021	26	2	49	1	3	3	5	6
AR3530	Armor Brand/ Croplan	2015	31	7	49	2	5	NA	5	4
AR3915	Armor Brand/ Croplan	2019	27	4	48	NA	2	NA	5	4
Ascend-SD	SD	2022	31	5	48	2	4	NA	5	4
Bolles	MN	2015	30	4	50	2	2	4	6	6
Boost	SD	2016	30	4	49	2	4	NA	3	3
Brawn-SD	**SD**	**2022**	**29**	**4**	**48**	**NA**	**2**	**NA**	**4**	**4**
CAG-Justify	Champions Alliance Grp	2021	29	6	49	2	2	5	6	5
CAG-Reckless	Champions Alliance Grp	2021	30	5	48	2	2	6	6	5
CDCLandmarkVB	ND CISA	2018	30	4	48	NA	5	NA	6	6
CP3099A	Croplan	2020	31	5	51	6	3	4	7	6
CP3188	Croplan	2020	29	8	48	6	2	6	7	5
CP3322	Croplan		29	3	53	NA	3	NA	4	6
Driver	SD	2019	30	4	48	2	1	7	7	4
Elgin ND	ND	2012	32	5	46	2	6	NA	7	5
Glenn	ND	2005	31	4	46	2	6	6	5	4
Lang MN	MN	2017	31	4	50	2	2	NA	5	3
Lanning	MT	2017	29	3	50	2	7	4	5	6
LCS Ascent	Limagrain	2022	28	4	45	2	6	NA	7	4
LCS Boom	Limagrain		26	4	45	NA	6	NA	6	7
LCS Buster	Limagrain	2020	30	4	51	1	4	4	4	4
LCS Cannon	Limagrain	2018	26	4	44	1	7	5	7	6
LCS Dual	Limagrain	2020	28	4	46	2	6	NA	7	6
LCS Hammer AX	Limagrain	2022	26	4	47	2	6	NA	7	6
LCS Trigger	Limagrain	2016	31	5	53	6	1	4	4	3
MN- Rothsay	MN	2022	26	3	50	2	6	NA	5	5
MN-Torgy	MN	2020	29	4	49	2	3	3	5	4
MS Charger	Meridian Seeds	2022	27	7	46	2	2	NA	7	5
MS Cobra	Meridian Seeds	2022	27	4	47	1	2	4	7	5
MS Ranchero	Meridian Seeds	2020	34	5	54	2	4	5	5	6
ND Frohberg	ND	2020	30	4	47	2	5	8	5	5
ND Heron	ND	2021	28	6	45	1	7	NA	7	4
ND Thresher	**ND**	**2023**	**27**	**4**	**50**	**2**	**4**	**NA**	**4**	**4**
ND VitPro	ND	2016	28	4	46	2	4	6	6	4
PFS Buns	Peterson Farm Seeds	2021	28	4	57	1	2	NA	4	6
Shelly	MN	2016	27	4	49	2	6	3	7	5
SY 611CL2	Syngenta/AgriPro	2019	26	3	48	2	6	4	6	5
SY Ingmar	Syngenta/AgriPro	2014	27	2	48	2	3	6	6	6
SY Longmire[7]	Syngenta/AgriPro	2019	27	5	48	2	6	4	6	6
SY McCloud	Syngenta/AgriPro	2019	28	4	47	2	5	7	7	6
SY Valda	Syngenta/AgriPro	2015	27	4	48	2	2	7	6	5
TCG-Heartland	21st Century Genetics	2019	26	3	46	2	3	4	7	6
TCG-Spitfire	21st Century Genetics	2015	28	3	50	2	5	6	5	6
TCG-Teddy	**21st Century Genetics**	**2023**	**25**	**3**	**48**	**NA**	**4**	**NA**	**5**	**6**
TCG-Wildcat	21st Century Genetics	2020	27	3	48	2	5	6	7	6
WB9590	WestBred	2017	25	3	47	2	3	8	8	7
WB9606	WestBred	2020	29	4	49	NA	4	NA	6	6
WB9719	WestBred	2018	27	4	49	NA	5	NA	5	6

[1]Refers to agent or developer: MN = Univ of Minnesota; MT = Montana State Univ; ND = North Dakota State Univ; SD = South Dakota State Univ Canada = Agri-Food Canada. NDCISA = ND Crop & Seed Improvement Assoc. Bold varieties are recently released, so data are limited and rating values may change.

[2]Height data averaged from multiple locations in 2023.

[3]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.

[4]Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2023.

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

[6]Stem rust scores determined from field severity ratings and *Puccinia graminis* f. sp. *tritici* race QFCQ

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

Hard Red Spring Wheat - 2023 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Concord	57	34	6	57.3	14.8	42.3	63.6	68.4	66.0	58.1
AAC Rimbey	57	32	5	58.8	12.8	--	--	72.7	--	--
AAC Starbuck	55	33	3	58.8	14.7	46.6	76.1	82.6	79.3	68.4
AAC Westlock	56	32	3	59.6	12.9	--	--	76.6	--	--
AP Gunsmoke CL2	55	30	2	59.8	13.7	48.4	78.8	84.9	81.9	70.7
AP Murdock	54	29	2	58.1	13.3	39.5	73.6	75.2	74.4	62.8
AP Smith	56	30	0	59.8	13.9	38.0	76.5	80.8	78.6	65.1
AR3530	57	33	1	59.7	14.1	40.3	76.0	86.5	81.2	67.6
AR3915	56	31	0	60.3	13.4	--	--	76.6	--	--
Asend-SD	56	35	2	60.0	13.2	40.9	74.4	83.4	78.9	66.2
Bolles	57	31	2	58.6	15.5	42.7	70.3	75.8	73.1	63.0
Boost	57	33	4	59.6	14.3	--	69.9	72.0	70.9	--
Brawn-SD	55	32	3	59.9	13.4	--	84.1	89.1	86.6	--
CAG Justify	57	33	3	58.7	12.3	48.0	82.4	93.6	88.0	74.7
CAG Reckless	55	34	2	59.5	14.2	49.9	75.2	83.8	79.5	69.6
CDC Landmark VB	55	33	2	59.6	14.7	--	--	81.8	--	--
CP3055	63	32	0	58.5	11.2	--	--	88.0	--	--
CP3099A	61	35	0	58.4	10.6	41.9	76.8	91.7	84.2	70.1
CP3119A	64	34	0	55.8	11.6	42.8	74.0	87.1	80.5	67.9
CP3188	56	31	5	58.7	12.0	43.7	77.2	80.8	79.0	67.2
CP3322	59	31	0	59.3	11.3	--	--	84.0	--	--
Dagmar	56	32	2	59.3	14.3	48.4	82.6	81.6	82.1	70.9
Driver	57	33	0	60.0	13.4	45.9	76.9	86.8	81.9	69.9
Elgin-ND	52	34	1	58.8	13.7	--	--	78.9	--	--
Glenn	52	32	1	60.6	14.6	41.6	71.2	73.3	72.2	62.0
Lang-MN	56	32	1	59.7	13.8	--	--	76.9	--	--
Lanning	54	31	0	58.1	13.9	48.6	77.3	78.5	77.9	68.1
LCS Ascent	51	30	1	59.6	13.1	--	80.9	80.0	80.4	--
LCS Boom	51	29	2	60.0	14.2	--	--	76.2	--	--
LCS Buster	59	33	1	58.7	11.6	43.5	81.3	90.6	85.9	71.8
LCS Cannon	50	29	1	60.2	14.3	48.5	79.6	76.3	77.9	68.1
LCS Dual	53	31	2	59.8	13.1	--	80.2	85.2	82.7	--
LCS Hammer AX	53	27	0	58.2	13.6	--	77.6	73.3	75.5	--
LCS Trigger	61	33	1	60.0	11.4	43.1	77.1	93.2	85.1	71.1
MN Rothsay	57	30	0	58.9	13.9	43.1	74.2	85.1	79.6	67.5
MN Torgy	55	30	1	58.8	14.4	45.2	77.1	85.4	81.2	69.2
MS Charger	53	30	4	59.8	12.2		86.5	88.9	87.7	--
MS Cobra	54	30	1	59.1	14.3	42.3	77.7	76.7	77.2	65.5
MS Ranchero	58	34	2	58.7	12.5	49.3	78.2	91.4	84.8	73.0

Table continued on next page

Hard Red Spring Wheat - 2023 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page										
ND Frohberg	55	32	1	59.7	14.4	46.0	73.7	78.4	76.0	66.0
ND Heron	52	31	3	59.4	14.7	47.7	74.3	75.7	75.0	65.9
ND Thresher	55	24	3	58.6	14.0	38.0	73.5	82.0	77.7	64.5
ND VitPro	53	30	2	60.2	14.7	39.4	71.6	74.3	72.9	61.8
PFS Buns	63	30	0	57.3	11.9	--	--	91.9	--	--
Shelly	57	30	2	58.9	13.1	--	78.9	86.4	82.7	--
SY 611 CL2	55	29	2	60.3	14.1	44.6	81.4	82.9	82.2	69.6
SY Ingmar	57	30	0	60.0	14.8	42.6	65.1	70.8	67.9	59.5
SY Longmire	56	31	3	59.6	14.2	40.2	70.7	76.6	73.7	62.5
SY McCloud	54	31	1	59.4	14.6	46.5	76.9	73.3	75.1	65.5
SY Valda	56	30	2	59.6	14.5	43.3	74.8	86.7	80.7	68.3
TCG Heartland	52	28	1	59.6	14.9	45.7	73.2	72.5	72.8	63.8
TCG Spitfire	57	32	1	58.8	13.4	42.6	77.4	84.2	80.8	68.1
TCG Teddy	56	28	1	58.9	13.7	--	--	78.5	--	--
TCG Wildcat	56	31	0	59.8	14.6	44.9	75.5	78.6	77.1	66.3
WB9590	53	26	1	58.4	14.3	43.2	77.6	79.1	78.4	66.6
WB9606	55	30	1	59.8	12.8	--	--	86.0	--	--
WB9719	56	31	1	61.0	13.2	--	--	81.6	--	--
Trial Mean	55.5	31.2	1.6	59.2	13.6	44.2	76.6	81.5	79.2	66.9
C.V. %	1.2	6.2	71.2	0.7	4.1	7.4	3.1	5.5	--	--
LSD 5%	0.8	2.3	1.3	0.5	0.7	3.8	2.8	5.2	--	--
LSD 10%	0.6	1.8	1.0	0.4	0.5	3.0	2.2	4.1	--	--

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

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

Planting Date: April 24

Harvest Date: August 18

Previous Crop: Cover Crop Mix

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2023 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Starbuck	28	1	56.1		--	32.0	63.6	47.8	--
AP Gunsmoke CL2	29	2	55.0		--	32.1	58.8	45.4	--
AP Smith	28	0	56.3		20.8	34.3	61.2	47.7	38.7
Ascend-SD	29	0	54.5		--	28.2	70.9	49.6	--
Bolles	28	0	56.0		23.2	28.7	62.2	45.5	38.0
Brawn-SD	30	1	57.8		--	--	69.5	--	--
CAG Reckless	29	0	55.4		--	36.3	67.0	51.6	--
CP3188	27	2	53.8		--	31.9	61.1	46.5	--
CP3322	28	0	56.0		--	--	65.9	--	--
Dagmar	29	0	56.5		18.7	35.1	61.0	48.1	38.3
Driver	29	0	56.2		21.1	31.3	64.1	47.7	38.8
Glenn	28	0	57.5		19.0	28.6	58.1	43.3	35.2
Lanning	29	0	55.5		19.9	30.0	64.5	47.3	38.1
LCS Ascent	29	1	57.4		--	--	66.9	--	--
LCS Boom	29	0	55.9		--	--	66.4	--	--
LCS Buster	29	0	56.1		20.6	31.0	66.8	48.9	39.4
LCS Dual	28	0	55.4		--	--	62.5	--	--
MN Rothsay	27	0	55.5		--	35.4	65.7	50.6	--
MN Torgy	29	0	57.5		20.1	35.9	66.4	51.1	40.8
MS Charger	28	2	55.6		--	--	65.5	--	--
ND Frohberg	27	0	56.8		20.1	28.7	55.9	42.3	34.9
ND Heron	30	2	55.1		--	31.2	59.5	45.3	--
ND Thresher	29	0	55.9		--	--	57.5	--	--
TCG Teddy	29	0	57.0		--	--	67.0	--	--
WB9590	28	0	55.4		20.5	36.8	63.1	50.0	40.1
WB9606	27	0	56.3		--	--	66.7	--	--
Trial Mean	28	0.4	56.0		43.5	20.4	63.8	47.7	38.3
C.V. %	7.4	230	3.5		9.6	13.8	5.3	--	--
LSD 5%	2.5	0.9	2.3		5.9	4.0	3.9	--	--
LSD 10%	1.9	0.8	1.8		4.9	3.3	3.1	--	--

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

Planting Date: May 10

Harvest Date: August 19

Previous Crop: Flax

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2023 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Starbuck	31	0	57.4	14.5	--	51.5	58.3	54.9	--
AP Gunsmoke CL2	27	0	55.0	15.0	--	56.2	51.4	53.8	--
AP Smith	26	0	56.9	14.3	37.4	51.2	52.5	51.8	47.0
Ascend-SD	31	0	57.6	14.1	--	53.1	53.2	53.1	--
Bolles	29	0	54.5	16.1	36.3	46.2	50.0	48.1	44.2
Brawn-SD	30	0	59.3	13.4	--	--	58.6	--	--
CAG Reckless	30	0	56.9	14.0	--	57.4	62.7	60.0	--
CP3188	30	0	53.5	13.1	--	61.9	52.8	57.4	--
CP3322	28	0	53.8	13.2	--	--	53.3	--	--
Dagmar	30	0	55.0	14.4	38.6	47.6	57.8	52.7	48.0
Driver	29	0	56.3	14.1	38.8	54.4	48.0	51.2	47.1
Glenn	31	0	58.7	15.0	39.4	51.3	51.8	51.6	47.5
Lanning	29	0	55.4	14.4	41.3	53.3	54.7	54.0	49.8
LCS Ascent	28	0	55.9	13.5	--	--	51.2	--	--
LCS Boom	26	0	56.0	14.2	--	--	48.9	--	--
LCS Buster	31	0	54.0	12.3	45.0	71.6	63.1	67.3	59.9
LCS Dual	28	0	56.7	13.4	--	--	55.8	--	--
MN Rothsay	26	0	57.6	14.4	--	53.3	57.9	55.6	--
MN Torgy	29	0	56.0	14.4	44.1	66.9	53.2	60.0	54.7
MS Charger	27	0	55.4	13.0	--	--	54.4	--	--
ND Frohberg	30	0	56.9	14.4	40.8	50.2	51.2	50.7	47.4
ND Heron	29	0	55.9	14.7		44.3	46.7	45.5	--
ND Thresher	28	0	54.0	14.3	--	--	48.4	--	--
TCG Teddy	25	0	54.5	14.2	--	--	53.7	--	--
WB9590	26	0	56.1	14.8	40.7	54.7	56.2	55.4	50.5
WB9606	28	0	57.5	13.4	--	--	55.1	--	--
Trial Mean	28	0	56.0	14.1	41.2	53.4	53.9	54.3	49.6
C.V. %	3.4	--	2.5	1.8	12.7	10.0	5.6	--	--
LSD 5%	1.1	--	1.6	0.3	7.3	6.3	3.6	--	--
LSD 10%	0.9	--	1.3	0.2	6.2	4.9	2.8	--	--

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

Planting Date: May 10

Harvest Date: August 29

Prvious Crop: HRSW

Hard Red Spring Wheat - 2023 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Concord	35	0	56.5	13.3	21.4	54.3	55.8	55.0	43.8
AAC Rimbey	29	0	56.6	11.4	--	--	58.6	--	--
AAC Starbuck	30	0	56.8	13.7	20.1	51.6	54.2	52.9	42.0
AAC Westlock	30	0	57.6	11.7	--	--	57.3	--	--
AP Gunsmoke CL2	27	0	55.8	12.5	19.8	66.4	49.4	57.9	45.2
AP Murdock	26	0	57.0	12.1	16.7	65.2	52.6	58.9	44.8
AP Smith	26	0	57.1	13.4	23.7	58.5	48.8	53.6	43.6
AR3530	33	0	57.3	12.7	19.1	58.4	54.4	56.4	44.0
AR3915	28	0	57.1	12.0	--	--	53.0	--	--
Asend-SD	31	0	57.6	12.4	19.7	65.7	56.3	61.0	47.2
Bolles	30	0	56.6	13.9	18.4	56.5	51.3	53.9	42.1
Boost	30	0	57.5	13.1	--	56.5	50.9	53.7	--
Brawn-SD	29	0	57.4	12.1	--	70.8	50.3	60.5	--
CAG-Justify	29	0	55.3	11.0	20.8	67.2	50.3	58.7	46.1
CAG-Reckless	29	0	58.0	12.6	19.0	57.9	52.4	55.1	43.1
CDC Landmark VB	31	0	58.0	13.6	--	--	55.7	--	--
CP3055	29	0	54.0	11.4	--	--	51.6	--	--
CP3099A	33	0	52.7	10.6	15.1	62.8	54.4	58.6	44.1
CP3119A	33	0	54.7	11.1	--	--	58.3	--	--
CP3188	30	0	56.2	11.6	24.3	58.7	56.4	57.6	46.5
CP3322	29	0	55.6	11.5	--	--	53.6	--	--
Dagmar	30	0	55.0	13.5	18.8	57.7	48.4	53.0	41.6
Driver	30	0	57.9	12.0	23.3	57.0	56.9	57.0	45.7
Elgin-ND	32	0	55.4	12.6	--	--	41.8	--	--
Glenn	31	0	58.5	13.0	19.1	54.6	45.9	50.2	39.9
Lang-MN	31	0	58.5	13.0	--	--	56.8	--	--
Lanning	31	0	56.0	13.2	22.4	56.0	52.3	54.1	43.5
LCS Ascent	27	0	56.4	11.9	--	54.9	45.6	50.3	--
LCS Boom	26	0	57.7	12.7	--	--	47.0	--	--
LCS Buster	31	0	56.8	10.8	22.2	69.5	59.0	64.2	50.2
LCS Cannon	25	0	55.9	12.2	18.1	56.6	45.1	50.8	39.9
LCS Dual	27	0	55.0	12.3	--	55.1	45.2	50.1	--
LCS Hammer AX	27	0	56.0	12.4	--	62.8	51.7	57.2	--
LCS Trigger	31	0	58.9	10.5	22.2	70.4	60.3	65.4	51.0
MN Rothsay	26	0	57.5	12.9	20.5	63.5	56.8	60.1	46.9
MN Torgy	31	0	59.0	12.7	21.4	65.7	60.7	63.2	49.2
MS Charger	27	0	55.5	11.7	--	61.6	46.9	54.3	--
MS Cobra	27	0	55.7	13.1	17.1	62.1	50.7	56.4	43.3
MS Ranchero	36	0	57.3	11.8	27.0	64.3	66.6	65.5	52.6

Table continued on next page

Hard Red Spring Wheat - 2023 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page									
ND Frohberg	31	0	58.0	13.2	18.8	57.9	47.9	52.9	41.5
ND Heron	28	0	55.8	12.8	15.5	54.2	44.2	49.2	38.0
ND Thresher	28	0	56.8	12.3	17.1	54.4	53.2	53.8	41.5
ND VitPro	29	0	56.9	13.2	16.8	51.1	47.5	49.3	38.4
PFS Buns	28	0	56.3	11.3	--	--	63.9	--	--
Shelly	29	0	55.8	12.4	--	60.9	51.5	56.2	--
SY 611 CL2	27	0	57.5	12.5	20.0	60.7	57.4	59.1	46.1
SY Ingmar	27	0	58.0	13.3	21.5	54.3	49.9	52.1	41.9
SY Longmire	29	0	58.6	12.8	19.6	55.2	52.5	53.8	42.4
SY McCloud	28	0	57.0	13.9	17.5	59.8	48.6	54.2	42.0
SY Valda	27	0	57.2	12.0	21.4	60.8	60.3	60.5	47.5
TCG Heartland	26	0	56.7	13.6	15.4	51.0	45.4	48.2	37.3
TCG Sptifire	29	0	57.7	12.1	25.5	63.5	62.6	63.1	50.5
TCG Teddy	24	0	55.3	13.1	--	--	40.6	--	--
TCG Wildcat	28	0	57.2	13.4	21.6	63.9	55.5	59.7	47.0
WB9590	25	0	53.9	12.6	17.5	57.2	45.7	51.4	40.1
WB9606	30	0	56.5	11.6	--	--	51.5	--	--
WB9719	27	0	58.4	12.0	--	--	53.0	--	--
Trial Mean	29	0	56.6	12.5	20.3	59.4	52.4	56.0	44.2
C.V. %	4.2	NA	1.6	4.4	7.2	6.5	9.2	--	--
LSD 5%	1.4	NA	1.1	0.6	3.0	4.5	5.6	--	--
LSD 10%	1.1	NA	0.8	0.5	2.5	3.5	4.4	--	--

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

Planting Date: May 9

Harvest Date: August 24

Previous Crop: Soybean

2023 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	KWT	Plant Height	Test Weight	Protein	Grain Yield 2020	Grain Yield 2021	Grain Yield 2023	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			g/1000	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Concord	52	12,244	37	25	58.3	13.6	43.5	19.8	46.3	33.0	36.5
AAC Starbuck	53	11,850	39	25	61.2	13.8	--	--	51.3	--	--
AP Gunsmoke CL2	52	11,837	39	21	60.2	13.7	45.8	22.7	53.0	37.9	40.5
AP Murdock	52	13,586	34	19	58.5	14.8	42.0	15.9	41.6	28.8	33.2
AP Smith	53	12,592	36	22	60.9	13.9	43.8	19.5	53.1	36.3	38.8
AR3530	54	12,973	35	24	59.8	12.9	44.4	19.8	52.5	36.1	38.9
AR3915	53	12,846	35	21	62.0	14.7	44.5	21.7	46.3	34.0	37.5
Ascend-SD	52	15,087	30	22	60.6	13.4	--	20.2	48.6	34.4	--
Bolles	54	12,298	37	26	60.2	14.9	38.6	14.3	45.7	30.0	32.9
Boost	54	11,845	38	24	60.4	15.2	--	--	45.6	--	--
Brawn-SD	52	12,820	35	21	61.6	12.8	--	--	50.1	--	--
CAG-Justify	53	13,700	33	24	58.6	11.9	--	16.1	61.2	38.7	--
CAG-Reckless	51	13,099	35	22	61.2	14.7	--	19.0	45.5	32.2	--
CDC Landmark VB	53	12,251	37	22	61.0	15.1	--	--	47.2	--	--
CP3099A	55	11,725	39	23	59.3	12.0	--	12.6	54.7	33.6	--
CP3188	53	13,429	34	24	58.9	11.9	--	24.4	54.3	39.4	--
CP3322	54	15,737	29	24	60.7	11.4	--	--	62.5	--	--
Dagmar	50	11,313	40	22	60.6	14.2	44.8	22.3	50.8	36.6	39.3
Driver	53	13,090	35	25	61.1	13.5	45.4	21.0	46.5	33.7	37.6
Elgin-ND	50	12,805	35	24	60.2	14.2	43.8	18.4	50.4	34.4	37.5
Glenn	51	13,054	35	24	62.3	14.6	37.3	19.6	45.6	32.6	34.2
Lang-MN	54	13,618	34	22	60.4	13.8	42.6	18.3	51.0	34.7	37.3
Lanning	53	12,217	37	21	59.2	14.4	44.4	19.4	47.4	33.4	37.1
LCS Ascent	48	13,321	34	24	60.9	13.4	--	--	54.3	--	--
LCS Boom	49	12,338	37	22	61.2	14.5	--	--	46.5	--	--
LCS Buster	55	13,612	33	25	59.3	11.0	52.2	12.2	59.6	35.9	41.3
LCS Cannon	49	12,889	35	23	60.4	12.2	44.4	21.0	54.3	37.7	39.9
LCS Dual	51	12,879	36	21	60.8	13.3	--	--	48.9	--	--
LCS Hammer AX	52	12,933	35	22	59.5	13.9	--	--	49.8	--	--
LCS Trigger	56	14,238	32	23	60.6	12.0	51.6	14.7	54.1	34.4	40.1
MN Rothsay	54	13,966	32	20	60.9	13.7	43.3	20.7	51.4	36.0	38.4
MN Torgy	52	12,628	36	22	60.6	13.7	45.4	17.3	53.4	35.4	38.7
MS Charger	50	12,436	36	22	60.1	12.5	--	--	52.7	--	--
MS Cobra	51	12,871	35	21	60.5	14.9	--	20.3	45.7	33.0	--
MS Ranchero	54	13,620	34	24	60.0	12.1	47.5	19.3	59.4	39.3	42.1
ND Frohberg	52	11,825	38	24	60.1	14.9	41.2	16.8	44.2	30.5	34.1
ND Heron	49	13,079	35	25	60.2	15.3	40.2	22.0	45.2	33.6	35.8
ND Thresher	54	14,314	32	21	59.0	13.8	--	17.7	46.3	32.0	--
ND VitPro	51	12,659	36	23	61.5	15.0	38.9	19.2	42.9	31.1	33.7

Table continued on next page

2023 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	KWT	Plant Height	Test Weight	Protein	Grain Yield 2020	Grain Yield 2021	Grain Yield 2023	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			g/1000	in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Table continues from previous page											
PFS Buns	61	14,090	32	23	59.4	11.6	--	5.0	57.4	31.2	--
Shelly	54	13,574	33	20	60.8	13.7	--	--	51.6	--	--
SY 611 CL2	52	12,502	36	19	62.3	14.0	44.2	20.8	49.4	35.1	38.1
Sy Ingmar	54	12,857	35	23	62.0	14.3	43.3	16.2	49.8	33.0	36.4
SY Longmire	54	12,029	38	21	61.1	15.4	43.0	15.0	45.1	30.1	34.4
SY McCLoud	51	11,584	39	21	60.7	14.6	39.9	16.9	41.5	29.2	32.8
SY Valda	53	11,854	39	21	60.2	13.3	46.6	15.5	55.6	35.5	39.2
TCG-Heartland	50	11,612	39	18	61.7	14.5	41.0	15.6	43.8	29.7	33.5
TCG-Spitfire	54	11,654	39	20	61.1	13.3	47.7	13.0	53.1	33.0	37.9
TCG-Teddy	53	11,499	40	20	61.1	13.9	--	--	50.6	--	--
TCG-Wildcat	54	11,655	39	21	61.2	14.1	47.3	19.0	50.5	34.7	38.9
WB 9590	50	11,590	39	19	59.7	14.6	--	19.8	44.1	31.9	--
WB 9606	53	12,432	37	21	61.3	13.2	--	--	45.1	--	--
WB 9719	53	11,444	40	21	63.0	13.3	--	--	52.9	--	--
Trial Mean	52	12,773	36	22	60.5	13.8	43.3	17.9	49.8	--	--
CV %	1.8	4.1	4.3	8.8	0.8	6.0	7.6	20.9	10.3	--	--
LSD 0.05	1	618	1.8	2	0.5	1.0	4.6	5.2	6.0	--	--
LSD 0.10	1	481	1.4	2	0.4	0.8	3.8	4.4	4.7	--	--

Planting Date: April 26, 2023

Harvest Date: August 11, 2023

Protein adjusted to 12% moisture

[1] 2022 crop hailed out so previous 2 years were used in averages

Previous Crop: Sudan hay

Seeding Rate: 1.2 million live seeds/ac

2023 Glen Ullin Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	KWT	Test Weight	Protein	Grain Yield 2021	Grain Yield 2022	Grain Yield 2023	Average Yield 2 Year	Average Yield 3 Year
		g/1000	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AP Gunsmoke CL2	12,747	35.5	60.5	10.2	--	--	40.5	--	--
Ascend-SD	14,468	31.5	61.8	10.3	--	43.7	42.6	43.2	--
Brawn-SD	13,304	34.0	61.8	9.8	--	--	37.9	--	--
CAG-Reckless	13,578	33.5	61.8	10.8	--	--	39.7	--	--
CP3322	15,230	29.8	60.6	9.6	--	--	44.9	--	--
LCS Ascent	14,057	32.3	61.1	10.5	--	40.3	45.7	43.0	--
LCS Boom	13,418	33.8	61.0	10.8	--	--	37.5	--	--
MN Rothsay	13,769	33.0	61.3	11.1	--	48.3	38.8	43.5	--
MS Charger	12,705	35.5	60.8	9.7	--	--	42.8	--	--
ND Frohberg	12,375	37.0	61.5	11.6	40.4	36.4	35.0	35.7	37.3
ND Heron	13,473	33.8	60.9	11.6	--	39.2	35.1	37.1	--
ND Thresher	14,810	30.8	59.9	10.9	--	34.1	33.4	33.7	--
TCG-Teddy	13,313	34.0	60.0	10.9	--	--	38.0	--	--
Trial Mean	13,634	34.4	61.0	10.6	41.2	41.4	39.4	--	--
CV %	2.3	2.6	0.4	2.7	8.2	10.1	6.6	--	--
LSD 0.05	371	1.0	0.3	0.3	4.9	6.0	3.1	--	--
LSD 0.10	287	0.8	0.2	0.3	4.1	5.0	2.4	--	--

Planting Date: May 3, 2023
Harvest Date: August 17, 2023
Seeding Rate: 1.2 million live seeds/ac

NDSU Dickinson Research Extension Center

2023 Organic Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	KWT	Plant Height	Test Weight	Protein	Grain Yield 2022	Grain Yield 2023	Grain Yield 2-Year Average
			g/1000	in	lbs/bu	%	bu/ac	bu/ac	bu/ac
Bolles	47	16,154	28	24	56.2	14.5	48.8	13.6	31.2
Dagmar	43	13,629	33	25	56.0	14.5	66.8	16.7	41.7
Driver	45	14,965	31	24	58.4	12.9	51.9	18.8	35.3
Faller	46	14,820	31	24	56.2	12.9	59.9	21.5	40.7
Glenn	42	15,644	29	23	58.8	14.2	56.3	13.8	35.1
Lang-MN	47	17,663	26	23	58.1	13.3	62.1	21.2	41.6
Lanning	47	15,658	29	25	56.7	13.5	61.7	21.4	41.6
MN Washburn	47	16,605	28	23	56.9	13.9	54.2	14.8	34.5
MN-Torgy	47	16,092	28	21	57.9	13.5	69.0	16.5	42.7
ND Frohberg	46	15,577	29	23	56.0	15.6	51.6	11.9	31.8
ND VitPro	44	15,253	30	23	58.5	14.1	62.2	20.5	41.3
Shelly	48	15,647	29	23	56.5	13.2	59.6	14.9	37.2
Barlow	42	14,337	32	25	58.6	14.0	58.4	17.9	38.1
Linkert	44	14,140	32	23	57.9	14.9	55.2	12.4	33.8
Prosper	44	13,604	34	25	57.7	13.2	68.0	15.8	41.9
Dapps	46	14,872	31	29	57.1	15.0	54.9	18.8	36.8
Mida	46	13,421	34	35	57.4	14.4	45.8	14.3	30.1
Ceres	46	15,633	29	31	57.3	14.3	52.9	14.9	33.9
FBC Dylan	46	14,184	32	26	57.9	13.9	59.2	14.8	37.0
Red Fife	49	14,331	32	33	56.6	13.3	51.6	14.8	33.2
Elgin-ND	43	15,307	30	24	57.9	13.1	52.8	17.3	35.1
ND Heron	42	14,335	32	24	58.9	13.8	63.3	14.5	38.9
Trial Mean	45	15,085	30.3	25	57.4	13.9	57.5	16.4	--
CV %	1.9	5.8	5.4	12.8	2.3	7.0	14.1	26.1	--
LSD 0.05	1	1,023	1.9	4	1.6	1.2	11.5	NS	--
LSD 0.10	1	794	1.5	3	1.2	0.9	9.6	NS	--

Planting Date: May 10, 2023
Harvest Date: August 22, 2023
Protein adjusted to 12% moisture
Previous Crop: Oat Hay
Seeding Rate: 1.5 million live seeds/ac

2023 North Dakota hard red winter wheat variety description and agronomic traits.

Variety	Agent or Origin[2]	Year	Reaction to Disease[1]					Days to Heading[3]	Straw Strength[4]	Height[5] (inches)	Winter[6] Hardiness
			Stripe Rust	Leaf Rust	Stem Rust	Scab	Tan Spot				
AAC Goldrush	**AAFC**	**2021**	**NA**	**6**	**4**	**NA**	**NA**	**2**	**3**	**26**	**3**
AAC Vortex	AAFC	2021	NA	NA	NA	4	8	2	2	25	2
AAC Wildfire	AAFC	2015	1	4	8	4	6	3	3	26	2
AC Emerson	Meridian	2011	1	6	1	3	5	1	2	26	3
AP Bigfoot	Agripro	2020	NA	7	NA	7	4	-3	4	21	6
Jerry	ND	2001	8	4	1	8	8	0	5	30	3
Keldin	WB	2011	2	3	3	5	6	1	4	28	6
MS Maverick	Meridian	2020	1	6	5	8	5	-1	4	23	5
MS Sundown	**Meridian**	**2022**	**NA**	**NA**	**NA**	**5**	**NA**	**-3**	**6**	**23**	**4**
ND Noreen	ND	2020	3	3	1	3	4	1	4	28	3
Northern	MT	2015	1	8	1	8	6	2	4	24	4
SD Andes	SD	2020	1	8	NA	5	3	0	2	25	2
SD Midland	SD	2021	1	8	NA	6	4	0	4	26	3
SY Monument	Agripro	2014	3	3	1	8	8	-2	4	23	4
SY Wolverine	Agripro	2018	NA	7	NA	8	3	-4	5	21	5
WB 4309	WB	2019	NA	8	NA	6	5	-2	6	22	5
Winner	SD	2019	5	NA	NA	4	8	-2	5	23	4

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

[2]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.

[3]Days to heading relative to Jerry.

[4]Straw strength: 1 = strongest, 9 = weakest. Based on field observations from limited sites.

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

[6]Relative winter hardiness rating: 1 = excellent, 10 = no survival. These values are subject to change as additional information becomes available.

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

Hard Red Winter Wheat - 2023 **Hettinger, ND**

Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	Grain Protein	---- Grain Yield ---- 2021	2022	2023	Average Yield 2 yr	3 yr
	Julian	inches	0-9[1]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Goldrush	159	26	0	61.2	13.4	--	--	54.5	--	--
AAC Vortex	158	26	0	60.8	14.0	--	101.4	55.3	78.4	--
AAC Wildfire	158	26	0	61.0	13.2	26.6	93.8	58.6	76.2	59.7
AC Emerson	158	26	0	60.3	14.8	27.1	87.3	46.4	66.9	53.6
AP Bigfoot	154	22	0	61.4	13.5	--	93.7	41.9	67.8	--
CP7017AX	154	22	0	61.1	12.3	28.7	88.4	44.4	66.4	53.8
CP7266AX	154	23	0	60.1	13.7	--	--	40.8	--	--
CP7909	152	21	0	60.9	12.8	--	93.0	28.9	60.9	--
Jerry	157	27	0	59.4	14.1	28.0	88.3	48.5	68.4	54.9
Keldin	158	25	0	60.5	13.0	30.0	98.4	58.9	78.7	62.4
MS Maverick	156	22	0	60.4	14.5	--	97.8	45.2	71.5	--
MS Sundown	153	23	0	60.8	13.5	--	--	43.7	--	--
ND Noreen	158	28	0	61.6	14.7	27.5	94.1	55.5	74.8	59.0
Northern	159	25	0	61.4	13.9	31.6	94.5	58.0	76.3	61.4
Oahe	155	24	0	60.9	14.0	29.9	92.4	44.7	68.6	55.7
SD Andes	156	25	0	61.5	13.0	30.3	99.2	58.7	78.9	62.7
SD Midland	156	25	0	61.1	13.0	--	96.8	58.9	77.8	--
SY Monument	156	23	0	59.0	13.5	30.4	89.7	44.6	67.1	54.9
SY Wolverine	154	21	0	60.6	14.2	28.2	84.8	41.5	63.1	51.5
WB4309	154	21	0	57.2	14.5	32.7	81.3	35.7	58.5	49.9
Winner	153	23	0	61.1	13.5	30.8	95.1	44.1	69.6	56.7
Trial Mean	156	24	0.0	60.7	13.6	29.1	90.1	49.1	70.1	56.5
C.V. %	0.5	4.2	--	1.6	2.9	7.5	7.0	7.1	--	--
LSD 0.05	1.1	1.4	NS	1.4	0.6	2.6	6.7	5.7	--	--
LSD 0.10	0.9	1.2	NS	1.1	0.5	2.0	5.4	4.8	--	--

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

Previous Crop: Cover Crop Mix

Planting Date: September 20

Harvest Date: August 1

2023 Winter Wheat - Recrop **Dickinson, ND**

Variety	Winter Survival	Seeds per Pound	KWT (g/1000)	Test Weight	Protein	Grain Yield 2020	Grain Yield 2021	Grain Yield 2023	Average Yield[1] 2 Year	Average Yield[1] 3 Year
				lbs/bu	%	-----bu/ac-----			bu/ac	bu/ac
AAC Vortex	53	15,331	29.6	55.4	14.0	--	--	47.1	--	--
AAC-Wildfire	56	14,742	30.9	55.2	12.9	51.8	21.9	55.8	38.8	43.2
AC Emerson	50	17,791	25.5	56.8	14.3	38.0	17.4	40.2	28.8	31.9
AP Bigfoot	38	16,272	27.9	56.6	13.1	--	--	24.1	--	--
Goldrush	50	16,491	27.5	55.3	13.4	--	--	47.5	--	--
Jerry	63	14,439	31.5	55.6	13.4	45.1	21.2	42.3	31.7	36.2
Keldin	10	13,589	33.4	56.0	12.4	38.2	22.1	33.0	27.5	31.1
MS Maverick	15	13,343	34.0	56.3	13.4	--	--	32.4	--	--
MS Sundown	45	15,683	29.0	56.5	12.7	--	--	28.0	--	--
ND Noreen	64	12,677	35.8	58.8	13.2	44.6	22.6	52.1	37.3	39.7
Northern	45	15,196	29.9	56.6	12.7	44.3	25.5	54.7	40.1	41.5
SD Andes	80	13,733	33.1	58.3	12.6	--	26.4	56.6	41.5	--
SD Midland	55	13,327	34.1	57.1	12.3	--	--	47.9	--	--
SY Monument	33	15,386	29.5	54.3	12.5	41.0	20.8	32.3	26.5	31.3
SY Wolverine	23	14,815	30.6	55.8	12.9	40.5	12.6	26.5	19.6	26.5
WB4309	29	17,794	25.6	54.3	13.2	--	16.0	25.9	20.9	--
Winner	43	14,245	31.9	57.4	13.2	--	23.2	37.0	30.1	--
Trial Mean	43	14,962	30.6	56.3	12.9	42.9	19.3	41.0	--	--
CV %	40.4	4.1	3.9	1.3	3.1	8.1	18.1	15.0	--	--
LSD 0.05	24	857	1.7	1.1	0.6	4.9	5.7	8.7	--	--
LSD 0.10	20	716	1.4	0.9	0.5	4.1	4.8	7.3	--	--

[1]2022 crop hailed out so previous 2 years were used in averages

Planting Date: September 14, 2022

Harvest Date: August 18, 2023

Protein adjusted to 12% moisture

Previous Crop: Oat hay

Seeding Rate: 1 million live seeds/ac

Winter Rye - 2023 **Hettinger, ND**

Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2020	2021	2023	Average Yield 2 yr	3 yr
		inches	0-9[1]	lbs/bu	---------- Bushels per acre ----------				
Aroostok	5/28	41	7	48.1	36.6	28.4	35.8	32.1	33.6
Danko	5/31	35	1	52.3	45.5	31.8	67.7	49.8	48.3
Hazlet	5/31	37	5	50.5	50.1	29.7	56.4	43.1	45.4
ND Dylan	5/29	39	8	48.3	50.5	28.4	38.3	33.4	39.1
ND Gardner	5/31	38	7	47.3	38.3	32.1	40.2	36.2	36.9
Receptor	5/30	29	2	51.0	--	--	71.5	--	--
Rymin	5/31	39	4	49.4	44.6	29.7	52.1	40.9	42.1
Serfanio	6/1	32	1	52.7	--	43.0	74.7	58.9	--
Spooner	5/29	38	6	48.6	42.2	29.9	49.8	39.9	40.6
Tayo	6/1	30	0	50.2	--	37.3	73.6	55.5	--
Trial Mean	5/30	35	3	50.1	47.9	32.7	59.3	43.3	40.9
C.V. %	0.9	6.1	31.3	2.2	15.0	9.0	12.4	--	--
LSD 0.05	1.9	3.0	1.3	1.6	10.5	3.5	10.5	--	--
LSD 0.10	1.7	2.5	1.1	1.3	8.7	2.7	8.7	--	--

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

Planting Date: September 20

Harvest Date: August 8

Previous Crop: Cover Crop Mix

Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2023.

						Reaction to Disease[5]				
	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Heading[4]	Stem Rust	Leaf Rust	Foliar Disease	Bact. Leaf Streak	Head Scab
AAC Stronghold[7]	Can.	2016	28	3	54	NA	NA	NA	NA	NA
Alkabo	ND	2005	31	2	54	1	1	5	7	6
Carpio	ND	2012	30	6	56	1	1	5	6	5
CDC Defy	Can.	2019	31	3	54	NA	NA	NA	NA	NA
CDC Vantta	Can.	2021	27	3	60	NA	NA	NA	NA	NA
Divide	ND	2005	32	4	56	1	1	5	7	5
Joppa	ND	2013	30	5	55	1	1	5	7	5
Maier	ND	1998	29	4	55	1	1	5	NA	8
Mountrail	ND	1998	31	5	55	1	1	5	7	8
MT Blackbeard[6]	**MT**	**2022**	**32**	**4**	**58**	**NA**	**NA**	**NA**	**NA**	**NA**
MT Raska[7]	**MT**	**2022**	**24**	**4**	**54**	**NA**	**NA**	**NA**	**NA**	**NA**
ND Grano[6]	ND	2017	31	5	56	1	1	8	7	6
ND Riveland[6]	ND	2017	32	4	56	1	1	5	6	5
ND Stanley[6]	ND	2021	78	3	56	1	1	5	6	5
Strongfield[6]	Can.	2004	30	5	55	1	1	6	NA	8
Tioga	ND	2010	34	5	57	1	1	5	7	6

[1]Refers to agent or developer: Can. = Agriculture Canada, WB = Westbred, ND = North Dakota State University. MT = Montana State University. Bold varieties are those recently released, so data are limited and rating values may change.

[2]Plant height was obtained from the average of four locations in 2023.

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

[4]Days to Heading = the number of days from planting to head emergence from the boot. Averaged from three locations in 2023.

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

[6]Low cadmium accumulating variety.

[7]Solid stem variety to reduce wheat stem sawfly damage.

Durum Wheat - 2023 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Stronghold	57	31	0	58.7	14.1	27.8	64.5	76.9	70.7	56.4
AAC Weyburn	57	36	1	58.7	12.5	--	--	77.7	--	--
Alkabo	57	34	0	58.2	12.8	25.7	72.3	76.9	74.6	58.3
Carpio	58	32	3	59.4	12.5	23.3	71.9	77.6	74.7	57.6
CDC Defy	56	35	1	59.5	13.3	33.5	72.1	83.6	77.8	63.0
CDC Vantta	64	32	0	58.3	12.8	--	61.1	82.2	71.6	--
Divide	58	35	2	58.9	12.9	24.0	68.1	75.2	71.6	55.8
Joppa	57	34	2	59.3	12.8	25.8	75.3	80.1	77.7	60.4
Maier	57	32	1	58.3	14.0	30.4	71.2	67.8	69.5	56.5
Mountrail	57	34	3	58.5	13.0	26.6	72.7	77.4	75.0	58.9
MT Blackbeard	58	37	2	59.1	13.1	--	--	81.0	--	--
MT Raska	53	28	3	58.9	13.7	--	--	68.9	--	--
ND Grano	58	35	3	59.5	12.8	25.2	71.2	76.1	73.7	57.5
ND Riveland	58	35	1	59.2	12.8	30.3	69.2	75.2	72.2	58.2
ND Stanley	58	33	0	58.9	13.3	30.1	73.9	74.3	74.1	59.4
Strongfield	57	33	2	58.5	14.2	25.7	68.9	74.5	71.7	56.4
Tioga	58	37	3	57.4	13.2	27.9	63.5	75.4	69.4	55.6
Trial Mean	58	34	2	58.9	13.1	27.6	70.8	78.3	74.4	59.0
C.V. %	1.1	4.2	NA	0.6	4.3	13.3	3.7	4.7	--	--
LSD 5%	0.7	1.7	NA	0.4	0.7	4.3	3.1	4.4	--	--
LSD 10%	0.6	1.3	NA	0.3	0.5	3.3	2.4	3.4	--	--

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

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

Planting Date: April 24

Harvest Date: August 18

Previous Crop: Cover Crop Mix

Durum Wheat - 2023 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Carpio	37	2	60.5		16.6	30.0	53.8	41.9	33.5
Joppa	37	2	60.4		17.9	28.8	57.4	43.1	34.7
ND Grano	36	0	61.3		18.5	30.9	59.5	45.2	36.3
ND Riveland	40	0	60.3		16.5	30.3	62.3	46.3	36.3
ND Stanley	35	0	61.3		17.4	29.1	59.4	44.2	35.3
Trial Mean	37	1	61.0		17.4	29.4	58.7	44.1	35.2
C.V. %	3.3	44.3	0.8		5.5	10.4	4.6	--	--
LSD 5%	1.5	0.3	0.6		1.5	3.8	3.3	--	--
LSD 10%	1.2	0.2	0.5		1.2	2.9	2.6	--	--

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

Planting Date: May 10

Harvest Date: August 19

Previous Crop: Flax

Durum Wheat - 2023 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2020	2021	2023	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
Carpio	34	0	56.9	13.4	28.9	36.0	49.7	42.9	38.2
Joppa	33	0	54.9	13.4	25.8	37.1	44.5	40.8	35.8
ND Grano	33	0	55.8	14.0	24.8	36.6	45.3	40.9	35.6
ND Riveland	34	0	56.4	13.5	28.9	32.1	51.0	41.6	37.3
ND Stanley	32	0	56.8	13.9	--	33.7	46.8	40.2	--
Trial Mean	33	0	56.4	13.5	26.5	34.8	47.8	41.3	36.7
C.V. %	3.3	--	1.2	1.5	9.0	5.6	6.6	--	--
LSD 5%	1.3	--	0.8	0.3	3.6	2.9	3.9	--	--
LSD 10%	1.0	--	0.6	0.2	2.9	2.4	3.0	--	--

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

Planting Date: May 10

Harvest Date: August 29

Previous Crop: HRSW

2023 Durum - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	KWT	Protein	Grain Yield 2020	Grain Yield 2021	Grain Yield 2023	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	g/1000	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Maier	57	10,118	27	60.2	45.5	13.5	35.1	13.5	48.1	30.8	32.2
Mountrail	58	10,020	28	60.4	45.5	12.2	40.9	11.4	58.2	34.8	36.8
Alkabo	56	9,513	25	60.3	48.1	12.3	39.4	13.9	56.9	35.4	36.7
Divide	59	10,260	30	60.3	44.4	12.3	38.3	12.4	51.8	32.1	34.1
Tioga	56	9,183	29	59.7	49.5	12.5	37.6	15.3	51.5	33.4	34.8
Carpio	58	9,488	29	60.4	48.0	12.2	36.4	12.9	57.1	35.0	35.5
Joppa	57	10,228	26	60.5	44.6	12.7	41.5	11.5	49.2	30.3	34.0
ND Grano	58	9,898	29	61.0	45.9	12.2	38.7	11.3	57.6	34.4	35.8
ND Riveland	57	9,421	28	59.8	48.3	13.1	38.3	15.3	48.2	31.8	33.9
ND Stanley	58	9,676	26	60.9	47.0	13.1	40.0	13.8	54.3	34.0	36.0
Strongfield	57	9,935	28	60.1	45.8	14.0	36.2	9.9	47.4	28.7	31.2
MT Blackbeard	59	9,285	31	60.3	48.9	12.9	--	--	45.4	--	--
MT Raska	56	10,524	22	60.8	43.5	13.6	--	--	50.5	--	--
Trial Mean	58	9,664	28	60.5	47.2	12.8	37.9	12.7	52.9	--	--
CV %	1.1	4.3	7.0	0.6	4.2	4.9	7.4	19.0	11.1	--	--
LSD 0.05	1	491	2	0.4	2.3	0.7	4.0	3.4	6.9	--	--
LSD 0.10	1	381	2	0.3	1.8	0.6	3.3	2.8	5.3	--	--

Planting Date: April 26, 2023
Harvest Date: August 15, 2023
Previous Crop: Sudan hay
Seeding Rate: 1.2 million live seeds/ac

[1] 2022 crop hailed out so previous 2 years were used in averages

2022 North Dakota barley variety descriptions.

Variety	Use[1]	Origin[2]	Year Released	Awn[3] Type	Rachilla Hair[4] Length	Aleurone Color	Height (inch)	Days to Head	Straw[5] Strength	Reaction to Disease[6]			
										Stem Rust	Spot-form Net Blotch	Spot Blotch	Net Blotch
Six-rowed													
Tradition	M/F	BARI	2003	S	L	White	30	48	3	8	6	3	7
Two-rowed													
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[7]	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.

[1]M = malting; F = feed.

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

[3]R = rough; S = smooth.

[4]L = long S = short.

[5]Straw Strength scores from 1-9, with 1 = strongest and 9 = weakest.

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

[7]Lower DON accumulations than other varieties tested.

NDSU Hettinger Research Extension Center

Barley - 2023 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW											
AAC Connect	63	30	0	91	38.1	11.8	46.4	94.6	121.8	108.2	87.6
AAC Synergy	62	31	0	92	36.4	12.4	47.5	103.4	134.7	119.1	95.2
ABI Cardinal	60	28	0	94	40.3	11.7	50.3	93.9	124.2	109.1	89.5
Brewski	60	30	0	92	44.5	11.9	60.1	105.1	132.3	118.7	99.1
CDC Fraser	64	32	0	93	38.6	11.7	45.9	101.2	125.8	113.5	91.0
CDC Praire	61	31	0	90	38.6	11.8	--	--	111.0	--	--
Conlon	52	27	0	96	41.7	12.6	43.9	95.2	94.4	94.8	77.8
Explorer	61	23	0	91	45.7	12.6	54.3	105.3	124.2	114.7	94.6
ND Genesis	58	31	0	93	46.0	11.0	57.5	95.6	140.8	118.2	98.0
Pinnacle	57	30	0	91	44.3	10.5	54.8	85.7	96.2	90.9	78.9
SIX ROW											
ND Treasure	55	28	0	90	40.6	12.1	51.5	108.5	132.1	120.3	97.4
Tradition	55	30	0	93	42.4	12.3	50.4	101.6	115.8	108.7	89.3
Trial Mean	59	29	0	92	41.8	11.7	53.1	98.0	119.5	108.8	90.4
C.V. %	1.6	5.7	--	2.4	3.2	4.7	9.4	5.2	6.9	--	--
LSD 5%	1.1	2.0	--	2.6	1.6	0.7	5.9	6.1	9.8	--	--
LSD 10%	0.9	1.5	--	2.0	1.2	0.6	4.6	4.7	7.6	--	--

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

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

Planting Date: April 24

Harvest Date: August 11

Previous Crop: Cover Crop Mix

Barley - 2023 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	inches	0-9*	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW										
AAC Connect	34	3		44.0		17.5	67.4	88.4	77.9	57.8
ABI Cardinal	31	2		45.5		17.2	61.8	100.3	81.0	59.8
Brewski	31	1		46.4		21.3	63.5	81.5	72.5	55.4
CDC Fraser	34	3		42.7		--	--	92.5	--	--
ND Genesis	35	1		46.0		20.9	60.3	94.7	77.5	58.6
SIX ROW										
ND Treasure	32	3		44.0		--	--	87.9	--	--
Trial Mean	33	2		44.8		19.7	62.3	90.9	77.2	57.9
C.V. %	5.5	48.3		4.1		22.9	12.6	15.4	--	--
LSD 5%	2.2	1.1		2.3		6.8	9.7	17.3	--	--
LSD 10%	1.7	1		1.7		5.6	7.4	13.3	--	--

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

Planting Date: May 10

Harvest Date: August 19

Previous Crop: Flax

Barley - 2023 **Regent, ND**

Variety	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2020	2021	2023	Average Yield 2 yr	3 yr
	inches	0-9*	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW										
AAC Connect	30	0	78	39.0	13.8	32.2	46.2	74.7	60.4	51.0
ABI Cardinal	29	0	91	38.5	13.3	--	51.3	78.9	65.1	--
Brewski	27	0	90	37.8	12.5	--	45.8	81.2	63.5	--
CDC Fraser	27	0	80	37.1	13.7	--	--	80.3	--	--
ND Genesis	32	0	91	42.0	12.0	39.9	41.6	81.9	61.8	54.5
SIX ROW										
ND Treasure	26	0	79	39.5	12.8	--	--	76.4	--	--
Trial Mean	28	0	85	39.0	13.0	34.1	44.6	78.9	62.7	52.8
C.V. %	4.8	--	2.5	7.6	4.8	7.7	9.0	5.2	--	--
LSD 5%	1.7	NS	2.7	3.7	0.8	4.1	6.1	5.1	--	--
LSD 10%	1.3	NS	2.0	2.8	0.6	3.3	5.0	3.9	--	--

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

Planting Date: May 10

Harvest Date: August 19

Previous Crop: HRSW

NDSU Dickinson Research Extension Center

2023 Glen Ullin Barley - Recrop **Dickinson, ND**

Variety	Seeds per Pound	KWT	Test Weight	% Plump	Protein	Grain Yield 2021	Grain Yield 2022	Grain Yield 2023	Average Yield 2 Year	Average Yield 3 Year
		g/1000	lbs/bu	>6/64	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Six Row										
Tradition	12,168	37.3	47.1	92	9.9	65.5	41.0	43.3	42.2	49.9
Two Row										
AAC Connect	10,306	44.3	45.5	96	8.6	--	62.1	55.0	58.6	--
AAC Synergy	9,907	46.0	46.2	97	9.1	74.6	56.9	63.1	60.0	64.8
ABI Cardinal	10,437	43.8	47.3	97	8.0	80.6	68.3	61.3	64.8	70.1
Brewski	9,996	45.5	46.4	97	8.1	69.6	74.0	57.5	65.8	67.0
ND Genesis	10,246	44.5	47.2	96	8.1	72.0	67.6	62.9	65.3	67.5
ND Treasure	12,243	37.0	45.5	92	8.6	--	--	62.9	--	--
Trial Mean	10,645	43.1	46.4	95	8.6	69.1	60.7	65.7	--	--
CV %	2.6	2.5	0.8	0.7	5.3	11.3	8.3	13.7	--	--
LSD 0.05	334	1.3	0.5	1	0.6	11.5	7.4	11.2	--	--
LSD 0.10	257	1.0	0.4	1	0.4	9.5	6.1	9.9	--	--

Planting Date: May 3, 2023
Harvest Date: August 17, 2023
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[1]	Year Released	Grain Color	Height (inch)	Straw Strength	Days to Heading[2]	Reaction to Diseases[3]			Test Weight	Protein[4]
							Stem Rust	Crown Rust[3]	Barley Y.Dwf		
AAC Douglas	**AAFC**	**2019**	**White**	**39**	**NA**	**52**	**NA**	**4**	**5**	**Good**	**M**
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
MN-Pearl	**MN**	**2019**	**White**	**39**	**NA**	**54**	**NA**	**7**	**4**	**Good**	**M/L**
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[5]	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
SD Buffalo	**SD**	**2022**	**White**	**41**	**Strong**	**52**	**NA**	**6**	**NA**	**V.good**	**M**
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.

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

[2]Days after planting.

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

[4]H = high; M = medium; L = low.

[5]Hull-less variety.

Oat - 2023 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2021	2022	2023	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Douglas	56	36	0	36.0		96.0	179.5	174.6	177.1	150.1
AAC Nevel	60	34	1	37.3		--	--	139.1	--	--
Beach	56	37	5	38.3		63.0	153.3	135.0	144.1	117.1
CDC Endure	58	40	0	36.9		--	--	160.7	--	--
CS Camden	58	38	1	34.7		88.1	165.3	164.3	164.8	139.2
Deon	59	38	2	36.9		81.0	165.8	130.5	148.2	125.8
HiFi	59	42	4	35.3		68.7	165.5	119.7	142.6	118.0
Jury	57	41	7	35.9		80.5	165.1	126.2	145.6	123.9
Killdeer	57	34	5	36.2		78.4	180.1	140.8	160.4	133.1
Leggett	58	38	2	37.0		67.2	165.3	133.8	149.5	122.1
MN Pearl	59	42	4	36.6		--	176.6	141.8	159.2	--
ND Carson	59	37	4	35.8		79.9	175.1	140.2	157.6	131.7
ND Heart	56	40	4	36.7		67.6	163.2	113.4	138.3	114.7
ND Spindle	58	40	2	34.9		78.1	181.0	130.3	155.7	129.8
Newburg	59	38	4	36.1		78.2	164.5	143.2	153.9	128.6
ORE3541M	57	34	2	37.8		75.5	184.0	134.2	159.1	131.2
Otana	58	41	7	36.0		81.9	168.0	131.7	149.8	127.2
Rockford	59	40	2	38.3		86.7	162.9	134.2	148.5	127.9
SD Buffalo	56	40	1	37.9		--	176.1	126.1	151.1	--
ND Crema (hull-less)	62	43	1	43.1		38.4	113.1	101.8	107.5	84.4
Paul (hull-less)	61	42	1	40.2		44.3	121.9	106.6	114.3	90.9
Trial Mean	58.8	40	3	36.7		77.1	163.4	134.7	148.5	123.5
C.V. %	1.6	6.4	54.0	1.6		7.9	4.3	8.7	--	--
LSD 5%	1.1	3.0	1.8	0.7		7.2	8.2	13.7	--	--
LSD 10%	0.9	2.3	1.4	0.5		5.6	6.4	10.7	--	--

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

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

Planting Date: April 25

Harvest Date: August 18

Previous Crop: Lentils

2023 Oat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	KWT	Plant Height	Test Weight	Grain Yield 2020	Grain Yield 2021	Grain Yield 2023	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			g/1000	in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Douglas	54	11,735	38.8	37	37.2	--	--	172.4	--	--
Beach	54	11,178	40.5	39	40.3	90.3	18.4	123.1	70.7	77.3
CS Camden	57	11,230	40.8	36	36.5	98.5	15.3	161.2	88.2	91.7
Deon	57	12,853	35.5	36	38.7	94.5	18.5	132.3	75.4	81.8
Endure	58	10,974	41.8	39	38.1	--	--	175.5	--	--
HiFi	57	13,467	33.8	39	38.8	93.3	13.6	145.1	79.3	84.0
Jury	56	13,201	34.8	38	37.7	93.6	27.5	138.3	82.9	86.5
Killdeer	57	12,812	35.5	35	37.4	102.5	21.7	149.3	85.5	91.2
Leggett	57	12,081	37.8	35	39.6	88.5	15.6	151.6	83.6	85.2
MN Pearl	58	12,064	38.0	37	38.0	--	--	155.3	--	--
ND Carson	57	11,495	39.8	35	38.6	100.6	22.4	153.8	88.1	92.2
ND Crema	60	17,564	26.0	39	45.4	53.6	3.2	95.7	49.4	50.8
ND Heart	56	12,775	35.5	37	38.5	93.0	25.1	124.3	74.7	80.8
ND Spilde	58	12,329	37.0	40	37.0	91.9	25.1	127.2	76.2	81.4
Newburg	59	11,477	39.5	37	38.6	101.3	16.0	160.8	88.4	92.7
Otana	57	14,016	32.8	43	38.9	94.5	17.0	122.0	69.5	77.8
Paul	60	17,906	25.5	38	42.3	62.3	9.5	107.5	58.5	59.8
Rockford	57	13,768	33.0	38	39.3	90.5	17.1	131.9	74.5	79.9
SD Buffalo	56	11,353	40.0	37	39.9	--	--	146.5	--	--
Trial Mean	57	12,195	37.9	38	38.8	91.3	20.2	139.2	--	--
CV %	1.8	5.2	5.4	7.0	1.3	7.9	30.5	9.4	--	--
LSD 0.05	2	745	2.4	3	0.6	10.1	8.6	15.3	--	--
LSD 0.10	1	579	1.9	2	0.5	8.4	7.2	11.9	--	--

Planting Date: April 28, 2023
Harvest Date: August 15, 2023
Previous Crop: Sudan hay
Seeding Rate: 1 million live seeds/ac

[1] 2022 crop hailed out so previous 2 years were used in averages

NDSU Hettinger Research Extension Center

Corn - 2023 **Hettinger, ND**

Brand	Hybrid	Relavtive Maturity[1]	Days to Silk	Plant Height	Ear Height	Stalk Lodge	Moisture Content	Test Weight	Grain Yield 2023	Grain Yield 2-Yr
		days	DAP[2]	inches	inches	%	%	lbs/bu	------bu/ac------	
Integra	3009	80	69	84	33	0	16.0	57.0	113.4	92.4
Integra	3114	81	72	89	36	0	18.6	55.7	130.7	--
Thunder	T6983 VTP2P	83	72	91	36	0	17.9	56.6	123.4	--
Integra	3431	84	73	91	38	0	18.8	56.8	130.0	--
Thunder	T6185 VT2P	85	73	87	35	0	19.1	55.5	126.4	--
Thunder	T6485 PC	85	76	93	37	0	19.4	56.0	150.7	--
Trial Mean			72	89	36	0.0	18.3	56.3	129.1	92.4
C.V. %			1.0	5.3	5.3	--	5.3	2.1	7.0	--
LSD 5%			1.1	7.1	2.9	--	1.5	1.7	13.0	--
LSD 10%			0.9	5.8	2.3	--	1.2	1.4	10.7	--

[1] Relavtive maturity provided by company.

[2] Days after planting

Planting Date: May 17

Harvest Date: November 8

Previous Crop: Winter Wheat

NDSU Hettinger Reserach Extension Center

Canola - Liberty Link - 2023 **Hettinger, ND**

Brand	Cultivar	Status	Oil Type[1]	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Oil Content	Seed Yield	
										2023	2-Yr. Avg.
				DAP[1]	days	DAP[1]	inches	0 - 9[2]	%	-------lbs/a-------	
BASF	InVigor L340PC	CA	TR	41	26	84	52	0	40.3	2533	--
BrettYoung	BY 7204LL	EXP	TR	40	27	85	51	0	43.1	2512	--
Canterra	CS4000 LL	CA	TR	41	25	85	52	0	41.7	2497	--
CROPLAN	CP7250LL	CA	TR	41	27	86	54	0	41.0	2589	--
DL Seeds	DL225372LL	EXP	TR	44	26	88	52	0	42.3	2467	--
DL Seeds	DL225373LL	EXP	TR	53	22	93	58	0	41.7	2389	--
Trial Mean				43	25	87	53	0	41.7	2498	--
C.V. %				1.2	2.1	0.3	3.1	--	2.1	7.4	--
LSD 5%				0.7	0.7	0.3	2.0	--	1.1	227	--
LSD 10%				0.5	0.5	0.2	1.5	--	0.9	174	--

Status: CA = Commercially Available, EXP = Experimental

[1] Days after planting.

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

Planting Date: May 18

Harvest Date: September 1

Previous Crop: Oats

NDSU Hettinger Reserch Extension Center

Canola - Roundup Ready - 2023 **Hettinger, ND**

Brand	Cultivar	Status	Oil Type[1]	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Lodging	Oil Content	Seed Yield 2023	Seed Yield 2-Yr. Avg.
				DAP[2]	days	DAP[2]	inches	0 - 9[3]	%	lbs/a	lbs/a
BrettYoung	BY 6211TF	CA	TR	40	27	85	53	0	41.2	2304	--
Canterra	CS2600 CR-T	CA	TR	40	24	82	52	0	41.6	2300	--
Canterra	CS3000 TF	CA	TR	38	25	82	47	0	42.1	2227	--
Canterra	CS3100 TF	CA	TR	38	31	88	50	0	41.7	2350	--
CROPLAN	CP9978TF	CA	TR	37	29	84	50	0	40.9	2366	--
CROPLAN	CP9221TF	CA	TR	40	22	80	46	3.25	41.2	1973	--
Dekalb	DKTFLL 21 SC	CA	TR	38	26	81	47	0	41.6	2307	--
DL Seeds	DL225595TF	EXP	TR	38	32	88	56	0	42.0	2255	--
DL Seeds	DL225634TF	EXP	TR	38	29	86	57	0	41.3	2167	--
Nuseed	NC155 TF	CA	TR	40	27	86	50	0	41.5	2195	--
Nuseed	NC471 TF	CA	TR	43	23	84	52	0	42.8	1949	--
Nuseed	NC527CR TF	CA	TR	39	28	85	51	0	42.2	2140	--
Nuseed	GST210351	EXP	TR	38	28	84	47	0	42.5	2255	--
Nuseed	GST210201	EXP	TR	39	31	89	55	0	41.8	2267	--
Nuseed	GST210199	EXP	TR	38	30	87	49	0	42.2	2392	--
Proseed	TR 23127	CA	TR	39	29	85	52	0	41.1	2279	--
Star	StarFlex	CA	TR	40	27	85	51	0	42.2	2486	--
Trial Mean				39	27	84	51	0	41.7	2251	--
C.V. %				4.1	6.9	1.1	4.4	125.0	1.5	5.1	--
LSD 5%				1.9	2.3	1.1	2.7	0.3	0.8	138	--
LSD 10%				1.5	1.7	0.8	2.1	0.2	0.6	107	--

Status: CA = Commercially Available, EXP = Experimental

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

[2] Days after planting.

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

Planting Date: May 18

Harvest Date: Sept 1

Previous Crop: Oats

NDSU Hettinger Research Extension Center

Flax - 2023 **Hettinger, ND**

Variety	Days to Bloom	Plant Height	Test Weight	Oil Content	-------Grain Yield-------- 2020	2021	2023	Average Yield 2-Yr	3-Yr[1]
	DAP [2]	inches	lbs/bu	%	---------- bu per acre ----------				
AAC Bright	51	27	48.1	48.0	12.5	18.3	31.9	25.1	20.9
AAC Marvelous	52	27	49.5	46.9	--	17.9	29.9	23.9	--
Bison	49	27	49.6	43.6	--	--	26.1	--	--
Carter [3]	49	27	49.7	45.6	14.1	18.49	27.9	23.2	20.2
CDC Dorado [3]	46	24	49.7	47.0	13.9	18.17	30.9	24.5	21.0
CDC Glas	50	29	49.0	46.1	15.0	17.1	31.1	24.1	21.1
CDC Kernen	52	27	49.2	44.8	--	--	31.9	--	--
CDC Neela	51	26	50.0	45.8	16.1	17.5	35.8	26.7	23.1
CDC Rowland	53	27	49.6	45.5	--	17.5	34.3	25.9	--
Gold ND [3]	52	29	50.1	46.5	13.9	17.29	30.0	23.6	20.4
ND Hammond	49	26	49.3	44.4	13.2	18.27	28.5	23.4	20.0
Omega [3]	50	27	50.6	45.6	16.3	18.1	29.3	23.7	21.2
Webster	52	28	49.7	45.4	14.8	18.41	30.1	24.3	21.1
York	49	28	49.7	44.7	17.2	17.52	32.2	24.9	22.3
Trial Mean	51	27	49.6	45.8	16.3	18.0	30.3	24.7	21.1
C.V. %	2.3	5.6	0.8	2.0	13.0	5.6	10.4	--	--
LSD 5%	1.4	1.8	0.5	1.1	3.0	1.2	3.7	--	--
LSD 10%	1.22	1.4	0.4	0.8	2.5	0.9	2.9	--	--

[1] Average of 2020, 2021 and 2023

[2] Days after planting.

[3] Yellow seed type.

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

Planting Date: May 4

Harvest Date: August 31

Previous Crop: Peas

2023 Flax - Recrop **Dickinson, ND**

Variety	Days to Flower	Days to Mature	Plant Height	Test Weight	Oil Content	-- Grain Yield-- 2020	2021	2023	Average Yield[1] 2 Year	3 Year
			in	lbs/bu	%	------bu/ac------			----bu/ac----	
Gold ND	48	95	22	53.8	44.2	19.1	13.4	29.1	21.3	20.5
Carter	47	95	22	54.0	43.8	20.0	10.4	27.6	19.0	19.3
Omega	48	96	20	54.1	43.9	19.0	12.2	25.2	18.7	18.8
AAC Bright	49	96	20	52.1	45.0	20.1	13.4	24.2	18.8	19.2
ND Hammond	47	95	20	53.1	42.8	19.2	11.3	27.2	19.3	19.2
York	47	95	20	53.3	42.8	20.6	11.0	26.6	18.8	19.4
Bison	46	95	21	53.6	42.9	--	--	22.6	--	--
Webster	49	96	20	53.4	44.5	22.2	11.4	27.1	19.3	20.2
CDC Neela	48	95	22	52.9	43.2	22.7	12.2	29.0	20.6	21.3
AAC Marvelous	49	95	20	53.2	44.7	--	10.9	28.4	19.7	--
CDC Rowland	49	96	21	53.4	43.8	--	10.8	28.5	19.7	--
CDC Dorado	46	94	21	53.0	44.0	17.9	9.2	25.8	17.5	17.6
CDC Glass	48	95	21	52.3	43.0	19.7	8.6	28.4	18.5	18.9
CDC Kernen	48	95	24	53.4	43.6	--	--	31.5	--	--
Trial Mean	48	95	21	53.4	44.1	21.1	11.3	28.1	--	--
CV %	2.5	0.8	6.8	0.4	2.2	10.9	24.4	12.3	--	--
LSD 0.05	2	1	2	0.3	1.3	3.7	NS	4.8	--	--
LSD 0.10	1	1	1	0.2	1.0	3.1	NS	3.7	--	--

Planting Date: May 1, 2023
Harvest Date: August 18, 2023
Previous Crop: Oat Hay
No Lodging observed
Oil content reported on 9% moisture basis

[1] 2022 crop hailed out so previous 2 years were used in averages

NDSU Hettinger Reserach Extension Center

Crambe - 2023 **Hettinger, ND**

Variety	Days to Bloom	Bloom Duration	Plant Height	Lodging	Oil Content	Grain Yield
	DAP[1]	days	inches	0 - 9[2]	%	lbs/a
Westhope	41	26	48	0		1354
Meyer	40	26	46	0		1311
BelAnn	40	27	48	0		1263
BelEnzian	41	26	52	0		1176
Canola check	39	25	49	0		1914
Trial Mean	40	26	49	0		1403
C.V. %	1.1	2.2	5.0	--		6.1
LSD 5%	0.7	0.8	3.7	--		133
LSD 10%	0.6	0.7	3.0	--		109

[1] Days after planting.

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

Planting Date: May 18

Harvest Date: September 1

NDSU Hettinger Research Extension Center

Dry Bean - 2023 **Hettinger, ND**

Variety	Type	Days to Mature	Plant Height	Test Weight	Grain Yield 2021	Grain Yield 2022	Grain Yield 2023	Average Yield 2 yr	Average Yield 3 yr
		DAP[1]	inches	lbs/bu	lbs per acre				
Cowboy	Pinto	95	22	52.5	586	1230	1788	1509	1201
LaPaz	Pinto	98	23	56.4	819	965	2044	1504	1276
Lariat	Pinto	98	20	53.9	690	1177	1765	1471	1211
Monterrey	Pinto	97	24	56.1	809	1129	2183	1656	1374
ND Falcon	Pinto	99	23	54.4	746	1115	1979	1547	1280
ND Palomino	Pinto	99	22	50.6	801	1072	1579	1325	1151
ND Rodeo	Pinto	100	22	54.4	793	1160	1839	1500	1264
Torreon	Pinto	95	22	52.8	895	1250	1709	1480	1285
USDA Diamondback	Pinto	99	24	55.5	--	--	1922	--	--
USDA Rattler	Pinto	97	27	55.1	--	--	2016	--	--
Vibrant	Pinto	94	25	54.1	569	908	2045	1476	1174
Windbreaker	Pinto	94	19	51.6	640	560	1652	1106	951
ND172582	Pinto	97	19	55.7	--	--	1800	--	--
Armada	Navy	100	23	55.6	--	915	1760	1337	--
Blizzard	Navy	100	23	57.2	448	894	1583	1239	975
HMS Medalist	Navy	101	23	55.9	474	868	1819	1343	1054
ND Polar	Navy	101	27	58.7	709	964	1925	1444	1199
T9905	Navy	102	22	56.6	580	1078	1720	1399	1126
Merlot	Red	99	22	48.5	654	782	1292	1037	909
Ruby	Red	98	20	48.9	--	--	1489	--	--
ND151006-2	Red	98	23	48.8	--	--	1424	--	--
Rosetta	Pink	98	24	48.6	738	736	1599	1167	1024
ND171707-SD	Pink	99	25	50.7	--	--	2132	--	--
Black Tails	Black	100	25	53.2	730	946	1826	1386	1167
Eclipse	Black	97	24	52.8	457	983	2007	1495	1149
ND Twilight	Black	99	20	53.6	663	1018	1956	1487	1212
Zorro	Black	99	24	49.3	753	768	1841	1304	1120
ND Pegasus	Great Northern	100	26	49.1	740	1404	2049	1726	1397
Powderhorn	Great Northern	95	19	47.0	--	--	1778	--	--
Trial Mean		98	23	52.9	709	1016	1804	1401	1165
C.V. %		--	10.2	4.9	18.7	12.8	16.4	--	--
LSD 5%		--	2.7	3.1	187	178	348	--	--
LSD 10%		--	2.1	2.4	156	138	270	--	--

[1] Days after planting.

Planting Date: May 23

Harvest Date: September 19

Previous Crop: Winter Wheat

Field Pea - 2023 **Hettinger, ND**

Variety	Brand	Days to Flower	Days to Mature	Canopy Height	Lodging	Seed Protein	1,000 Seed Wt.	Seeds Lb	Test Weight	Seed Yield 2023	Seed Yield 2-Yr. Avg.	Seed Yield 3-Yr. Avg.
		DAP[1]	DAP[1]	inches	0 - 9[2]	%	gm	seeds	lb/bu	-------Bushels per acre-------		
Yellow Cotyledon Type												
2822	Valesco Genetics	49	91	35	3	25.8	217	2092	63.5	70.5	--	--
3513	Valesco Genetics	51	89	33	3	27.0	224	2010	63.7	63.8	--	--
5206	Valesco Genetics	49	90	37	5	25.6	216	2100	64.6	75.6	--	--
AAC Beyond	Meridian Seeds	49	88	31	8	25.7	199	2273	63.6	67.4	53.3	--
AAC Chrome	Valesco Genetics	49	88	30	6	24.9	227	2000	64.1	73.3	55.7	45.1
AAC Julius	Valesco Genetics	49	88	31	5	25.1	202	2228	63.9	66.2	54.0	--
AAC Profit	Premier Genetics	50	90	35	6	27.3	201	2258	63.8	65.7	54.2	44.3
Agassiz	Meridian Seeds	49	90	34	7	24.8	219	2069	63.1	62.1	50.6	41.7
CDC Amarillo	Meridian Seeds	51	92	36	4	25.6	209	2171	63.9	69.7	54.1	44.0
CDC Inca	Meridian Seeds	50	90	35	4	25.9	216	2105	64.4	72.4	58.8	47.9
CDC Specturm	Meridian Seeds	49	91	34	7	26.7	226	2012	63.0	70.7	58.0	47.7
CP5222Y	CROPLAN	47	87	31	4	25.6	256	1770	63.9	65.5	53.4	--
CP5244Y	CROPLAN	48	89	33	6	25.2	200	2301	61.8	55.6	47.0	--
DS Admiral	Pulse USA	47	83	29	8	24.4	236	1928	63.0	61.5	55.0	44.3
EP_6816	Equinom	48	90	34	6	25.9	207	2191	63.1	62.7	--	--
EP_8272	Equinom	47	88	31	7	27.6	221	2041	63.1	60.5	--	--
EP_8971	Equinom	49	89	32	6	29.4	239	1896	62.6	53.6	--	--
Hyline	Valesco Genetics	48	87	30	8	25.0	237	1909	63.4	69.5	--	--
MS Growpro	Meridian Seeds	49	88	34	6	27.5	275	1659	62.9	60.4	49.3	41.5
MS ProStar	Meridian Seeds	49	87	32	7	25.6	235	1936	63.1	69.2	55.5	--
ND Dawn	NDSU	48	83	29	7	24.1	230	1971	63.1	61.5	53.1	43.8
Orchestra	Premier Genetics	47	85	31	7	26.4	253	1807	63.2	58.4	48.4	40.3
PG Cash	Premier Genetics	48	84	32	7	25.7	245	1850	62.8	66.3	--	--
Pizzazz	Valesco Genetics	46	83	30	8	24.1	278	1641	64.0	62.7	52.8	--
Salamanca	Valesco Genetics	49	86	35	5	25.3	235	1939	63.9	63.7	55.2	45.3
Green Cotyledon Type												
Aragorn	Pulse USA	47	85	29	9	24.3	204	2232	62.3	40.5	--	--
Arcadia	Pulse USA	49	84	28	9	24.4	202	2239	63.7	52.4	42.4	34.9
CDC Striker	Pulse USA	49	83	26	7	27.5	226	2009	63.9	59.6	47.9	39.8
ND Victory	NDSU	51	93	40	4	26.1	152	3002	64.0	63.0	50.0	41.4
PG8318	Premier Genetics	51	91	39	4	26.6	197	2338	63.1	63.4	51.7	--
Shamrock	Valesco Genetics	50	86	33	7	25.0	224	2033	63.0	61.9	36.6	--
Mean		49	87	32	6	25.8	226	2035	63.4	63.2	51.7	43.0
C.V. %		1.0	1.3	6.3	17.8	2.5	4.0	4.1	1.3	8.2	--	--
LSD 5%		0.6	1.3	2.4	1.3	0.8	11	97	1.0	6.1	--	--
LSD 10%		0.5	1.0	1.8	1.0	0.7	8	76	0.8	4.7	--	--

[1] Days after planting.

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

Planting Date: May 3

Harvest Date: August 9

NDSU Dickinson Research Extension Center

2023 Field Pea - Recrop **Dickinson, ND**

Variety	Brand	Days to Flower	Days to Mature	1000 Seed Weight	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2023	Average Yield 2 Year	Average Yield 3 Year
				gm		in	lbs/bu	%		--bu/ac--	
Yellow Cotyledon Type											
DS Admiral	Pulse USA	44	82	119	3,837	16	65.2	26.8	24.2	34.0	28.1
Agassiz	Meridian Seeds	44	84	115	3,959	20	65.9	26.2	27.7	34.8	28.1
CDC Amarillo	Meridian Seeds	47	84	112	4,050	18	66.0	26.3	28.8	34.0	27.3
ND Dawn	NDSU	45	83	114	4,012	14	65.3	25.9	23.2	31.6	26.4
AAC Profit	Premier Genetic	47	85	118	3,851	19	66.2	28.2	39.0	--	--
EP_6816	Equinom	46	83	108	4,234	17	64.6	27.5	27.8	--	--
EP_8272	Equinom	44	84	117	3,895	18	65.7	27.4	23.8	--	--
EP_8971	Equinom	47	85	126	3,608	19	66.8	28.2	21.7	--	--
CDC Inca	Meridian Seeds	47	82	103	4,403	20	66.0	26.4	27.3	34.4	28.3
CDC Spectrum	Meridian Seeds	47	84	115	3,969	18	65.7	27.4	31.4	35.4	28.6
MS GrowPro	Meridian Seeds	46	85	143	3,180	20	67.4	27.7	28.9	30.4	25.1
MS Prostar	Meridian Seeds	47	85	121	3,767	22	66.7	26.6	31.5	--	--
AAC Beyond	Meridian Seeds	45	82	105	4,309	13	65.9	26.3	36.1	--	--
CP5222Y	CROPLAN	42	85	135	3,386	17	65.7	28.5	27.9	34.5	--
CP5244Y	CROPLAN	44	84	109	4,169	15	65.8	26.4	25.7	32.7	--
PRO 173-7406	ProGene	42	83	118	3,858	17	65.4	25.6	25.3	--	--
PRO 6220	ProGene	46	83	108	4,221	18	64.6	27.2	27.5	--	--
AAC Julius	Valesco Genetic	46	84	112	4,049	20	66.3	26.7	33.6	39.4	31.4
Orchestra	Premier Genetic	44	82	130	3,518	17	65.9	28.9	25.3	--	--
PG Cash	Premier Genetic	45	85	113	4,065	21	65.8	27.4	35.2	--	--
Green Cotyledon Type											
Aragorn	Pulse USA	42	80	105	4,346	11	62.9	27.4	21.6	28.1	22.5
Arcadia	Pulse USA	44	82	111	4,099	16	65.2	27.0	25.5	33.1	27.0
CDC Striker	Pulse USA	47	84	112	4,046	16	66.2	28.4	22.6	33.2	27.0
ND Victory	NDSU	47	85	95	4,818	22	65.9	26.2	24.5	28.2	--
Trial Mean		45	83	116	3,965	17	65.8	26.8	27.9	--	--
CV %		1.5	2.0	8.4	10.3	16.2	1.0	2.1	9.1	--	--
LSD 0.05		1	2	11	479	3	0.8	0.7	2.3	--	--
LSD 0.10		1	2	9	372	3	0.6	0.5	2.0	--	--

Planting Date: May 3, 2023
Harvest Date: August 2, 2023
Previous Crop: cover crop forage
Seeding Rate: 325,000 live seeds/ac
Grain protein percentages reported on 0% moisture basis

NDSU Hettinger Research Extension Center

Soybean - Roundup Ready - 2023 **Hettinger, ND**

Company/Variety		Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield		
								2023	2-Yr	3-Yr
				inches	lbs/bu	%	%			
NDSU	ND21008GT20	00.8	9/19	31	55.4	16.4	35.7	47.6	36.8	--
NDSU	ND17009GT	00.9	9/22	32	56.9	17.1	36.9	44.0	35.5	30.7
REA	R00934XF	00.9	9/25	30	54.5	15.4	34.5	49.7	--	--
Xitavo	XO 0094E	0.0	9/21	30	55.1	16.3	35.2	51.1	--	--
REA	R0112XF	0.1	9/23	38	55.4	16.3	35.2	48.3	--	--
Integra	XF0212	0.2	9/22	37	55.4	16.5	35.0	48.6	--	--
Xitavo	XO 0213E	0.2	9/23	33	53.9	16.9	34.1	54.4	42.4	--
Xitavo	XO 0234E	0.2	9/25	30	56.3	16.5	34.6	50.8	--	--
Integra	E0324	0.3	9/26	30	55.0	16.8	33.8	49.3	--	--
Xitavo	XO 0311E	0.3	9/29	31	54.6	16.4	33.8	54.0	42.2	--
REA	R0422XF	0.4	9/28	31	55.6	16.7	34.2	47.9	--	--
Xitavo	XO 0554E	0.5	10/3	30	56.3	16.8	33.6	53.9	--	--
Xitavo	XO 0602E	0.6	10/3	33	56.6	16.0	34.1	57.3	44.2	--
Xitavo	XO 0731E	0.7	10/4	31	57.3	16.3	34.8	58.1	43.4	--
NDSU	ND2108GT73	0.8	10/6	30	56.5	16.9	33.8	58.0	43.1	36.6
Trial Mean			9/26	32	55.8	16.5	34.7	50.9	41.1	30.7
C.V. %			0.1	5.1	0.9	1.6	1.2	5.3	--	--
LSD 5%			1.9	1.9	0.6	0.3	0.5	3.2	--	--
LSD 10%			1.6	1.5	0.5	0.2	0.4	2.5	--	--

Planting Date: May 22

Harvest Date: October 8

Previous Crop: Spring Wheat

NDSU Hettinger Research Extension Center

Soybean - Roundup Ready - 2023 **Mandan, ND**

Company/E	Variety	Maturity	Plant Height	Test Weight	Seed Oil	Seed Protein	Seed Yield		
							2023	2-Yr	3-Yr
			inches	lbs/bu	%	%			
NDSU	ND21008GT20	00.8	32	54.4	16.3	34.4	46.9	44.4	--
NDSU	ND17009GT	00.9	34	57.6	17.0	35.7	48.2	44.4	38.9
REA	R00934XF	00.9	34	54.4	16.3	32.9	53.9	--	--
Xitavo	XO 0094E	0.0	30	54.5	16.6	34.1	49.3	--	--
REA	R0112XF	0.1	40	53.8	16.6	33.9	50.1	--	--
Integra	XF0212	0.2	39	53.9	16.5	34.5	52.6	--	--
Xitavo	XO 0213E	0.2	35	53.0	17.0	33.9	46.5	44.6	--
Xitavo	XO 0234E	0.2	32	55.3	16.4	34.6	54.9	--	--
Integra	E0324	0.3	34	54.3	16.4	33.6	54.1	--	--
Xitavo	XO 0311E	0.3	31	53.4	16.3	33.6	50.3	48.2	--
REA	R0422XF	0.4	34	54.1	16.4	34.1	54.5	--	--
Xitavo	XO 0554E	0.5	30	54.6	16.9	32.8	61.5	--	--
Xitavo	XO 0602E	0.6	34	55.8	15.8	34.2	63.8	53.8	--
Xitavo	XO 0731E	0.7	35	55.7	16.3	34.6	60.4	54.3	--
NDSU	ND2108GT73	0.8	35	55.6	16.5	34.5	61.3	54.8	47.2
Trial Mean			34	54.9	16.5	34.2	53.3	50.0	43.0
C.V. %			5.1	0.7	1.9	1.4	7.4	--	--
LSD 5%			2.0	0.5	0.4	0.6	4.7	--	--
LSD 10%			1.6	0.4	0.3	0.5	3.7	--	--

Planting Date: May 16
Harvest Date: October 21
Previous Crop: Spring Wheat

Lupin - 2023 **Hettinger, ND**

Variety	Days to Flower	Canopy Height	Lodging	Seed Protein	Test Weight	Seed Yield 2023	Seed Yield 2-Yr. Avg.
	DAP[1]	inches	0 - 9[2]	%	lb/bu	lb/ac	lb/ac
BLU 31	50	28	0		54.1	1652	1471
LND0127	47	21	0		53.9	1641	1501
LND0212	47	19	0		57.0	1408	1400
LND0228	47	19	0		55.0	1695	1500
LND0229	47	21	0		52.9	1381	1333
LND0431	47	18	0		55.6	1366	1236
LND0502	47	19	0		56.9	1691	--
LND0603	47	19	0		56.4	1549	1712
LND0605	47	19	0		55.2	1584	1379
LND0614	47	19	0		56.0	1669	1591
LND0617	47	20	0		54.8	1545	1235
LND0619	47	19	0		54.7	1568	1426
LND0621	47	18	0		55.2	1617	1423
LND0704	46	20	0		57.1	1506	--
LND0705	47	20	0		55.0	1590	1459
LND0727	47	17	0		53.7	1438	1409
LND0733	47	20	0		55.5	1513	--
LNDA210	47	20	0		55.4	1400	1396
LUPRO 2085	47	20	0		56.7	1553	1404
NR55-BAER	47	22	0		53.5	1634	1495
Trial Mean	47	20	0		55.2	1550	1434
C.V. %	1.1	12.4	--		--	18.6	--
LSD 5%	0.6	2.9	--		--	340	--
LSD 10%	0.5	1.7	--		--	264	--

[1] Days after planting.

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

Planting Date: May 3

Harvest Date: September 28

HRSW Fungicide - 2023 **Hettinger, ND**

Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield
	DAP[1]	inches	0-9[2]	lbs/bu	%	bu/ac
Variety						
ND VitPro	51	31	0	58.5	15.2	78.4
SY Valda	54	30	0	58.5	14.1	91.3
Shelly	56	30	0	57.5	13.5	91.8
LSD 5%	0.1	0.6	NS	0.5	0.4	2.7
Fungicide						
CONTROL	54	30	0	58.4	14.3	86.1
TILT Feekes 2-3	54	31	0	58.0	14.3	87.2
PROSARO Feekes 10.51	54	30	0	58.2	14.2	87.8
TILT Feeks 2-3 + PROSARO Feeks 10.51	54	30	0	58.3	14.3	87.7
LSD 5%	NS	NS	NS	NS	NS	NS
Variety x Fungicide						
ND Vitpro						
CONTROL	51	31	0	58.7	15.4	78.3
TILT Feekes 2-3	51	32	0	58.4	15.3	78.9
PROSARO Feekes 10.51	51	30	0	58.4	15.1	78.1
TILT Feeks 2-3 + PROSARO Feeks 10.51	51	31	0	58.7	15.1	78.5
SY Valda						
CONTROL	54	30	0	58.9	14.1	88.4
TILT Feekes 2-3	54	30	0	58.1	14.4	91.7
PROSARO Feekes 10.51	54	29	0	58.5	13.8	93.2
TILT Feeks 2-3 + PROSARO Feeks 10.51	54	30	0	58.6	14.2	91.7
Shelly						
CONTROL	56	29	0	57.5	13.5	91.5
TILT Feekes 2-3	56	30	0	57.5	13.2	91.0
PROSARO Feekes 10.51	56	30	0	57.7	13.5	92.0
TILT Feeks 2-3 + PROSARO Feeks 10.51	56	29	0	57.5	13.6	92.8
LSD 5%	NS	NS	NS	NS	NS	NS
Average	54	30	0	58.2	14.3	87.0
CV	0.4	2.7	--	1.1	3.5	4.25

Durum Fugicide - 2023 **Hettinger, ND**

Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield
	DAP[1]	inches	0-9[2]	lbs/bu	%	
CONTROL	57	38	0	58.5	14.4	79.2
TILT @ Feeks 2-3	56	38	0	58.1	13.6	90.0
PROSARO @ Feeks 10.51	56	36	0	58.4	14.1	89.1
TILT @ Feeks 2-3 + PROSARO @ Feeks 10.51	56	38	0	58.3	13.7	87.7
Trial Mean	56	37	0	58.3	13.9	86.5
C.V. %	0.9	2.4	--	0.9	1.7	6.3
LSD 5%	NS	NS	--	NS	0.4	8.7
LSD 10%	NS	NS	--		0.3	7.0

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

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

Variety: ND Riveland
Planting Date: April 26
Harvest Date: August 18
Feeks 2-3 Application: May 31
Feeks 10.51 Application: June 28

Chcikpea Planting Date Study - 2023					Hettinger, ND
	Plant Height	Moisture	Test Weight	Yield 2022	Yield 2023
	inches	%	lbs/bu	--------lbs/ac--------	
Planting Date					
Early (May 3, May 5)	26	13.3	60.3	3590	1669
Normal Final (May 20, May 18)	28	14.4	59.5	2879	1464
Week Later (May 27, May 26)	27	15.9	59.8	2668	1843
LSD 5%	NS	0.7	NS	327	244
Fungicide					
Fungicide	27	14.7	60.2	3068	1862
No Fungicide	27	14.4	59.5	3024	1456
LSD 5%	NS	NS	NS	NS	199
Planting Date X Fungicide					
May 3 - Fungicide	26	13.3	60.5	3547	1810
May 3 - No Fungicide	26	13.3	60.1	3633	1528
May 20 - Fungicide	27	14.6	59.7	3002	1744
May 20 - No Fungicide	29	14.2	59.3	2756	1185
May 27 - Fungicide	28	16.2	60.3	2654	2032
May 27 - No Fungicide	26	15.7	59.3	2682	1654
LSD 5%	NS	NS	NS	NS	NS
Trial Mean	27	14.5	59.9	3046	1659
C.V. %	8.1	3.8	1.4	10.1	13.8

Variety: 2022 - Orion, 2023 - Sawyer
First fungicide application was made at bloom initiation.
Subequent applications were made on a 10-14 day interval.

Fungicide Appliations
May 3 Planting Date - June 20, July 6
May 20 Planting Date - June 30, July 14
May 27 Planting Date - July 14, July 27
Harvest Date: September 13

Canola Planting Date - 2023 **Hettinger, ND**

Treatment	Start Flower	End Flower	Start Flower	End Flower	Bloom Duration	Plant Height	Test Weight	Seed Oil	Grain Yield
	date	date	DAP[1]	DAP[1]	days	inches	lbs/bu	%	bu/ac
Planting Date									
4/27	6/13	7/17	48	82	34	44	49.3	39.5	2193
5/4	6/16	7/18	44	76	32	42	49.9	39.6	2364
5/10	6/20	7/23	42	75	32	43	49.7	39.4	2263
5/18	6/27	7/23	41	67	26	50	49.8	40.2	2461
5/25	7/4	7/27	41	64	23	48	49.5	40.1	2485
6/1	7/10	7/29	40	59	19	49	46.9	40.5	1446
LSD 5%	1	1	1	1	1	2	0.5	0.6	137
Date X Variety									
4/27 - CS2300	6/15	7/18	50	83	34	50	49.9	39.8	2033
4/27 - CP9978TF	6/13	7/17	48	82	34	42	49.7	39.0	2281
4/27 - DKTFLL21SC	6/11	7/16	46	81	35	42	48.4	39.9	2264
5/4 - L340PC	6/18	7/19	46	77	31	44	50.3	39.6	2393
5/4 - CP9978TF	6/16	7/17	44	75	31	42	49.7	39.0	2221
5/4 - DKTFLL21SC	6/14	7/17	42	75	33	39	49.8	40.2	2479
5/10 - L340PC	6/22	7/23	44	75	31	45	49.9	38.8	1934
5/10 - CP9978TF	6/20	7/22	42	74	32	44	49.9	40.0	2142
5/10 - DKTFLL21SC	6/20	7/23	42	75	34	40	49.2	39.6	2713
5/18 - L340PC	6/29	7/24	43	68	25	52	50.2	40.3	2192
5/18 - CP9978TF	6/27	7/23	41	67	26	50	50.4	40.6	2568
5/18 - DKTFLL21SC	6/27	7/23	41	67	26	48	48.9	39.8	2623
5/25 - L340PC	7/5	7/26	42	63	21	55	50.1	39.6	2172
5/25 - CP9978TF	7/2	7/25	39	62	24	46	50.0	40.3	2578
5/25 - DKTFLL21SC	7/7	7/30	44	67	24	44	48.5	40.5	2705
6/1 - L340PC	7/11	7/29	41	59	18	50	47.1	40.3	1359
6/1 - CP9978TF	7/9	7/30	39	60	20	50	47.7	41.2	1439
6/1 - DKTFLL21SC	7/8	7/28	38	58	20	47	45.9	40.1	1540
LSD 5%	1	1	1	1	2	NS	NS	1.2	247
Trial Mean	6/25	7/23	43	70	28	46	49.2	39.9	2172
C.V. %	1.4	1.4	1.4	1.4	4.1	6.4	1.2	1.9	7.5

[1] Days after planting

Harvest Dates: Dates 1, 2 - August 31, Dates 3, 4, 5 - September 1

Previous Crop: Oat

HRSW Seeding Rate Study - 2023							Hettinger, ND
		Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	Grain Yield
		DAP[1]	inches	0-9[2]	lbs/bu	%	bu/ac
Seeding Rate (seeds/acre)							
1,000,000		31	54	0	57.6	14.7	83
1,200,000		30	53	0	57.7	14.2	79
1,400,000		30	53	0	57.7	14.6	81
1,600,000		30	53	0	57.7	14.4	79
1,800,000		30	53	0	57.5	14.8	83
2,000,000		29	53	0	57.9	14.4	81
LSD 5%		NS	NS	NS	NS	NS	NS
Variety x Seeding Rate							
ND Heron	1,000,000	32	51	0	56.9	15.3	77
ND Heron	1,200,000	31	50	0	57.1	14.9	74
ND Heron	1,400,000	30	50	0	57.5	14.8	77
ND Heron	1,600,000	30	50	0	57.1	15.1	75
ND Heron	1,800,000	31	50	0	56.9	15.4	77
ND Heron	2,000,000	31	50	0	57.3	14.9	75
ND Thresher	1,000,000	30	54	0	57.8	14.8	81
ND Thresher	1,200,000	29	53	0	57.7	14.3	74
ND Thresher	1,400,000	30	53	0	58.0	15.1	76
ND Thresher	1,600,000	29	53	0	57.9	14.7	77
ND Thresher	1,800,000	29	54	0	57.5	15.5	81
ND Thresher	2,000,000	29	53	0	57.8	14.7	78
MN Rothsay	1,000,000	28	56	0	57.9	14.6	84
MN Rothsay	1,200,000	28	55	0	58.0	14.0	80
MN Rothsay	1,400,000	27	55	0	57.3	14.7	83
MN Rothsay	1,600,000	28	55	0	57.5	14.2	78
MN Rothsay	1,800,000	28	55	0	57.7	14.9	84
MN Rothsay	2,000,000	27	55	0	57.7	14.5	81
Faller	1,000,000	33	55	0	57.8	14.0	89
Faller	1,200,000	32	55	0	57.9	13.6	89
Faller	1,400,000	32	54	0	58.2	13.6	89
Faller	1,600,000	31	55	0	58.2	13.7	86
Faller	1,800,000	33	55	0	58.1	13.7	89
Faller	2,000,000	31	54	0	58.7	13.7	88
LSD 5%		NS	NS	NS	NS	NS	NS
Trial Mean		30	53	0	57.7	14.5	81
C.V. %		3.5	1.1	--	1.0	3.3	4.6

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

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

Planting Date: April 26

Harvest Date: August 17

Previous Crop: Cover crop mix

Soil Test 0-3 Inches to Pinpoint Acidity Acres

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Introduction

Soil acidity is a soil health issue that reduces fertilizer efficiency through nutrient tie-up and aluminum toxicity. Aluminum toxicity further hinders plant growth and nutrient uptake by stunting and malforming root development. Nitrogen fertilizers mineralize into plant available nitrate. During the mineralization process, hydrogen is released and causes a localized zone of acidity.

Acid soil is corrected by applying a carbonate (lime) or other soil amendment that neutralizes the positively charged hydrogen ion. Lime is comprised of calcium-carbonate. Calcium does not neutralize soil acidity as calcium and hydrogen are positively charged soil cations and repel from each other. However, the carbonate in lime is negatively charged and produces water and carbon-dioxide when neutralizing hydrogen ions that cause soil acidity.

Having said that, the first step in managing soil acidity is to soil test. Whole field or composite soil testing will rarely render a good picture or truly show the status of your field since there is a dilution effect from the mixing of different soil types. Zone sampling a field will better pinpoint the acid acres in a given field.

Methods

This study compared the soil pH at the 0-6, 0-2, 2-4, 4-6, 0-3, and 3-6 inch depths at 12 different sites spread across North Dakota. Each research location had three replications. A total of 215 samples were analyzed. All collaborating producers were long-term no-tillers who applied nitrogen at the surface or a few inches into the soil. The producers reported that their soil acidity increased during the recent years.

Results

The lowest pH was observed at the 0-3 inch depth and was similar to the 0-2 inch depth (Figure 1). The 4-6 and 3-6 inch soil pH were the highest. This data suggests that the 0-3 inch soil test will more likely identify soil acidity issues. The 0-2 inch soil test was similar to the 0-3 inch soil test, but much more sampling is needed for the soil testing and adds a lot of time. Additionally, the 0-2 inch depth may not identify if an acidity hotspot is present as the pH was similar to the 0-6 inch soil test depth (Figure 1). Some large seeded crops such as field pea are planted deeper than two inches. The 0-2 inch depth doesn't account for the soil environment around the deeper planted seeds whereas the 0-3 inch depth does.

Summary

Soil sampling depth impacts soil pH test results. Soil sampling at the 0-3 inch depth pinpoints the acidity acres when paired with precision soil sampling.

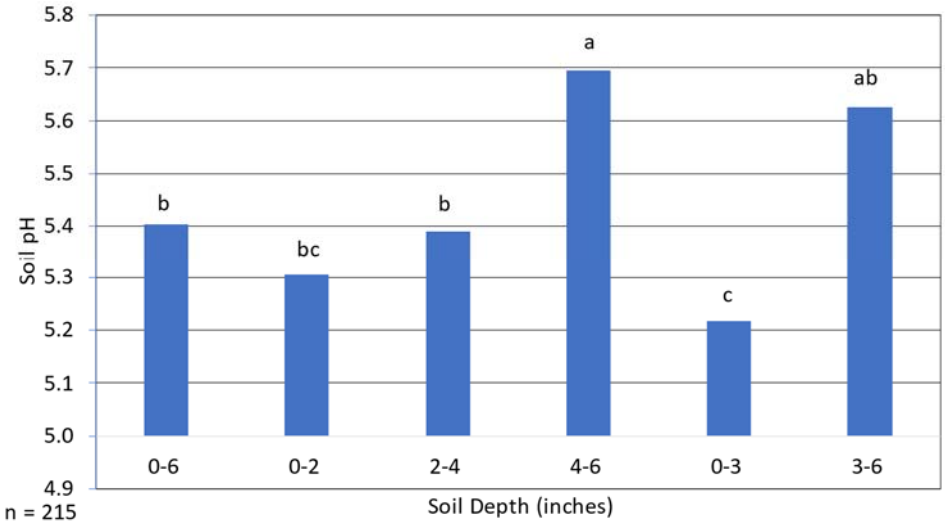

Figure 1. The impacts of soil sample depth on soil pH.

We thank the North Dakota Wheat Commission, North Dakota Soybean Council, North Dakota Corn Council, and Northern Canola Growers Associaiton for their financial support to conduct this research!

Surface Applied Lime Impacts on North Dakota No-till Soils

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Introduction

Soils become acidic from the mineralization of ammonium-based fertilizers. Hydrogen which causes acidity is released as the nitrogen fertilizer nitrifies into nitrate. 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.

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. Soil pH less than 5.5 can reduce bacteria activity and increase nitrogen deficiencies.

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

Lime requirement recommendations have not been developed for North Dakota. This project investigated the impacts of surface applied SBWL on acidic no-till soils in North Dakota.

Methods

Twenty-four sites were established in the spring of 2021 and 2022. 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 with four replications. 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, 0.5, 1, 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 to determine soil pH impacts.

Results

All sugarbeet waste lime treatments increased the soil pH of the 0-3 and 0-6 in depths (Table 1), except for the 0.5 t/ac treatment. The regression analysis procedure produced statistically significant polynomial regressions for environments having a buffer pH of 5.9, 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, and 6.9 (Table 2). A stepwise regression procedure was used to fill in the gaps for the soil buffer pH of 6.0 and 6.2

Up to two tons of lime/ac reacted with the soil in one growing season. Future research will evaluate the lime recipe and assess lime application timing and application methods.

Table 1. Beet lime impacts on soil pH by depth.

Treatment	Soil pH (inches)		
Calcium Carbonate Effectiveness			
T/ac	0-3	3-6	0-6
0	5.16c	5.54	5.41c
0.5	5.16c	5.52	5.30cd
1	5.31b	5.52	5.40cd
2	5.35b	5.5	5.60b
4	5.51a	5.49	5.77a
8	5.33b	5.59	5.75a
16	5.37ab	5.5	5.73a
Variance	0.213	0.213	0.126
P-value	<.0001	NS	<.0001

Table 2. Tons of calcium carbonate equivalent needed to remediate acid soils at the 0-3 inch depth.

Buffer pH	Tons Calcium Carbonate Equivalent/acre for Desired Soil pH		
Desired pH	5.5	6	6.5
	----------0-3 inch soil depth----------		
5.9*	3.6	5.1	6.6
6.0†	1.8	5.7	9.9
6.1*	2.2	3.2	4.1
6.2†	4.6	5.3	7.7
6.3*	3.4	4.7	6.1
6.4*	2.9	6.6	12.2
6.5*	1.4	4.2	9.4
6.6*	2.9	6.2	11.0
6.7*	1.8	4.5	6.8
6.8*	0.7	1.8	4.5
6.9*	0.0	0.0	3.0
7.0†	0.0	0.0	1.0

*Indicates statistically significant at the 0.05 level.

†Recommendations are based off of stepwise regression procedure.

We thank the North Dakota Wheat Commission, North Dakota Soybean Council, North Dakota Corn Council, and Northern Canola Growers Associaiton for their financial support to conduct this research!

Phosphorus Fertilizer Impacts on Soybean Yield

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Introduction

Soybean is a new crop for many west river farmers. Fertilizer trials are needed to help producers better manage their inputs. This project looked at the impact of phosphorus fertilizer on soybean yield at the Dickinson Research Extension Center.

Methods

The experimental location had an Olsen phosphorus test of 5 ppm and soil pH of 5.6. Triple Super Phosphate (0-46-0) was hand applied shortly after planting. Phosphorus treatments were 0, 23, 46, 69, and 92 lbs P_2O_5/ac. Plots were 30x10 ft with four replications. The middle five feet of each plot was harvested to reduce the impact of adjacent treatments. The soybean variety NDSU 17009GT was planted at 150,000 pls/a.

Results

Even though the initial phosphorus test of 5 ppm would be considered "low", the phosphorus treatments did not impact soybean yield (Table 1). Many researchers have found soybean to be an efficient nutrient scavenger and phosphorus results are conflicting. More research on this will occur with multiple sites each year to develop a better understanding of soybean phosphorus management.

Table 1. Phosphorus impacts on soybean yield.

Phosphorus (lbs P_2O_5/ac)	**Yield (bu/ac)**
0	16.4
23	18.5
46	16.6
69	18.0
92	18.3
P-value	0.24
C.V.	8.82

We thank the North Dakota Soybean Council for their financial support for this project!

Sulfate Fertilizer Impacts on Wheat Yield

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Introduction

Sulfur is a micro-nutrient however, many are starting to condsider sulfur more so a macro-nutrient as the frequency of sulfur deficiencies have increased. The objective of this project is to help spring wheat producers better manage their sulfur fertilizer.

Methods

This is the first year of a multi-year/site research project. ND Vitpro was planted at a rate 1 million pls/ac on May 15. Plots were 10 x 25 ft with four replications. The middle five feet of each plot was harvested with a plot combine for data to reduce the impact of adjacent treatments. Fertilizer treatments were 0, 5, 10, 15, and 20 lbs sulfur/ac. Sulfur fertilizer sources were amonium sulfate (AMS), gypsum, and elemental sulfur (E-sulfur). Fertilizer was hand applied two days after planting. Plots were supplimented with urea and monammonium phosphate to equal 125 lbs nitrogen/ac and 20 lbs P_2O_5/ac respectively across all plots. The initial soil test was 49 lbs nitrogen/ac, 16 ppm Olsen phosphorus test, 276 ppm potassium, 10 lbs sulfur/ac, 3.2% organic matter, and soil pH of 5.5.

Results

Fertilizer treatments did impact spring wheat yield (Figure 1). However, conclusions are difficult to make with one growing season of data. Research does suggest that a fertilizer response is more likely with AMS than gypsum or E-sulfur. This is likely due to sulfur being more plant available from AMS versus gypsum or E-sulfur. This research will continue and results will be shared as the project progresses.

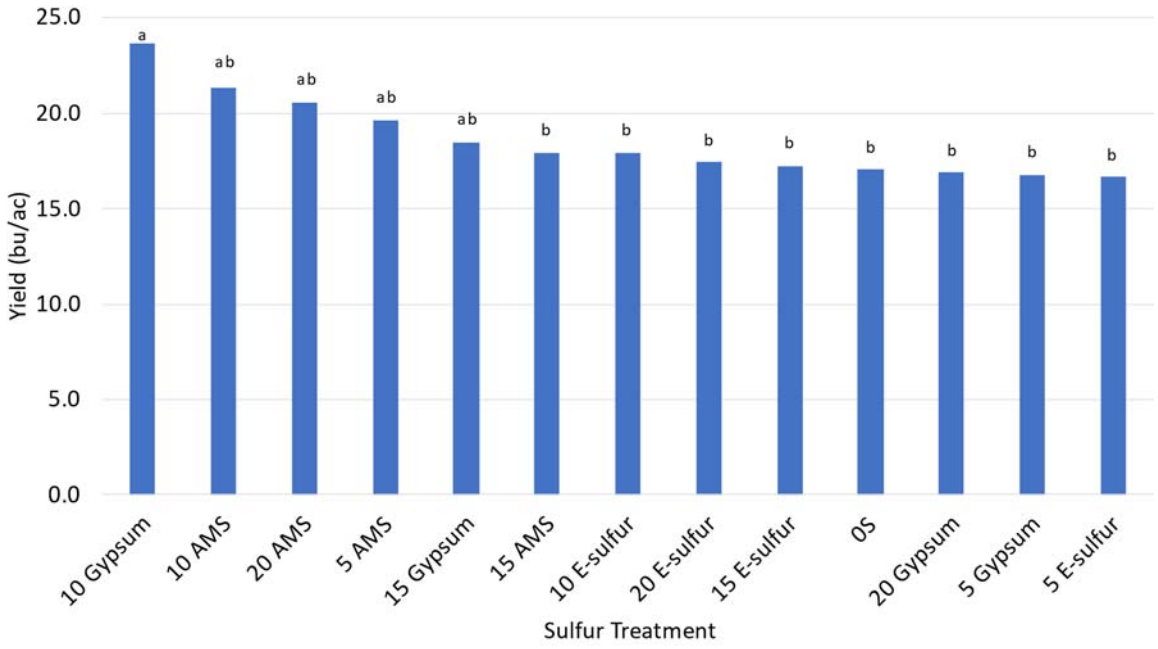

Figure 1. Sulfur fertilizer impacts on hard red spring wheat yield.

We thank the North Dakota Wheat Commission for their financial support for this project!

Sulfate Fertility Impacts on Canola Grown in Southwest North Dakota

Chris Augustin 701-456-1100 chris.augustin@ndsu.edu

Introduction

Canola acres have significantly grown in southwest North Dakota. Sulfur has been found to be an essential nutrient of canola. Current NDSU recommendations are to apply 20 lbs of sulfate per acre in areas south and west of the Missouri River. This research is being conducted to assess sulfate fertilizer impacts on canola in the warmer and drier climate of southwest North Dakota.

The objectives of this research are to:

-Evaluate sulfur fertilizer rates on canola yield and quality.

-Evaluate different sulfur fertilizer sources on canola yield and quality.

Methods

Research was conducted at the NDSU-Dickinson Research Extension Center. Sulfate treatments were 0, 10, 20 and 30 lbs sulfate per acre. Fertilizer sources were ammonium sulfate (AMS), elemental sulfur (E-S), and gypsum (Gy). Nitrogen applications were 0, and 120 lbs of nitrogen per acre. Fertilizer treatments were hand applied shortly after canola was planted. Nitrogen fertilizer was urea. The plots that did not receive 120 lbs N/ac were supplemented with urea to equal the nitrogen amount from the 30 lbs AMS/ac treatment. The initial soil test was 35 lbs nitrogen/ac, 15 ppm phosphorus/ac, 278 ppm potassium/ac, 12 lbs sulfate/ac, 3.3% organic matter, and soil pH of 5.8. Canola was solid seeded on May 18 and fertilizer was hand applied the following day. Plots were 30x10 ft with four replications. The middle five feet of each plot was harvested with a plot combine to reduce the impact of adjacent treatments.

Results

Fertilizer treatments did impact yield (Table 1). However, it is difficult to distinguish a recommendation from one year of data. The AMS fertilizer produced the response curve with the greatest R^2 value (Figure 1). This suggests that AMS was the most reliable sulfur fertilizer source. The R^2 values of the gypsum and elemental sulfur curves were not statistically significant. We plan to continue this study to help you better manage your canola fertility program. More research is needed to draw a conclusion.

Table 1. Fertilizer impacts on canola yield.

Fertilizer Treatment*	Yield**
	----------lbs/ac----------
20 Gy	734a
20 AMS + 120 N	724ab
10 E-S + 120 N	713ab
10 AMS	679ab
30 AMS + 120 N	677ab
10 Gy + 120 N	675ab
20 E-sulfur	663ab
20 AMS	663ab
0S	659ab
30 AMS	647ab

30 E-S + 120 N	646ab
10 AMS + 120 N	632ab
0S + 120 N	626ab
30 E-S	619ab
30 Gy + 120 N	617ab
20 Gy + 120 N	591b
10 Gy	581b
30 Gy	580b
20 E-sulfur	563b
10 E-S + 120 N	550b
120 N Average	656
No Nitrogen Average	627
Plot Average	641

*Gypsum (Gy), Ammonium Sulfate (AMS), Elemental Sulfur (E-S)

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

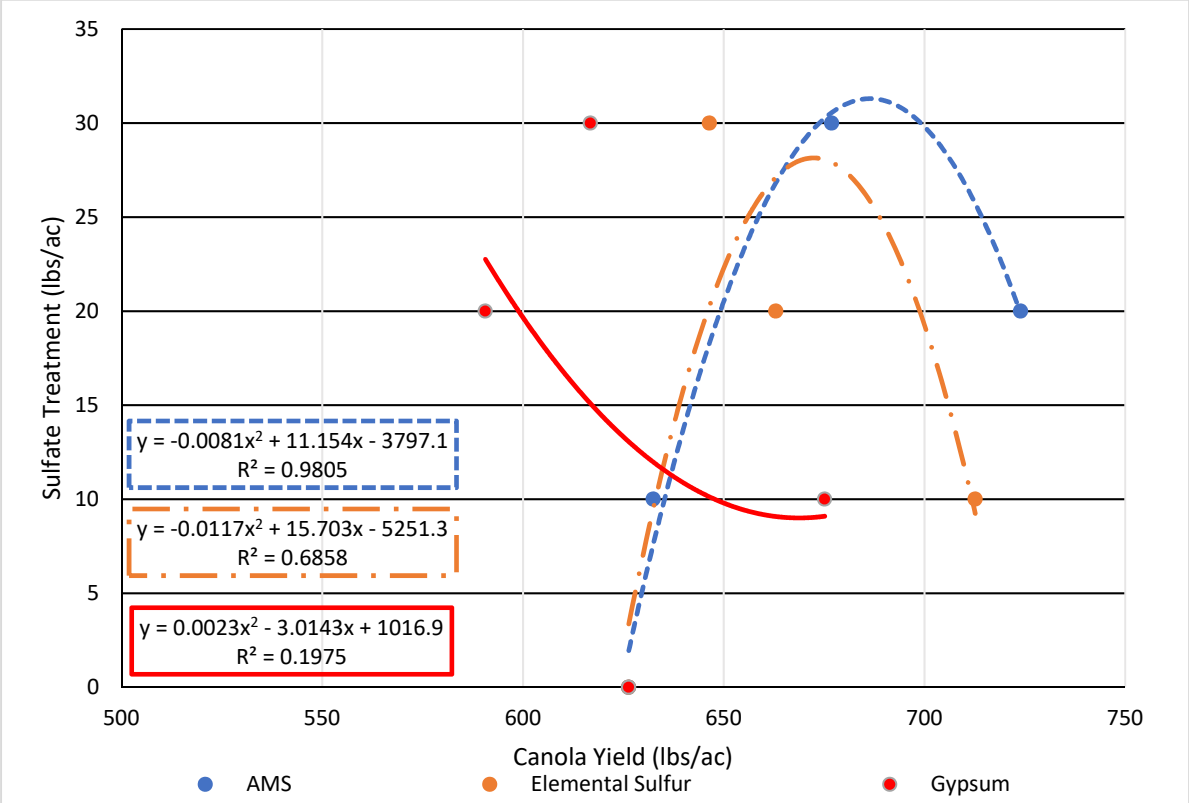

Figure 1. Sulfate plus 120 lbs N/ac fertilizer treatments trendlines.

We thank the Northern Canola Growers Association for their financial support for this project!

Table 1. Comparison of postemergence herbicide treatments for weed control in spring wheat at Hettinger, ND, 2023.

			Kochia[b]			
Herbicide treatment[a]	Rate	14	32	68	Wheat yield	
	oz/A	percent control			Bu/A	
1 Untreated		0	0	0	102	-
2 Starane Ultra	5.3	72 de	75 fg	75 d	99	-
3 OpenSky	16	83 abc	84 b-f	79 cd	106	-
4 Quelex	0.75	85 ab	86 bcd	82 bcd	100	-
Starane Ultra	5.3					
5 Quelex	0.75	81 bc	86 bc	82 bcd	101	-
OpenSky	16					
6 WideMatch	21.3	67 e	74 g	77 d	103	-
7 WideMatch	21.3	74 cde	77 d-g	76 d	97	-
MCPE	8					
8 WideMatch	21.3	80 bcd	87 bc	89 ab	100	-
Quelex	0.75					
9 PerfectMatch	16	80 bcd	85 b-e	80 bcd	97	-
10 Supremacy	4	85 ab	85 b-e	81 bcd	99	-
11 Talinor	13.7	82 abc	81 b-g	88 abc	98	-
12 Huskie Complete	13.7	86 ab	90 ab	88 abc	107	-
13 Huskie FX	18	91 a	98 a	97 a	98	-
14 Carnivore	16	74 cde	76 efg	75 d	96	-
LSD P=.05		8.8	9.3	9.4	NS	
Standard Deviation		6.2	6.5	6.6	7.6	
CV		8.2	8.4	8.8	7.6	
Treatment F		45.42	43.85	40.00	1.00	
Treatment Prob(F)		0.0001	0.0001	0.0001	0.4751	

[a] Starance Ultra, fluroxypyr; OpenSky, fluroxypyr plus pyroxsulam; Quelex, Halauxifen plus florasulam; WideMatch; fluroxypyr plus clopyralid; MCPE, MCPA-ester; PerfectMatch, fluroxypyr plus clopyralid plus pyroxsulam; Supremacy, fluroxypyr plus thifensulfuron plus tribenuron; Talinor, bromoxynil plus bicyclopyrone; Huskie FX, fluroxypyr plus bromoxynil plus pyrasulfotole; Carnivore, fluroxypyr plus MCPA plus bromoxynil. Treatments were applied to spring wheat in the early tillering phase when kochia averaged 2.8 inches.

[b] Kochia was evaluated for control at 14, 32, and 68 days after treatments were applied.

Table 2. Description of herbicide application and equipment for treatments applied for weed control in spring wheat at Hettinger, ND, 2023.

Application Description			Application Equipment	
Date	6/8/2023		Sprayer Type	Tractor
Start Time	10:44 AM		Pressure	37 PSI
Stop Time	11:50 AM		Nozzle Model	11003
Air Temp	90 F		Nozzle Spacing	20 IN
Rel Humidity	45		Boom Length	100 IN
Wind Speed	1.2 MPH		Boom Height	28 IN
Soil Temp	69 F		Ground Speed	4.5 MPH
% Cloud Cover	20		Application Amount	10 GAL/AC
			Propellant	CO2

A trial was conducted to evaluate postemergence herbicide combinations for control of kochia in spring wheat. Spring wheat 'Lang' was planted on May 1, 2023 using a no-till drill at a depth of 2 inches; wheat emerged on May 9. At time of planting, soil conditions were dry due to limited rainfall during the month of April 2023 and there were few weeds present. In the two weeks following planting, over 5 inches of rainfall occurred which allowed for emergence of both crop and weeds. All treatments in this trial contained the active ingredient fluroxypyr. Fluroxypyr alone (Starane Ultra) provided just 75% control at 68 days after application. Similarly, Widematch (fluroxypyr plus clopyralid), WideMatch plus MCPE, and Carnivore (fluroxypyr plus MCPA plus bromoxynil) controlled kochia at 75 to 77%. Most other treatments controlled kochia at 80 to 88%, with the exception of Huskie FX, where kochia control was 97%. Wheat yield ranged from 96 to 106 bu/A and there was no significant difference in wheat yield due to herbicide treatment, even when no herbicide was applied. The lack of rainfall during April delayed the emergence of kochia in this trial until after wheat had been planted and was already emerged. This resulted in wheat having a competitive advantage which it maintained throughout the growing season due to the above average rainfall that occurred during the 2023 cropping season. Wheat yield, which often surpassed 100 bu/A was also much higher than the average for this location which is typically around 40 bu/A.

Table 1. Fall application of Anthem Flex for weed control in wheat at Hettinger, ND 2022-23.

	Herbicide treatment[a]	Rate	Time[b]	Japanese brome	Kochia		common lambsquarters		Prickly lettuce		green foxtail		Wheat yield
				36D	36D	85D	36D	85D	36D	85D	36D	85D	
		oz/A			percent control[c]								bu/A
1	Untreated			0 c	0 d	0 c	0 d	0 e	0 d	0 c	0 c	0 e	59 cd
2	glyphosate	22	Fall	70 b	0 d	0 c	0 d	0 e	0 d	0 c	0 c	0 e	56 d
3	Anthem Flex	3.5	Fall	88 a	80 ab	78 a	70 bc	23 d	52 c	11 c	56 b	51 d	61 bcd
	glyphosate	22	Fall										
4	Anthem Flex	4	Fall	86 a	70 b	77 a	59 c	28 d	78 b	34 b	73 a	74 b	67 abc
	glyphosate	22	Fall										
5	Anthem Flex	4.5	Fall	91 a	87 a	78 a	77 b	54 c	92 a	78 a	76 a	73 b	65 a-d
	glyphosate	22	Fall										
6	Olympus	0.2	Fall	94 a	33 c	39 b	65 bc	48 c	45 c	47 b	58 b	65 c	65 a-d
	glyphosate	22	Fall										
	Olympus	0.2	Spring										
7	Authority Sup	7.5	Fall	95 a	89 a	88 a	99 a	94 a	92 a	81 a	77 a	74 ab	69 ab
	glyphosate	22	Fall										
8	Anthem Flex	4	Fall	92 a	83 a	87 a	72 bc	68 b	94 a	71 a	79 a	79 a	74 a
	glyphosate	22	Fall										
	Olympus	0.2	Spring										
LSD P=.05				9.84	9.66	10.53	11.97	12.06	11.69	13.02	12.08	5.13	9.01
Standard Deviation				6.69	6.53	7.12	7.89	8.2	7.95	8.9	8.21	3.5	6.08
CV				8.71	12.32	14.04	15.44	20.94	14.21	21.37	15.74	6.72	10.42
Treatment F				91.47	133.35	97.88	78.88	64.49	96.37	58.5	65.92	360.30	3.971
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0078

[a] Glyphosate, Roundup PowerMax; Anthem Flex, carfentrazone plus pyroxasulfone; Olympus, propoxycarbazone; Authority Supreme, sulfentrazone plus pyroxasulfone.

[b] Time of application: Fall, 10/19/2022; Spring, 5/19/2023

[c] Weed control was visually evaluated on 6/14/2023 (36 days after wheat emergence) and prior to harvest on 8/2/23 (85 days after emergence).

Table 2. Description of herbicide application and equipment for treatments applied for weed control in spring wheat at Hettinger, ND, 2022-23.

Application Description		
Date	10/19/2022	5/19/2023
Start Time	11:10 AM	8:49 AM
Stop Time	11:46 AM	9:00 AM
Air Temperature	70 F	47 F
Rel Humidity	31	57
Wind Velocity (mph)	4.5	5
Soil Temperature	43 F	51 F
% Cloud Cover	0	0

Application Equipment		
Date	10/19/2022	5/19/2023
Sprayer type	Tractor	Tractor
Pressure	38 PSI	38 PSI
Nozzle Model	DG11002	DG11002
Nozzle Spacing	20 IN	20 IN
Spray Swath	100.0 IN	100.0 IN
Boom Length	100 IN	100 IN
Boom Height	20 IN	20 IN
Ground Speed	3.8 MPH	3.8 MPH
Application Amount	10 GAL/AC	10 GAL/AC
Propellant	CO2	CO2

A trial was conducted to evaluate fall application of Anthem Flex for weed control in spring wheat. Fall treatments were applied on October 19, 2022; A spring application of Olympus was included in some of the treatments for comparison and was applied on May 19 as a postemergence application. Spring wheat 'Lang' was planted on May 1, 2023 using a no-till drill at a depth of 2 inches with a seeding rate of 102 lb/A; wheat emerged on May 9. Wheat was evaluated for injury and weed control 24, 36, and 85 days after wheat emergence. No injury was observed for wheat. Glyphosate alone, applied in the fall control Japanese brome at 70%; other treatments increased control to a range of 86 to 95%. Fall-applied Anthem Flex provided fair to good control of kochia and prickly lettuce and poor control of common lambsquarters. Olympus alone provided poor control of the broadleaf weeds evaluated in this trial. Authority Supreme provided the most consistent control of all weeds evaluated in this trial. Only the Authority Supreme and Anthem Flex followed by a spring application of Olympus resulted in wheat yields that were significantly greater than the untreated control or just glyphosate alone.

Table 1. Comparison of fall and spring applications of Anthem Flex for weed control in spring wheat at Hettinger, ND, 2022-23.

	Herbicide treatment[a]	Rate	Time[b]	Kochia[v]			green foxtail			Wheat yield
		oz/A		16DAE	36DAE	86DAE	16DAE	36DAE	86DAE	
				percent control						bu/A
1	Untreated			0 d	0 d	0 d	0 d	0 c	0 d	62 a
2	Glyphosate	22	Fall	0 d	0 d	0 d	0 d	0 c	0 d	55 ab
3	Glyphosate	22	Spring	0 d	0 d	0 d	0 d	0 c	0 d	58 a
4	Anthem Flex	4	Fall	85 b	90 b	83 bc	90 ab	90 a	77 b	63 a
	Glyphosate	22	Fall							
5	Anthem Flex	4	Spring	99 a	99 a	95 a	89 ab	90 a	82 ab	60 a
	Glyphosate	22	Spring							
6	Anthem Flex	2.5	Fall	98 a	95 ab	83 b	92 a	88 a	88 a	62 a
	Glyphosate	22	Fall							
	Anthem Flex	2	Spring							
	Glyphosate	22	Spring							
7	Anthem Flex	4	Fall	85 b	90 b	97 a	85 b	90 a	78 b	48 bc
	Glyphosate	22	Fall							
	Bison	32	POST							
	Starane Flex	13.5	POST							
8	Glyphosate	22	Spring	70 c	73 c	85 b	72 c	72 b	71 c	46 c
	Bison	32	POST							
	Starane Flex	13.5	POST							
9	Fierce	6	Fall	80 b	81 c	74 c	90 ab	87 a	87 a	59 a
	Glyphosate	22	Fall							
LSD P=.05				7.62	7.07	9.2	5.47	4.5	6.56	8.06
Standard Deviation				5.25	4.86	6.32	3.76	3.03	4.51	5.42
CV				9.1	8.32	10.95	6.51	5.47	8.42	9.08
Treatment F				282.88	333.82	191.73	541.43	763.35	321.88	3.85
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0083

[a] Glyphosate, Roundup PowerMax; Anthem Flex, carfentrazone plus pyroxasulfone; Bison, bromoxynil plus MCPA; Starane Flex, fluroxypyr plus florasulam; Fierce, flumioxazin plus pyroxasulfone. AMS was included at 8.5 lb/100gal for all glyphosate treatments; HS-MSO (Destiny HC) at 1% v/v was added to treatments 4-7 and 9.

[b] Fall application was 10/19/2022; Spring application was 5/1/2023; POST application was 6/12/2023.

[c] Weed control was evaluated at 16, 36, and 86 days after emergence (DAE) for wheat.

Table 2. Description of herbicide application and equipment for treatments applied for weed control in spring wheat at Hettinger, ND, 2022-23.

Application Description				**Application Equipment**			
Date	10/19/22	5/1/23	C	Date	10/19/22	5/1/23	6/12/23
Start Time	11:56 AM	10:37 AM	6/12/23	Sprayer type	Tractor	Tractor	Tractor
Stop Time	12:15 PM	11:07 AM	11:48 AM	Pressure	38 PSI	38 PSI	38 PSI
Air Temp	69 F	57 F	11:48 AM	Nozzle Model	DG11002	DG11002	DG11002
Rel Humidity	29	27	75 F	Nozzle Spacing	20 IN	20 IN	30 IN
Wind Velocity	8.3 MPH	3.6 MPH	6.2 MPH	Spray Swath	100 IN	100 IN	100 IN
Soil Temp	43 F	50 F	58 F	Boom Length	100 IN	100 IN	100 IN
% Cloud Cover	0	0	10	Boom Height	20 IN	20 IN	20 IN
				Ground Speed	3.8 MPH	3.8 MPH	3.8 MPH
				Applic Amount	10 gal/A	10 gal/A	10 gal/A
				Propellant	CO2	CO2	CO2

A trial was conducted to compare and evaluate fall and spring applications of Anthem Flex for weed control in spring wheat. Fall applications were applied on October 19, 2022 and spring applications were applied on May 1, 2023. Spring wheat 'Lang' was planted on May 1, 2023 using a no-till drill at a depth of 2 inches and a seeding rate of 120 lbA; wheat emerged on May 9. At the time of planting, soil conditions were dry due to low precipitation during the month of April. In the two weeks following planting and PRE application, over 6 inches of rainfall occurred. This was more than sufficient to activate preemergence herbicides applied in this trial. Fall and spring application of glyphosate did not control kochia or green foxtail in this trial. Spring application of Anthem Flex provided slightly greater control of kochia, but not green foxtail. A split application of Anthem Flex where 2.5 oz/A was applied in the fall followed by 2 oz/A in the spring provided similar control of kochia and better control of green foxtail, compared with fall application alone. Anthem Flex in the fall followed by a POST application of Bison plus Starane Flex resulted in the greatest control of kochia, but was not significantly better than Anthem Flex applied alone in the spring and provided similar control of green foxtail. Glyphosate alone at planting followed by Bison plus Starane Flex postemergence resulted in the lowest control of both kochia and green foxtail. Fall application of Fierce resulted in an intermediate control of kochia at 80% at 16 DAE falling to 74% at 86 DAE, but provided the greatest control of green foxtail in the trial, compared with other fall applications. Fall application of preemergence herbicides allows for both fall and spring rainfall to activate in the soil. In years where dry conditions persist in the spring it can improve weed control compared with spring applications that do not receive sufficient rainfall for activation. In this trial, there was more than sufficient rainfall for activation of both spring and fall herbicide applications. Thus there was no advantage to the fall application in this trial.

Table 1. Comparison of postemergence herbicide treatments for weed control in spring wheat at Hettinger, ND, 2023.

Herbicide treatment[a]	Rate	Kochia[b]			Common lambsquarters			Green Foxtail			Wheat yield
		10	22	58	10	22	58	10	22	58	
	oz/A	Percent control									BU/A
1 Untreated		0	0	0	0	0	0	0	0	0	70 -
2 Huskie FX	15.5	86 ab	91 a	88 a	98 ab	100 -	100 -	72 -	66 -	78 -	69 -
3 Huskie FX	18	90 a	93 a	88 a	100 a	100 -	100 -	72 -	59 -	80 -	69 -
4 WideARmatch	14	80 c	77 b	77 b	89 c	97 -	100 -	71 -	71 -	78 -	69 -
MCPA ester	8										
5 Talinor	13.7	82 bc	87 a	88 a	93 bc	100 -	100 -	74 -	64 -	86 -	73 -
6 Bison	16	81 c	79 b	78 b	99 a	100 -	100 -	72 -	66 -	77 -	72 -
LSD P=.05		3.6	6.78	6.96	5.65	3.28	.	4	13.04	7.36	5.58
Standard Deviation		2.08	4.47	4.42	3.58	2.13	0	2.31	8.28	4.25	3.42
CV		2.52	5.26	5.05	3.78	2.14	0	3.11	11.57	5.24	4.75
Treatment F		13.05	10.52	8.19	6.35	1.58	0	2.72	0.43	1.38	1.32
Treatment Prob(F)		0.004	0.0004	0.0034	0.0082	0.2404	1	0.1315	0.7799	0.3424	0.3446

[a] Huskie FX, fluroxypyr plus bromoxynil plus pyrasulfotole; WideARmatch, fluroxypyr plus clopyralid plus halauxifen; Talinor, bromoxynil plus bicyclopyrone; Bison, bromoxynil plus MCPA. Treatments were applied on June 6 to wheat in the early tillering phase to kochia averaging 3 inches, common lambsquarters averaging 4.3 inches, and green foxtail averaging 5.6 inches.

[b] Weed control was evaluated at 10, 22, and 58 days after treatments were applied.

Table 2. Description of herbicide application and equipment for treatments applied for weed control in spring wheat at Hettinger, ND, 2023.

Application Description			Application Equipment	
Date	6/6/2023		Sprayer Type	Tractor
Start Time	9:14 AM		Pressure	37 PSI
Stop Time	9:23 AM		Nozzle Model	DG11003
Air Temp	80 F		Nozzle Spacing	20 IN
Rel Humidity	56		Boom Length	100 IN
Wind Speed	3.8 MPH		Boom Height	28 IN
Soil Temperature	66 F		Ground Speed	4.5 MPH
% Cloud Cover	0		Application Amount	10 GAL/AC
			Propellant	CO2

A trial was conducted to evaluate Huskie FX (fluroxypyr plus bromoxynil plus pyrasulfotole) compared with other commonly used postemergence herbicides for controlling weeds in spring wheat. Spring wheat 'Lang' was planted on May 1, 2023 using a no-till drill at a depth of 2 inches; wheat emerged on May 9. Wheat was seeded into dry soil due to limited rainfall during the month of April 2023. Few weeds were present at time of planting. In the two weeks following planting, more than 5 inches of rainfall occurred. This resulted in good emergence of both spring wheat and weeds. Postemergence herbicide treatments were applied on May 6 to spring wheat in the early tillering phase. Kochia averaged 3 inches; common lambsquarters averaged 4.3 inches, and green foxtail averaged 5.6 inches. Wheat response (injury) and weed control was evaluated at 10, 20, and 30 days after treatments application. No injury to wheat was observed. Kochia control 58 days after treatments was 88% for Huskie FX at both 15.5 and 18 oz/A. WiderARMatch resulted in 77% control; Talinor resulted in 88% control; and Bison resulted in 78% control. Common lambsquarters was controlled 100% by all herbicide treatments. Green foxtail was controlled 77 to 86% by herbicide treatments, but there were no statistical differences between treatments. Wheat yield ranged from 69 to 73 Bu/A and there were no statistical differences between herbicide treatments, even when no herbicide was applied. Weed emergence in this trial was delayed by the limited rainfall that occurred in April allowing wheat to emerged before weeds had emerged giving it a competitive advantage which it was able to maintain due to the above normal rainfall which occurred during the 2023 growing season. Even as there was no yield advantage to controlling weeds in this trial, failing to do so would increase the amount of weed seed in the harvested crop which could result in dockage and would also increase the weed seedbank for next years growing season; one which wheat or other rotational crop may not have a competitive advantage. Uncontrolled weeds would also likely result in need for an additional postharvest herbicide application.

Table 1. Comparison of standard herbicide treatments with Battalium Amped for weed control in spring wheat at Hettinger, ND, 2023.

	Herbicide Treatment[a]	Rate	Kochia[b]			Green foxtail			Wheat yield
			10DAT	30DAT	65DAT	10DAT	30DAT	65DAT	
		oz/A	percent control						bu/A
1	Untreated Check		0	0	0	0	0	0	91 -
2	Batalium Amped	16	86 ab	91 ab	86 a	79 a	91 ab	100 a	92 -
3	Batalium Amped H3384ae	16 0.4	88 a	87 abc	86 a	78 ab	95 a	97 a	90 -
4	Huskie Complete	13.7	85 abc	92 ab	87 a	76 bc	81 c	81 b	93 -
5	PerfectMatch	16	73 d	79 d	76 b	72 d	77 c	78 b	87 -
6	Rezuvant	16.4	76 d	85 bcd	81 ab	79 a	88 b	84 b	90 -
7	KFD-776-01	15.75	84 bc	84 cd	82 ab	78 ab	88 b	95 a	94 -
8	Huskie Complete H3384ae	13.7 0.4	86 abc	92 a	86 a	80 a	80 c	80 b	91 -
9	PerfectMatch H3384ae	16 0.4	83 c	91 ab	81 ab	76 c	80 c	80 b	88 -
LSD P=.05			3.09	6.3	6.85	2.46	6.24	6.34	4.82
Standard Deviation			2.13	4.24	4.61	1.69	4.27	4.36	3.25
CV			2.91	5.56	6.15	2.47	5.67	5.63	3.73
Treatment F			682.23	186.59	150.89	932.80	182.88	191.87	1.88
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.1263

[a] Batalium Amped; bromoxynil plus fluroxypyr plus flucarbazone; H3384ae, tribenuron plus thifensulfuron; Huskie Complete, thiencarbazone plus pyrasulfotole plus bromoxynil; Rezuvant, fluroxypyr plus pinoxaden plus halauxifen; KFD-776-01, flucarbazone; PerfectMatch, fluroxypyr plus clopyralid plus pyroxsulam. Treatments were applied postemergence to both wheat and weeds on June 5, 2023; wheat was in the early tillering phase; kochia was an average of 2 inches, green foxtail was an average of 3.2 inches at time of application..

[b] Kochia and green foxtail were evaluated for control 10, 30, and 60 days after treatments were applied

Table 2. Description of herbicide application and equipment for treatments applied for weed control in spring wheat at Hettinger, ND, 2023.

Application Description			**Application Equipment**	
Date	6/5/2023		Sprayer Type	Tractor
Start Time	9:12 AM		Pressure	37 PSI
Stop Time	9:36 AM		Nozzle Model	DG11003
Air Temp	77 F		Nozzle Spacing	20 IN
Rel Humidity	59		Boom Length	100 IN
Wind Speed	4.5 MPH		Boom Height	28 IN
Soil Temp	65 F		Ground Speed	3 MPH
% Cloud Cover	0		Application Amount	15 GAL/AC
			Propellant	CO2

A trial was conducted near Hettinger, ND to evaluate Battalium Amped with other standard herbicide treatments for control of kochia and green foxtail in spring wheat. Spring wheat was planted using a no-till drill at a depth of 2 inches on May 1, 2023 and emerged on May 9. Soil was dry at time of application due to very little rainfall in April; in the two weeks after planting there was over 5 inches of rainfall. Herbicide treatments were applied when wheat was in the early tillering phase and when kochia was averaging 2 inches in height and green foxtail averaged 3.2 inches in height. Batalium Amped provided good to excellent control of kochia and green foxtail and performed as well or better than the other standard treatments. Yield of spring wheat was much higher than normal during 2023 due to the above normal rainfall. Wheat yield ranged from 87 to 94 bu/A and there were no statistical differences in wheat yield due to herbicide treatment, even when no herbicide was applied. The lack of rainfall in April delayed the emergence of both kochia and green foxtail and allowed the spring wheat to gain a competitive advantage and the above average rainfall allowed the wheat to keep that advantage.

Table 1. Control of Japanese Brome, wild buckwheat, and common mallow and dry pea response from fall and/or spring herbicide applications at Hettinger, ND, 2023.

	Herbicide Treatment[a]	Rate	Timing[b]	Japanese brome	Wild buckwheat	Common mallow	Pea Stand	Pea Height	Pea Yield
		oz/A		——— percent control[c] ———			plants/A	cm	bu/A
1	Untreated			0	0	0	48 -	35 -	1 e
2	Glyphosate	22	Fall	76 c	0 d	0 d	56 -	38 -	40 d
3	Glyphosate	22	Spring	88 b	0 d	0 d	57 -	37 -	48 cd
4	Anthem Flex	4	Fall	98 a	79 c	77 c	52 -	37 -	55 bc
	Glyphosate	22	Fall						
5	Anthem Flex	4	Spring	99 a	82 bc	92 a	60 -	37 -	63 ab
	Glyphosate	22	Spring						
6	Anthem Flex	2.5	Fall	99 a	78 c	84 bc	50 -	37 -	59 abc
	Glyphosate	22	Fall						
	Anthem Flex	2	Spring						
	Glyphosate	22	Spring						
7	Anthem Flex	4	Fall	99 a	90 a	91 ab	57 -	35 -	69 a
	Glyphosate	22	Fall						
	Spartan Charge	5	Spring						
	Glyphosate	22	Spring						
8	Glyphosate	22	Spring	96 a	79 c	81 c	53 -	36 -	47 cd
	Spartan Elite	32	Spring						
9	Fierce	6	Fall	100 a	77 c	89 ab	57 -	36 -	61 ab
	Glyphosate	22	Fall						
10	Fierce	7.5	Fall	99 a	80 c	84 bc	56 -	36 -	63 ab
	Glyphosate	22	Fall						
11	Fierce	9	Fall	99 a	87 ab	90 ab	54 -	36 -	64 ab
	Glyphosate	22	Fall						
LSD P=.05				6.87	6.03	6.27	12.93	3.106	11.76
Standard Deviation				4.77	4.13	4.3	7.47	2.157	8.12
CV				5.5	6.72	6.55	13.62	5.94	15.83
Treatment F				156.18	369.027	388.529	0.608	0.791	22.117
Treatment Prob(F)				0.0001	0.0001	0.0001	0.7854	0.6374	0.0001

[a] glyphosate, Roundup PowerMax; Anthem Flex, carfentrazone plus pyroxasulfone; Spartan Charge, carfentrazone plus sulfentrazone; Spartan Elite, sulfentrazone plus pyroxasulfone; Fierce, flumioxazin plus pyroxasulfone. Ammonium sulfate (AMS) was added to all treatments at 8.5 lb/100 gallons; HSOC-MSO Destiny HC (1% v/v) was added to treatments 4-11.

[b] Fall herbicide treatments were applied on October 20, 2022; Spring herbicide treatments were applied after planting on April 26, 2023.

[c] Weed control was visually evaluated at 2 weeks after pea emergence. Pea stand and height were both measure at 5 weeks after emergence.

Table 2. Description of herbicide application and equipment for treatments applied to weeds in dry pea at Hettinger, ND, 2022-23.

Application description			Application Equipment		
	Fall	Spring		Fall	Spring
Date	10/20/22	4/26/23	Equipment Type	Tractor	Tractor
Start Time	10:27 AM	12:01 PM	Operation Pressure	38 PSI	38 PSI
Stop Time	10:31 AM	12:21 PM	Nozzle Model	11002	11002
Air Temperature	64 F	66.6, 64.7 F	Nozzle Spacing	20 IN	20 IN
Relative Humidity (%)	28	37.2, 36.7	Boom Length	100 IN	100 IN
Wind Velocity+Dir	7 MPH, W	10.5 MPH, W	Boom Height	20 IN	19.0 IN
Soil Temperature	43 F	50 F	Ground Speed	3.8 MPH	3.7 MPH
Cloud Cover (%)	10	100	Application Amount	10 GAL/AC	10 GAL/AC
			Propellant	CO2	CO2

A trial was conducted to evaluate fall and spring herbicide applications for control of weeds in dry peas. Fall treatments were applied on October 20, 2022 and spring treatments were applied on April 26, 2023 immediately following planting. Few weeds other than Japanese brome were present at time of spring application. Dry pea "Shamrock" was planted on April 26 using a no-till drill at a rate of 120 lb/a seed at a depth of 2 inches. Peas emerged on May 10. No injury was observed to dry pea from fall or spring applied treatments. Control of Japanese brome, wild buckwheat, and common mallow were visually evaluated 2 weeks after emergence (WAE) on a scale of 9 to 100% with 0% being no control and 100% being complete control. Japanese brome was controlled 76% with fall application of glyphosate and 88% with spring application of glyphosate. All other treatments controlled Japanese brome 96 to 100%. Wild buckwheat and common mallow were not controlled by fall or spring application of glyphosate. Spring application of Anthem Flex (carfentrazone plus pyroxasulfone) provided similar control of wild buckwheat and slightly better control of common mallow. Splitting application of Anthem Flex, 2.5 oz/A in fall plus 2 oz/A in spring, did not improve control compared with fall application at 4 oz/A. Anthem Flex at 4 oz/A in the fall plus Spartan Charge (carfentrazone plus sulfentrazone) at 5 oz/A in the spring controlled wild buckwheat and common mallow at 90 and 91%, respectively. Spartan Elite (sulfentrazone plus metolachlor) at 32 oz/A applied in the spring controlled wild buckwheat and common mallow at 79 and 81%, respectively. Fierce (flumioxazin plus pyroxasulfone) was applied at 6, 7.5, and 9 oz/A in the fall and controlled wild buckwheat at 77, 80, and 87%, respectively, and controlled common mallow at 89, 84, and 90%, respectively. Dry pea stand and height were not affected by any of the herbicide treatments. Dry pea yield was near 0 bu/A in the untreated control. Glyphosate alone in the fall and spring increased yield to 40 and 48 bu/A, respectively. Anthem Flex fall and spring applications resulted in yields of 55 and 63 bu/A, respectively, while the split application resulted in 59 bu/A. The highest yielding treatments resulted from fall application of Anthem Flex followed by spring application of Spartan Charge at 69 bu/A. Spartan Elite applied in spring resulted in 47 bu/A. Fierce applications in the fall at 6, 7.5, and 9 oz/A resulted in 61, 63, and 64 bu/A. Fall application of residual herbicides reduce weed pressure in the spring at planting and allow for rainfall both in the fall and spring to activate. In the trial this year, there was above normal rainfall in May that effectively activated the spring applied herbicides. In years when spring rainfall is below normal, preemergence herbicides often fail to become active in the soil.

Table 1. Response of chickpea to preemergence herbicides at Hettinger, ND 2023.

	Herbicide treatment[a]	Rate	Chickpea stand[b]	Chickpea Height	Chickpea yield
		oz/A	plant/m2	cm	lbs/acre
1	Untreated		35 -	27 d	1752 b
2	Authority Supreme	5	42 -	30 abc	2868 a
	Aim	1			
3	Authority Supreme	10	35 -	31 abc	2989 a
	Aim	1			
4	Authority Elite	20	39 -	30 abc	2725 a
	Aim	1			
5	Authority Elite	32	39 -	31 a	2643 a
	Aim	1			
6	Spartan Charge	3.75	44 -	30 abc	2592 a
7	Spartan Charge	5	42 -	29 abc	2513 a
8	Spartan Charge	7.75	44 -	30 abc	2925 a
9	Anthem Flex	3	49 -	31 abc	2808 a
10	Anthem Flex	4	44 -	29 c	2635 a
11	Anthem Flex	5	41 -	29 bc	2624 a
12	Sharpen	2	40 -	29 abc	2548 a
	Dual II Magnum	32			
13	Sharpen	2	41 -	30 abc	2607 a
	Dual II Magnum	32			
	Zidua	3.25			
14	Authority Elite	20	45 -	31 ab	2886 a
LSD P=.05			8.76	2.187	436.06
Standard Deviation			6.13	1.532	303.11
CV			14.79	5.12	11.02
Treatment F			1.316	2.466	5.361
Treatment Prob(F)			0.2444	0.014	0.0001

[a] Authority Supreme, sulfentrazone plus pyroxasulfone; Authority Elite, sulfentrazone plus metolachlor; Spartan Charge, sulfentrazone plus carfentrazone; Anthem Flex, carfentrazone plus pyroxasulfone; Sharpen, saflufencil; Dual II Magnum, metolachlor; Zidua, pyroxasulfone

[b] Chickpea stand count and height was measured on June 14, 26 days after emergence.

Table 2. Description of herbicide application and equipment for treatments applied preemergence in chickpea to evaluate tolerance to preemergence herbicides at Hettinger, ND, 2022-23.

Application Description		**Application Equipment**	
Date	5/3/2023	Equipment Type	Tractor
Start Time	3:45 PM	Operation Pressure	38 PSI
Stop Time	4:10 PM	Nozzle Model	11002
Air Temperature	80 F	Nozzle Spacing	20 IN
Relative Humidity	19	Boom Length	100 IN
Wind Speed	1.6 MPH	Boom Height	20 IN
Soil Temperature	62 F	Ground Speed	3.7 MPH
% Cloud Cover	10	Application Amount	10 GAL/AC
		Propellant	CO2

A trial was conducted to evaluate chickpea response to various preemergence herbicides at Hettinger, ND in 2023. Chickpea was seeded on May 3, 2023 using a no-till drill at a depth of 3 inches at a seeding rate of 174,000 seed per acre. Preemergence herbicide treatments were applied immediately after seeding. Chickpea emerged on May 19. No visual injury to chickpea was observed. No differences in chickpea stand count was found for the different herbicide treatments (Table 1). Most treatments resulted in chickpea height that was equal to or greater than in the untreated control. All treatments resulted in yield that was higher than yield of the untreated control. Yield in the untreated control was reduced by weed competition.

Table 1. Buckwheat response to preemergence herbicides at Hettinger, ND.

	Herbicide Treatment[a]	Rate	Injury[b]		Stand count		Height		Yield	
		oz ai/A	%		plantsA		Inch		LB/A	
1	Untreated		0	g	517000	ab	22	a	1162	bc
2	Metribuzin	4	17.5	cd	359000	cd	21	abc	1431	ab
3	Metribuzin	8	42.5	a	303000	d	13	f	1017	c
4	s-Metolachlor	25	4.5	ef	528000	ab	22	a	1097	bc
5	s-Metolachlor	50	16.8	cd	512000	ab	18	de	1237	abc
6	Dimethenamid-p	12	8.3	de	470000	ab	19	cd	1076	c
7	Dimethenamid-p	24	30	ab	470000	ab	16	ef	1180	bc
8	Pyroxasulfone	1.3	2.5	fg	530000	ab	21	ab	1329	abc
9	Pyroxasulfone	2.6	10.8	d	442000	bc	16	ef	1343	abc
10	Mesotrione	1.25	2.5	fg	463000	abc	20	bcd	1162	bc
11	Mesotrione	2.5	25	bc	438000	bc	20	bcd	1196	bc
12	Isoxaflutole	0.75	0	g	507000	ab	21	ab	1158	bc
13	Isoxaflutole	1.5	0	g	494000	ab	21	ab	1539	a
14	Topramezone	0.35	0	g	566000	a	23	a	1045	c
15	Topramezone	0.7	0	g	533000	ab	22	a	1095	c
LSD P=.05			8.57		103000		2.3		310.02	
Standard Deviation			6.01		72338.8		1.6		216.18	
CV			56.25		14.54		7.56		18.83	
Treatment Prob(F)			0.0001		0.0004		0.0001		0.0205	

[a] Trade names of herbicides used: Metribuzin, Dimetric DF 75; s-Metolachlor, Dual II Magnum; Dimethenamid-p, Outlook; Pyroxasulfone, Zidua SC; Mesotrione, Callisto; Isoxaflutole, Balance Flexx; Topramezone, Armezon.

[b] Injury and stand count were evaluated 2 weeks after emergence; buckwheat height was measured 4 weeks after emergence; Yield was collected on October 2, 2023.

Table 2. Description of herbicide application and equipment for treatments applied in buckwheat to evaluate tolerance to preemergence herbicides at Hettinger, ND, 2023.

Application Description			Application Equipment	
Date	5/31/2023		Equipment Type	Tractor
Start Time	8:38 AM		Operation Pressure	37 PSI
Stop Time	9:25 AM		Nozzle Model	11003
Air Temperature	80 F		Nozzle Type	DRIRED
Relative Humidity (%)	51		Nozzle Spacing	20 IN
Wind Velocity+Dir. Start	2.6 MPH, ENE		% Coverage	100
Wind Velocity+Dir. Stop	0 MPH, ESE		Boom Length	100 IN
Wind Velocity+Dir. Max	4.9 MPH, E		Boom Height	22.0 IN
Soil Temperature	65 F		Ground Speed	4.5 MPH
% Cloud Cover	100		Application Amount	10 GAL/AC
			Mix Size	2 L
			Propellant	CO2

A trial was conducted to evaluate the tolerance of buckwheat to preemergence herbicides. Buckwheat "Koto" was seeded on May 31, 2023 near Hettinger, ND using a no-till drill with a row spacing of 7.5 inches at seeding rate of 50 lbs/A at a depth of 1.25 inches. Herbicide treatments (Table 1) were applied on the same day after seeding using a tractor-mounted research sprayer. Herbicides evaluated were applied at a 1X and 2X rate of typical used rates for other crops grown in southwest North Dakota. Buckwheat emerged on June 7. Injury to buckwheat was evaluated on June 20 (2 weeks after treatment (WAT)). Stand counts of buckwheat were measured on June 19. Injury to buckwheat was greatest (43%) with the 2X rate (8 oz ai/A) of metribuzin, which also reduced stand count by 41%. However, even with the reduction in stand count, buckwheat yield was similar to the untreated control. Moderate injury was also observed in buckwheat treated with the 1X rate of metribuzin, the 2X rate of dimethenamid, and the 2X rate of mesotrione. Stand count was reduced for the 1X rate of metribuzin, but were not significantly reduced from the other two treatments, but buckwheat height was reduced for both of these treatments. Again, these treatments did not significantly reduce yield compared with the untreated control. Slight injury was observed following application of metolachlor, pyroxasulfone, and 1X rates of dimethenamid, and mesotrione. No injury was observed following application of isoxaflutole or topramezone. Yield was greatest following the 2X rate of isoxaflutole, likely due to reduction in weed competition. Further evaluations of herbicides for buckwheat is needed as none of the herbicides tested are currently labelled for use.

Table 1. Comparison of weed control and soybean yield from preemergence (PRE) herbicides applied at planting, 1 week before planting (1WEPP) and 2 weeks before planting (2WEPP) compared with other PRE/POST herbicide programs at Hettinger, ND, 2023.

	Herbicide treatment[a]	Rate	Timing[b]	Kochia	Common mallow	Lambs-quarters	Wild buckwheat	Green foxtail	Wild oat	Height	Yield
		oz/A		Percent control						cm	bu/A
1	Untreated			0	0	0	0	0	0	29 a-e	20 f
2	Valor	3	2WEPP	72 i	100 a	100 a	100 a	0 i	0 i	32 a	19 f
3	Valor	3	1WEPP	57 j	91 bc	78 d	100 a	0 i	42 g	28 b-f	28 a-e
4	Valor	3	PRE	74 hi	95 abc	92 abc	97 a	83 def	80 bcd	24 hi	32 a-d
5	Valor	3	2WEPP	88 c-f	100 a	90 bc	100 a	86 c-f	60 f	29 a-f	29 a-e
	Zidua SC	5	2WEPP								
6	Valor	3	1WEPP	84 d-g	100 a	90 bc	100 a	87 b-e	77 cd	26 e-i	28 b-e
	Zidua SC	5	1WEPP								
7	Valor	3	PRE	83 efg	100 a	97 abc	100 a	94 ab	86 abc	23 i	33 abc
	Zidua SC	5	PRE								
8	BroadAxe XC	32	2WEPP	84 d-g	100 a	100 a	98 a	89 bcd	0 i	27 c-g	25 ef
9	BroadAxe XC	32	1WEPP	80 gh	100 a	96 abc	100 a	68 h	0 i	31 ab	26 def
10	BroadAxe XC	32	PRE	85 d-g	92 abc	100 a	97 a	88 bcd	82 abc	25 ghi	31 a-d
11	Authority Sup	9.8	2WEPP	91 bcd	100 a	96 abc	97 a	82 def	41 g	29 a-f	27 cde
12	Authority Sup	9.8	1WEPP	89 b-e	91 bc	100 a	97 a	80 ef	63 ef	27 c-h	29 a-e
13	Authority Supr	9.8	PRE	86 d-g	93 abc	94 abc	97 a	84 def	84 abc	24 ghi	32 a-d
14	Authority MTZ	18	2WEPP	85 d-g	100 a	99 a	97 a	0 i	0 i	30 abc	24 ef
15	Authority MTZ	18	1WEPP	82 fg	100 a	100 a	100 a	79 fg	20 h	30 a-d	24 ef
16	Authority MTZ	18	PRE	93 bc	100 a	100 a	100 a	89 bcd	80 bcd	25 ghi	32 abc
17	Xtendimax	22	PRE	95 ab	87 c	90 bc	99 a	72 gh	71 de	26 f-i	30 a-e
	Glyphosate	20	PRE								
18	Xtendimax	22	POST	95 abc	96 ab	99 ab	99 a	99 a	87 ab	25 ghi	33 abc
	Glyphosate	20	POST								
19	Glyphosate	20	PRE	89 b-f	94 abc	89 c	98 a	94 abc	81 bcd	26 d-i	34 a
	Glyphosate	20	POST								
20	Glyphosate	20	PRE	100 a	100 a	100 a	100 a	99 a	92 a	25 ghi	34 ab
	BroadAxe XC	32	PRE								
	Glyphosate	20	POST								
LSD P=.05				6.8	8.7	9.0	4.4	7.5	10.0	3.4	6.3
Standard Deviation				4.78	6.11	6.31	3.11	5.28	7.10	2.41	4.43
CV				5.96	6.65	6.98	3.31	7.71	13.56	8.93	16.04
Treatment F				78.76	51.99	49.23	202.35	185.31	101.62	4.59	4.77
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[a] Valor, flumioxazin; Zidua, pyroxasulfone; BroadAxe XC, sulfentrazone + metolachlor; Authority Supreme; sulfentrazone + pyroxasulfone; Authority MTZ, sulfentrazone + metribuzin; Xtendimax, dicamba; glyphosate, Roundup PowerMax3. Treatments 1 to 16 included the addition of glyphosate (Roundup PowerMax3) at 20 oz/A plus AMS at 8.5 lb/100gal plus HS-MSO (Destiny) at 1% v/v. Xtendimax treatments included volatility reduction agent (Volt Edge) and water conditioner/NIS (Class Act Ridion). Treatments 19 and 20 included AMS at 8.5 lb/100 gal. Glyphosate was applied at R1 to all treatments.

[b] Application dates: 2WEPP, 5/10/23; 1WEPP, 5/19/23; PRE, 5/30/23; POST, 6/19/23

[c] Weed control was evaluated on July 19 (46 days after soybean emergence); soybean height was measured on 7/5.

Table 2. Description of herbicide application and equipment for treatments applied in soybean to evaluate weed control and soybean response at Hettinger, ND, 2023.

Application Description					
Date	5/10/2023	5/19/2023	5/30/2023	6/19/2023	6/19/2023
Start Time	4:30 PM	9:49 AM	9:22 AM	8:58 AM	9:00 AM
Stop Time	4:49 PM	10:03 AM	9:59 AM	9:00 AM	9:10 AM
Timing	2WEPP	1WEPP	PRE	POST	Xtendimax
Air Temp	78 F	54 F	76 F	72 F	72 F
Rel Humidity	38	52	46	54	54
Wind Speed (mph)	1.6	4.3	3.7	2	3.4
Soil Temperature	71 F	52 F	64 F	68 F	68 F
% Cloud Cover	10	0	0	20	20
Application Equipment					
Sprayer Type	Tractor	Tractor	Tractor	Tractor	Tractor
Operation Pressure	38 PSI	38 PSI	37 PSI	39 PSI	39 PSI
Nozzle Model	DG11002	DG11002	DG11002	DG11003	TTI11003
Nozzle Spacing	20 IN	20 IN	20 IN	20 IN	20 IN
Boom Length	100 IN	100 IN	100 IN	100 IN	100 IN
Boom Height	20 IN	20 IN	22 IN	28 IN	28 IN
Ground Speed	3.7 MPH	3.7 MPH	3.5 MPH	4.4 MPH	2.9 MPH
Application Amount	10 GAL/AC	10 GAL/AC	10 GAL/AC	10 GAL/AC	15 GAL/AC
Propellant	CO2	CO2	CO2	CO2	CO2

A trial was conducted to evaluate timing of preemergence herbicide application of herbicides commonly used in soybean. These treatments were compared with Xtendimax plus glyphosate applied PRE at planting or as a total postemergence at the V1 soybean or with two applications of glyphosate (PRE and POST) or with glyphosate plus BroadAxe XC applied PRE followed by glyphosate POST. Valor plus glyphosate provided only fair to poor control of kochia, but good to excellent control of common mallow, common lambsquarters, and wild buckwheat, control of green foxtail and wild oat was best at the PRE timing as it had not full emerged at the earlier application dates. The addition of Zidua SC to the Valor plus glyphosate treatment improved control of kochia, green foxtail, and wild oat. Adequate rainfall was received for activation of Zidua; Four inches of rain fell in the week following the 2WEEP application, only 0.1 inches of rain fell in the week after the 1WEPP application, and 0.69 inches of rain fell in the week following the PRE application. BroadAxe XC provided good control of kochia, and excellent control of common mallow, common lambsquarters, and wild buckwheat, and good control of green foxtail at the 2WEPP and PRE applications, but poor green foxtail control for the 1WEPP. Poor control of green foxtail at this timing was likely due to low rainfall during the week following this application timing. Wild oat control was best at the PRE timing as it had not emerged at the two earlier timings. Authority Supreme and Authority MTZ both provided good to excellent control of kochia, common lambsquarters, and common mallow. At the earlier application timings, Authority Supreme controlled both green foxtail and wild oat better than Authority MTZ, but control was similar at the PRE application timing. Xtendimax plus glyphosate applied PRE provided good control of all broadleaf weeds, but only fair control of grass, likely because grasses continued to emerge after application; delaying this application to the V1 stage of soybean improved control of common mallow, green foxtail, and wild oat. Two applications of glyphosate, with and without BroadAxe provided good to excellent control of all weeds in this trial. Soybean height was generally greatest in soybean with poorer weed control as the soybean tried to outgrow neighboring weeds. Soybean yield was highest in soybean where weeds were controlled best, improving from 20 bu/A in the untreated to 34 bu/A in the highest yielding treatments.

Table 1. Canada thistle control with different herbicide treatment in a non-crop location near Bucyrus, ND, 2022-23. Canada thistle was in late-bud to early bloom stage at time of application.

		Rate	1 WAT	2 WAT	3 WAT	5 WAT	8 WAT	1 YAT
Treatment[a]		lb/a	Percent control					
1	glyphosate	1	73 bc	89 b	92 b	99 ab	99 a	35 e
	AMS	8.5						
2	glyphosate	1.5	65 cde	87 bc	92 b	100 ab	98 a	43 de
	AMS	8.5						
3	glyphosate	2.25	70 bcd	92 ab	97 a	100 ab	99 a	57 cd
	AMS	8.5						
4	aminopyralid	0.11	53 e	80 d	80 de	93 cd	97 ab	80 ab
5	picloram	0.5	66 cde	78 de	81 de	92 cd	97 ab	94 ab
6	aminocyclopyrachlor	0.125	57 de	75 e	81 de	90 d	95 ab	93 ab
7	aminocyclopyrachlor	0.19	67 cd	81 d	83 cd	95 bc	98 a	100 a
8	dicamba	1	58 de	78 de	78 e	84 e	87 c	23 e
9	glyphosate	1	87 a	94 a	96 ab	100 a	97 a	100 a
	aminocyclopyrachlor	0.125						
	AMS	8.5						
10	glyphosate	1	73 abc	88 b	87 c	98 ab	98 a	88 ab
	aminocyclopyrachlor	0.125						
	2,4-D LV6	0.7						
	AMS	8.5						
11	glyphosate	1	82 ab	92 ab	96 ab	100 ab	99 a	92 ab
	aminopyralid	0.11						
	AMS	8.5						
12	picloram	0.25	59 de	79 de	80 de	90 de	92 b	76 bc
	dicamba	0.5						
13	aminocyclopyrachlor	0.125	60 cde	82 cd	83 cd	91 cd	95 ab	93 ab
	dicamba	0.5						
LSD P=.05			12.98	5.04	4.36	4.88	4.6	20.64
Standard Deviation			7.72	3	2.59	2.88	2.71	12.25
CV			11.53	3.56	2.99	3.08	2.79	16.34
Treatment F			5.145	13.809	27.446	10.467	4.911	13.929
Treatment Prob(F)			0.0003	0.0001	0.0001	0.0001	0.0007	0.0001

[a] Glyphosate, Roundup PowerMax 3; aminopyralid, Milestone; picloram, Tordon; aminocyclopyrachlor, Method; dicamba, Sterling Blue; AMS, ammonium sulfate.

Table 2. Description of herbicide application and equipment for treatments applied to control Canada thistle in non-crop location near Bucyrus, ND, 2022-23.

Application Description			Application Equipment	
Date	7/14/2022		Equipment Type	Backpack
Start Time	10:30 AM		Operation Pressure	25 PSI
Stop Time	11:30 AM		Nozzle Model	11015
Timing	POST		Nozzle Type	Flat fan
Air Temperature Start, Stop	79, 81 F		Nozzle Spacing	19 IN
% Relative Humidity Start, Stop	73, 70		Boom Height	43 IN
Wind Velocity+Dir. Start	3.9 MPH, NW		Ground Speed	2.6 MPH
Wind Velocity+Dir. Stop	4.2 MPH, NW		Carrier	WATER
Wind Velocity+Dir. Max	11 MPH, NW		Application Amount	20 GAL/AC
Wet Leaves (Y/N)	N, no		Propellant	CO2
Soil Temperature	70 F			
% Cloud Cover	0			

A trial to evaluate Canada thistle control using various herbicides and herbicide combinations was initiated in a heavily infested non-crop field near Bucyrus, ND. Treatments were applied on July 14, 2022 using a backpack research sprayer with a 5 foot spray boom using a spray volume of 20 gallons per acre (Table 2). Canada thistle was at the budding stage to early bloom at time of application. Control was evaluated 1 to 8 weeks after treatment (WAT) application and then again at 1 year after treatment (YAT). At 8 WAT, Canada thistle control was 90% or more for all treatments except dicamba alone. At 1 YAT, only sis of the 13 treatments continued to control Canada thistle at 90% or more. These included picloram, aminocyclopyrachlor, glyphosate plus aminocyclopyrachlor, glyphosate plus aminopyralid, and aminocyclopyrachlor plus dicamba. Glyphosate alone, even at 2.25 lb ae per acre, provided poor control of Canada thistle (35 to 57%). Dicamba alone at 1 lb ae per acre also provided little control (23%). Aminopyralid alone, a very commonly used treatment for Canada thistle, provided 80% control. While aminocyclopyrachlor alone and in combination provided the best control most consistently, it is only currently labelled for use in non-crop, right-of-ways, and other areas that will not be grazed or hayed. It must not be used around any trees, as it will cause serious injury or death of most tree species if it leaches into the tree's root zone.

Table 1. Effect of Plainview SC for long-term bare-ground control of kochia in a non-crop location near Hettinger, ND comparing early-fall, late-fall, early-spring, and late-spring application timings and comparing use of flat fan with flood nozzle application, 2022-23.

	Herbicide Treatment[a]	Rate	Timing[b]	Nozzle[c]	Kochia							
					240 DAA[d]		272 DAA		303 DAA		331 DAA	
		oz/A			percent control							
1	Untreated				0	f	0	e	0	h	0	h
2	Plainview SC	32	Sep	FF	96	a-d	94	cd	95	b-f	89	def
3	Plainview SC	48	Sep	FF	100	a	100	ab	99	abc	100	a
4	Plainview SC	64	Sep	FF	100	ab	100	a	100	abc	100	a
5	Plainview SC	32	Sep	Flood	98	abc	97	abc	99	abc	94	a-e
6	Plainview SC	48	Sep	Flood	100	ab	100	ab	99	abc	98	abc
7	Plainview SC	64	Sep	Flood	100	ab	99	ab	100	abc	100	a
8	Plainview SC	32	Oct	FF	100	abc	100	ab	100	a	100	a
9	Plainview SC	48	Oct	FF	100	ab	100	ab	100	a	99	ab
10	Plainview SC	64	Oct	FF	100	ab	100	a	100	ab	100	a
11	Plainview SC	32	Oct	Flood	100	a	100	a	100	ab	100	a
12	Plainview SC	48	Oct	Flood	100	ab	100	ab	100	a	100	a
13	Plainview SC	64	Oct	Flood	100	ab	100	ab	100	a	100	a
14	Plainview SC	32	Apr	FF	99	abc	98	ab	97	a-e	90	c-f
15	Plainview SC	48	Apr	FF	100	abc	97	abc	94	c-f	91	b-f
16	Plainview SC	64	Apr	FF	100	ab	99	ab	100	a	100	a
17	Plainview SC	32	Apr	Flood	92	d	96	bcd	89	g	75	g
18	Plainview SC	48	Apr	Flood	100	ab	97	abc	90	fg	86	f
19	Plainview SC	64	Apr	Flood	100	a	100	ab	98	a-d	93	a-f
20	Plainview SC	32	May	FF	84	e	93	cd	90	fg	86	ef
21	Plainview SC	48	May	FF	86	e	94	cd	91	efg	90	c-f
22	Plainview SC	64	May	FF	83	e	92	d	92	d-g	94	a-d
23	Plainview SC	32	May	Flood	93	d	100	a	97	a-d	96	a-d
24	Plainview SC	48	May	Flood	95	bcd	99	ab	96	a-f	94	a-f
25	Plainview SC	64	May	Flood	95	cd	100	ab	98	a-d	97	a-d
LSD P=.05					4.86		4.54		5.91		8.37	
Standard Deviation					3.45		3.22		4.19		5.94	
CV					3.71		3.41		4.52		6.52	
Treatment F					134.657		151.226		89.107		44.859	
Treatment Prob(F)					0.0001		0.0001		0.0001		0.0001	

[a] Roundup Pro Concentrate (64 oz/A) and NIS (0.25 % v/v) was added to all treatments. Plainview SC, indaziflam, imazapyr, aminocyclopyrachlor.
[b] Treatment dates: Sep, 9/27/22; Oct, 10/31/22; Apr, 4/24/23; May, 5/16/23
[c] Nozzle type: FF, Flat fan (DG 11002), Flood, Single nozzle flood-jet (FC-XT020)
[d] DAA is days after application for the September 27, 2022 application date.

Table 2. Description of herbicide application and equipment for treatments applied for bare-ground control of kochia near Hettinger, ND, 2022-23.

Application Description								
Date	9/27/22	9/27/22	10/31/22	10/31/22	4/24/23	4/24/23	5/16/23	5/16/23
Start Time	9:05AM	9:30AM	11:16AM	11:46AM	10:07AM	10:25AM	4:00PM	4:20PM
Stop Time	9:30AM	10:05AM	11:41AM	12:18PM	10:27AM	10:45AM	4:14PM	4:35PM
Air Temp (F)	61	63	60	60	50	51	77	78
Rel. Humid (%)	50	49	33	31	31	29	29	29
Wind Speed (mph)	2.1	2.9	5	8.5	7.8	6	1.4	2.6
Soil Temp (F)	40	40	40	40	33	33	68	68
Cloud (%)	0	0	30	30	10	10	100	100

Application Equipment								
Spayer Type	Backpack	Backpack	Backpack	Backpack	Backpack	Backpack	Backpack	Backpack
Pressure	35 PSI	35 PSI	35 PSI	35 PSI	35 PSI	35 PSI	35 PSI	35 PSI
Nozzle Model	DG11002	FC-XT020	DG11002	FC-XT020	DG11002	FC-XT020	DG11002	FC-XT020
Nozzle Type	FLAFAN	FLOOD	FLAFAN	FLOOD	FLAFAN	FLOOD	FLAFAN	FLOOD
Space (in)	19	0	19	0	19	0	19	0
Boom Length	76	0	76	0	76	0	76	0
Boom Ht (in)	18	18	18	18	18	18	18	18
Speed (mph)	2.4	2.75	2.4	2.75	2.4	2.75	2.4	2.75
Volume (gal/A)	25	25	25	25	25	25	25	25
Propellant	CO2	CO2	CO2	CO2	CO2	CO2	CO2	CO2

A trial was conducted to compare three rates of Plainview, combination of indaziflam, imazapyr, and aminocyclopyrachlor, at four different application dates using either a flat fan spray boom or a single flood-typed nozzle for controlling kochia in a bare-ground application in a non-crop area near Hettinger, ND. Glyphosate (Roundup Pro Concentrate at 64 oz/A) plus a non-ionic surfactant (NIS at 0.25% v/v) was added to all Plainview treatments. Plainview was applied on September 27 and October 31, 2022, and on April 24 and May 16, 2023. Treatments were applied in a feedlot field heavily infested with kochia. Treatments were evaluated for control beginning on May 25, 2023 and monthly thereafter. Fall applications, regardless of nozzle type, provided more consistent control of kochia throughout the final rating at 331 days after the first application. For April application, the flat fan nozzle provided more consistent kochia control compared with the flood type nozzle. However, kochia control was similar comparing nozzle types for the May application timing. Most treatments provided 90 to 100% control of kochia throughout the rating period. Treatments will be evaluated again in the spring of 2024.


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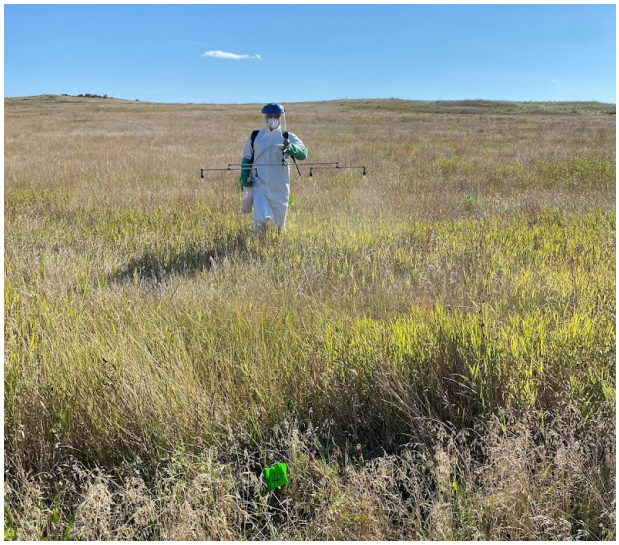

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