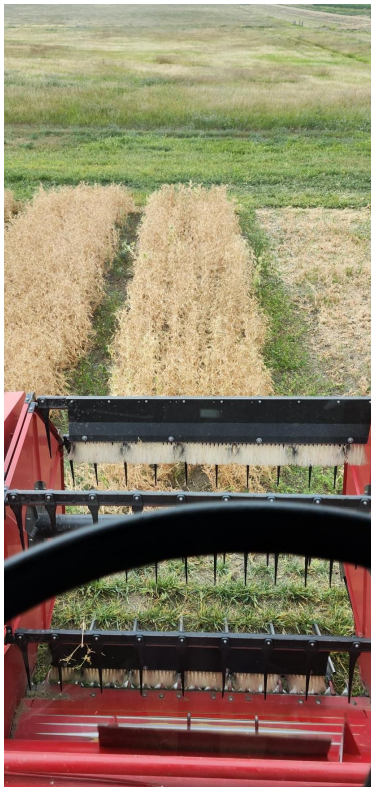

December 2024

Forty-First Annual Western Dakota Crops Day Research Report

Ag. Report No. 41

NDSU NORTH DAKOTA STATE UNIVERSITY

NDSU | HETTINGER RESEARCH EXTENSION CENTER

NDSU | DICKINSON RESEARCH EXTENSION CENTER

41st Annual Western Dakota Crops Day

December 17, 2024

Hettinger REC Classroom

MST

1:00 PM Opening Announcements

1:00 Annual and Cover Crop Options for the Western Dakota's
James Rogers, Extension Specialist Forage Crops Production, NDSU North Central Research Extension Center.

1:30 Soil Test Phosphorus Affects Microbial Parameters
Clarence Winter, Agronomy Field Specialist, SDSU West River Research and Extension.

2:00 Dickinson REC Crop Production Research Update
Chris Augustin, Director & Soil Scientist, NDSU Dickinson Research Extension Center.

2:30 Farmers for Soil Health Program
Rutendo Nyamusamba, Extension Conservation Agronomist, NDSU Dickinson Research Extension Center.

3:00 Adams County Commodity Elections, Coffee Break

3:15 HREC Weed Control and Herbicide Update
Caleb Dalley, Weed Scientist, NDSU Hettinger Research Extension Center.

3:45 HREC - Variety Updates and Agronomy Research
John Rickertsen, Research Agronomist, NDSU Hettinger Research Extension Center.

4:15 Drawing for Door Prizes, Conclusion

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. The sponsors listed below have made this event possible by providing for refreshments and supplies. We greatly appreciate their commitment and support.

2024 Western Dakota Crops Day Sponsors

Hettinger Area Chamber of Commerce
Farm Credit Services of Mandan
CHS Southwest Grain
Helena Agri-Enterprises

The Hettinger and Dickinson Research Extension Centers gratefully acknowledges and thank the following individuals for their willingness to cooperate with us at off-station plot sites and in providing us with materials for this publication. Their participation has enabled us to compile the enclosed information which would not otherwise be possible.

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2024 Table of Contents

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
Scranton Barley Variety Trial	17 bu/ac
Regent Barley Variety Trial	56 bu/ac

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 2024 Hettinger HRSW variety trial was 5.3% meaning that there was a 5.3% 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 2024, the variety “ND Thresher” averaged 58.1 bu/ac compared to “Glenn” at 51.5 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 6.6 bu/ac between the varieties (58.1 – 51.5) to the LSD 5% value of 3.6 bu/ac. Since the 6.6 bu/ac difference is more than the LSD value of 3.6 bu/a, the varieties do differ significantly in yield. If the difference between these two varieties would have been 2.5 bu/ac, their difference would have been less than 3.6 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 4	May 4	May 20
Date of First Frost	October 13	September 16	September 16
Frost Free Days	**162**	**141**	**119**

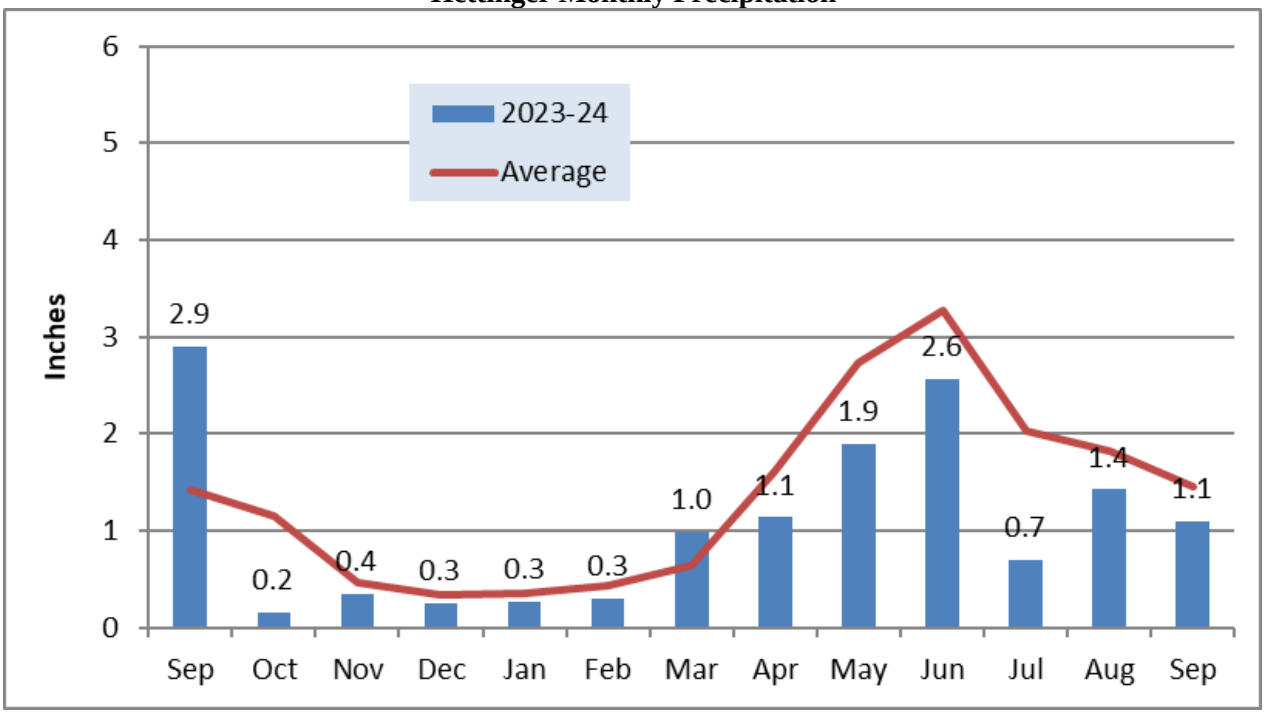
Precipitation (inches)

Month	2019-20	2020-21	2021-22	2022-23	2023-24	69 Year Average
October	2.2	0.6	3.9	0.2	0.2	1.2
November	0.6	0.0	0.1	0.4	0.4	0.5
December	0.3	0.0	0.8	0.3	0.3	0.3
January	0.1	0.0	0.1	0.2	0.3	0.3
February	0.2	0.0	0.4	0.6	0.3	0.4
March	0.1	0.1	0.1	1.0	1.0	0.6
April	0.2	0.6	4.0	0.2	1.1	1.6
May	0.5	4.5	2.3	5.5	1.9	2.7
June	1.7	0.5	3.8	5.3	2.6	3.3
July	2.5	1.2	2.6	1.2	0.7	2.0
August	1.9	2.7	0.4	3.7	1.4	1.8
September	1.1	0.4	1.0	2.9	1.1	1.4
April-August	**6.7**	**9.4**	**13.1**	**15.9**	**7.7**	**11.4**
Total	**11.2**	**10.6**	**19.4**	**21.4**	**11.1**	**16.3**

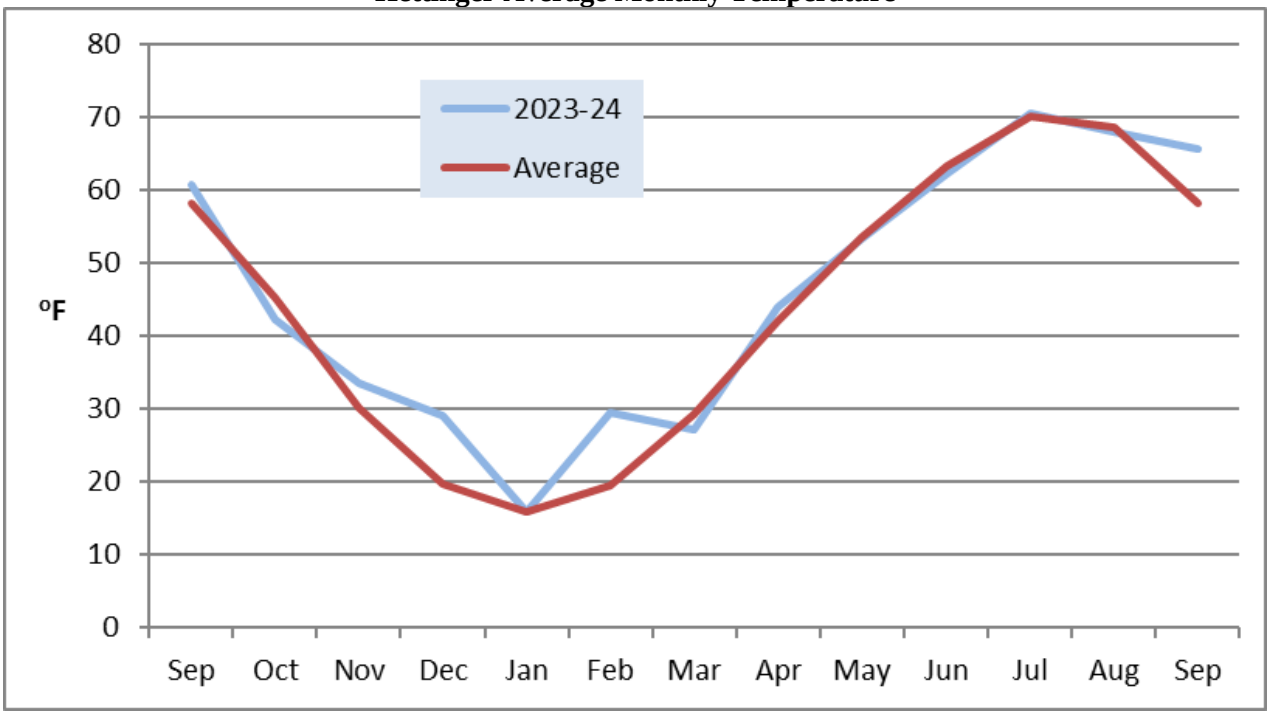
Air Temperature (ºF)

Month	2019-20	2020-21	2021-22	2022-23	2023-24	69 Year Average
October	36.3	37.0	48.0	46.2	42.3	45.2
November	27.9	36.1	35.2	22.4	33.5	30.1
December	21.6	27.3	19.6	10.4	29.1	19.7
January	19.5	24.7	18.5	18.4	15.9	15.9
February	22.8	9.4	17.4	21.0	29.5	19.6
March	33.3	36.3	30.6	18.6	27.2	29.2
April	37.5	40.9	34.3	39.8	44.0	42.2
May	51.3	50.8	51.3	58.9	53.5	53.6
June	65.7	67.7	61.8	65.8	62.4	63.4
July	69.4	74.6	69.7	66.7	70.6	70.2
August	69.5	68.5	71.1	67.5	68.1	68.6
September	57.4	62.2	62.0	60.8	65.7	58.2
Average	**39.4**	**44.6**	**43.3**	**41.4**	**45.1**	**43.0**

Hettinger Monthly Precipitation



Hettinger Average Monthly Temperature



2024 Weather Summary for the Dickinson Research Extension Center Ranch Headquarters, Manning, ND.

	-----Maximum temp.-----		-----Minimum temp.-----		-----Precipitation -----		-----Small grains GDD[1]-----		-----Corn GDD[2] -----	
Month	Long Term 1983 - 2024	Current Year	Long Term 1983 - 2024	Current Year	Long Term 1983 - 2024	Current year	Long Term 1983 - 2024	Current year	Long Term 1983 - 2024	Current year
	----------°F ----------		----------°F ----------		----- inches -----					
November - 23	39.7	43.5	19.0	21.7	0.56	0.02				
December - 23	27.1	39.6	8.0	20.9	0.47	1.69				
January	25.1	22.0	5.9	5.3	0.40	0.23				
February	28.5	38.0	8.5	18.8	0.43	0.29				
March	39.9	37.5	18.4	13.4	0.74	0.57				
April	53.9	58.1	28.9	31.6	1.42	1.35	334	427		
May	66.3	66.4	40.6	38.9	2.65	2.35	665	644	253	255
June	76.3	74.9	50.7	49.3	3.01	2.75	945	904	412	412
July	83.8	86.5	55.8	57.7	2.28	0.88	1172	1233	614	634
August	82.7	80.8	54.1	55.6	1.98	1.28	1128	1120	570	555
September	72.1	82.9	44.3	48.9	1.60	0.12	787	1016	332	498
October	56.2	65.5	31.4	33.9	1.20	0.00				
Mean	54.3	58.0	30.5	33.0						
Total					16.73	11.53	5031	5342	2181	2353

[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.

Hard Red Spring Wheat - 2024 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
Ambush	61	32	1	58.4	11.4	--	--	56.9	--	--
AP Elevate	64	29	1	58.3	12.1	--	--	60.4	--	--
AP Gunsmoke CL2	63	30	1	57.5	11.4	78.8	84.9	61.3	73.1	75.0
AP Murdock	63	30	1	55.5	11.5	73.6	75.2	56.7	65.9	68.5
AP Smith	64	29	1	59.0	12.0	76.5	80.8	54.6	67.7	70.6
Asend-SD	65	34	1	59.6	11.6	74.4	83.4	60.2	71.8	72.6
Ballistic	63	32	1	56.3	11.8	--	--	59.2	--	--
Bolles	64	32	1	57.8	12.6	70.3	75.8	60.8	68.3	69.0
Boost	66	33	1	57.5	11.6	69.9	72.0	59.3	65.6	67.1
Brawn-SD	63	33	1	60.1	11.8	84.1	89.1	64.0	76.5	79.0
CAG Ceres	62	31	1	57.6	12.5	--	--	55.4	--	--
CAG Justify	65	33	1	55.6	12.0	82.4	93.6	65.0	79.3	80.3
CAG Reckless	64	34	1	59.0	11.9	75.2	83.8	60.6	72.2	73.2
CAG Recoil	65	28	1	57.3	12.2	--	--	57.5	--	--
CDC Landmark VB	63	33	1	57.9	12.5	--	81.8	51.3	66.5	--
Commander	61	29	1	58.6	11.8	--	--	61.1	--	--
CP3055	71	33	1	56.3	12.3	--	88.0	57.8	72.9	--
CP3099A	70	36	1	55.4	11.0	76.8	91.7	60.0	75.8	76.2
CP3119A	71	34	1	53.8	11.8	74.0	87.1	60.2	73.6	73.7
CP3188	65	31	1	55.3	11.5	77.2	80.8	51.7	66.2	69.9
CP3322	69	32	1	58.2	11.5	--	84.0	54.9	69.5	--
CP3360AX	62	32	1	58.0	11.2	--	--	57.1	--	--
CP3915	64	29	1	58.4	11.7	--	--	54.4	--	--
Driver	66	32	1	59.4	12.0	76.9	86.8	61.8	74.3	75.2
Elgin-ND	63	37	1	57.4	12.4	--	78.9	60.4	69.7	--
Faller	64	34	1	57.6	12.2	--	--	54.5	--	--
Glenn	61	35	1	59.5	12.0	71.2	73.3	51.5	62.4	65.3
Lanning	63	31	1	57.8	12.1	77.3	78.5	59.3	68.9	71.7
LCS Ascent	61	30	1	58.2	11.8	80.9	80.0	58.0	69.0	73.0
LCS Boom	61	30	1	59.0	12.2	--	76.2	59.3	67.8	--
LCS Buster	66	32	1	57.0	11.6	81.3	90.6	58.8	74.7	76.9
LCS Cannon	61	31	1	58.3	12.6	79.6	76.3	56.9	66.6	70.9
LCS Dual	63	31	1	57.7	11.9	80.2	85.2	55.4	70.3	73.6
LCS Hammer AX	64	30	1	57.7	11.8	77.6	73.3	61.4	67.3	70.8
LCS Trigger	68	31	1	57.8	11.4	77.1	93.2	57.1	75.2	75.8
MN Rothsay	65	28	1	58.0	11.9	74.2	85.1	55.5	70.3	71.6
MN Torgy	63	30	1	58.7	12.0	77.1	85.4	60.1	72.7	74.2
MS Charger	62	30	1	57.6	11.1	86.5	88.9	59.3	74.1	78.2
MS Cobra	63	31	1	58.9	12.2	77.7	76.7	60.1	68.4	71.5
MS Nova	61	29	1	58.8	11.9	--	--	60.8	--	--

Table continued on next page

Hard Red Spring Wheat - 2024 — Hettinger, ND

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page										
MS Ranchero	63	32	1	57.0	11.9	78.2	91.4	55.5	73.5	75.0
MT Carlson	64	31	1	57.2	11.6	--	--	58.7	--	--
MT Dutton	64	31	1	56.7	11.7	--	--	57.5	--	--
MT Ubet	64	30	1	57.2	11.1	--	--	60.8	--	--
ND Frohberg	64	34	1	58.0	11.8	73.7	78.4	56.4	67.4	69.5
ND Heron	61	31	1	59.5	12.0	74.3	75.7	54.4	65.0	68.1
ND Stampede	62	31	1	55.8	11.5	84.2	90.0	53.6	71.8	75.9
ND Thresher	65	30	1	56.2	12.3	73.5	82.0	58.1	70.0	71.2
ND VitPro	63	31	1	58.6	12.3	71.6	74.3	53.7	64.0	66.5
PFS Buns	71	30	1	55.7	11.7	--	91.9	52.5	72.2	--
PFS Rolls	65	31	1	58.1	11.4	--	--	55.7	--	--
PG Predator	64	30	1	58.5	12.0	--	--	57.3	--	--
Rocker	65	32	1	57.8	11.7	--	--	60.3	--	--
Shelly	66	30	1	58.1	12.2	78.9	86.4	58.4	72.4	74.6
SY 611 CL2	63	29	1	59.3	11.4	81.4	82.9	56.6	69.7	73.6
SY Ingmar	65	30	1	58.8	11.6	65.1	70.8	53.9	62.4	63.3
SY Longmire	64	30	1	59.4	10.7	70.7	76.6	59.5	68.0	68.9
SY Valda	63	30	1	58.4	11.5	74.8	86.7	56.1	71.4	72.5
TCG Badlands	63	32	1	58.4	12.4	--	--	62.2	--	--
TCG Teddy	63	28	1	58.8	12.4	--	78.5	62.0	70.2	--
TCG Wildcat	64	31	1	58.2	12.2	75.5	78.6	57.4	68.0	70.5
TCG Zelda	62	27	1	57.3	11.9	--	--	55.3	--	--
WB9590	62	27	1	57.9	11.3	77.6	79.1	56.8	67.9	71.2
WB9719	64	29	1	58.4	11.7	--	81.6	57.2	69.4	--
Trial Mean	63.8	31.1	1.0	57.8	11.8	76.6	81.5	57.7	70.0	72.4
C.V. %	1.4	4.3	--	1.3	8.3	3.1	5.5	5.3	--	--
LSD 5%	1.1	1.6	--	0.9	1.2	2.8	5.2	3.6	--	--
LSD 10%	0.8	1.2	--	0.7	0.9	2.2	4.1	2.5	--	--

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

[2] 1 = no lodging, 9 = 100% lodged.

Planting Date: April 25

Harvest Date: August 15

Previous Crop: Canola

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2024 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	---------- Bushels per acre ----------				
AP Gunsmoke CL2	32	1	58.9	32.1	58.8	30.0	44.4	40.3
AP Smith	29	1	59.4	34.3	61.2	29.8	45.5	41.8
Ascend-SD	36	1	60.5	28.2	70.9	28.3	49.6	42.5
Brawn-SD	34	1	60.9	--	69.5	32.9	51.2	--
CAG Reckless	33	1	59.8	36.3	67.0	32.0	49.5	45.1
CP3055	31	1	56.7	--	--	24.9	--	--
CP3188	32	1	57.0	31.9	61.1	27.8	44.5	40.3
CP3322	29	1	58.0	--	65.9	33.1	49.5	--
Glenn	36	1	61.0	28.6	58.1	39.4	48.8	42.0
Lanning	32	1	58.7	30.0	64.5	37.0	50.7	43.8
LCS Buster	32	1	58.0	31.0	66.8	28.0	47.4	41.9
LCS Dual	33	1	58.9	--	62.5	30.7	46.6	--
LCS Hammer AX	32	1	59.2	--	--	30.4	--	--
MN Rothsay	30	1	59.2	35.4	65.7	33.4	49.5	44.8
MN Torgy	35	1	59.6	35.9	66.4	40.3	53.3	47.5
MS Charger	31	1	58.9	--	65.5	35.5	50.5	--
MT Carlson	31	1	59.1	--	--	41.9	--	--
MT Dutton	32	1	58.0	--	--	35.4	--	--
ND Frohberg	35	1	59.3	28.7	55.9	36.9	46.4	40.5
ND Heron	35	1	60.7	31.2	59.5	36.8	48.2	42.5
ND Stampede	32	1	58.0	--	--	31.9	--	--
ND Thresher	30	1	57.3	--	57.5	27.6	42.5	--
Rocker	30	1	59.3	--	--	38.1	--	--
TCG Teddy	29	1	59.4	--	67.0	32.0	49.5	--
WB9590	28	1	59.1	--	66.7	39.8	53.3	--
Trial Mean	32	1.0	59.0	20.4	63.8	33.4	48.4	43.0
C.V. %	3.2	--	0.9	13.8	5.3	14.2	--	--
LSD 5%	1.4	--	0.7	4.0	3.9	6.5	--	--
LSD 10%	1.1	--	0.5	3.3	3.1	5.0	--	--

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

Planting Date: May 14

Harvest Date: August 29

Previous Crop: Flax

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2024 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	---------- Bushels per acre ----------				
AP Gunsmoke CL2	32	1	57.5	56.2	51.4	41.8	46.6	49.8
AP Smith	30	1	58.9	51.2	52.5	41.5	47.0	48.4
Ascend-SD	37	1	59.4	53.1	53.2	48.0	50.6	51.4
Brawn-SD	35	1	60.0	--	58.6	50.9	54.7	--
CAG Reckless	35	1	58.9	57.4	62.7	49.0	55.8	56.3
CP3055	32	1	56.2	--	--	47.1	--	--
CP3188	33	1	55.3	61.9	52.8	37.7	45.2	50.8
CP3322	30	1	58.3	--	53.3	40.6	46.9	--
Glenn	36	1	59.4	51.3	51.8	43.5	47.7	48.9
Lanning	32	1	57.9	53.3	54.7	44.4	49.6	50.8
LCS Buster	34	1	57.0	71.6	63.1	43.8	53.4	59.5
LCS Dual	33	1	57.7	--	55.8	44.7	50.3	--
LCS Hammer AX	31	1	57.8	--	--	46.3	--	--
MN Rothsay	28	1	58.1	53.3	57.9	45.0	51.5	52.1
MN Torgy	37	1	58.5	66.9	53.2	47.3	50.2	55.8
MS Charger	30	1	57.6	--	54.4	41.5	47.9	--
MT Carlson	34	1	57.2	--	--	50.8	--	--
MT Dutton	25	1	56.7	--	--	45.2	--	--
ND Frohberg	34	1	58.0	50.2	51.2	42.5	46.9	48.0
ND Heron	34	1	59.4	44.3	46.7	42.7	44.7	44.6
ND Stampede	31	1	55.8	--	--	48.4	--	--
ND Thresher	31	1	56.4	--	48.4	42.3	45.3	--
Rocker	34	1	57.8	--	--	39.7	--	--
TCG Teddy	30	1	58.6	--	53.7	44.1	48.9	--
WB9590	29	1	58.0	54.7	56.2	46.0	51.1	52.3
Trial Mean	32	1	57.9	53.4	53.9	44.6	49.2	51.4
C.V. %	11.7	--	1.0	10.0	5.6	12.9	--	--
LSD 5%	4.4	--	0.7	6.3	3.6	6.8	--	--
LSD 10%	3.5	--	0.6	4.9	2.8	5.3	--	--

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

Planting Date: May 14

Harvest Date: August 23

Prvious Crop: Sunflower

Hard Red Spring Wheat - 2024 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	---------- Bushels per acre ----------				
Ambush	33	1	61.3	13.9	--	--	58.6	--	--
AP Elevate	32	1	60.8	13.8	--	--	70.0	--	--
AP Gunsmoke CL2	34	1	60.5	13.9	66.4	49.4	62.2	55.8	59.3
AP Murdock	34	1	60.2	13.6	65.2	52.6	68.7	60.6	62.2
AP Smith	32	1	59.9	13.9	58.5	48.8	61.3	55.0	56.2
Asend-SD	42	1	61.3	13.4	65.7	56.3	74.4	65.3	65.5
Ballistic	36	1	60.6	13.2	--	--	71.5	--	--
Bolles	35	1	59.3	14.2	56.5	51.3	60.6	56.0	56.1
Boost	37	1	60.2	13.8	56.5	50.9	63.5	57.2	57.0
Brawn-SD	39	1	61.8	12.3	70.8	50.3	67.5	58.9	62.9
CAG Ceres	35	1	60.6	14.2			62.3	--	--
CAG Justify	36	1	59.5	12.0	67.2	50.3	69.5	59.9	62.3
CAG Reckless	38	1	60.6	14.1	57.9	52.4	67.3	59.8	59.2
CAG Recoil	34	1	59.4	13.4	--	--	71.5	--	--
CDC Landmark VB	37	1	61.6	14.5	--	55.7	57.4	56.6	--
Commander	35	1	60.7	13.9	--	--	66.8	--	--
CP3055	36	1	57.0	11.9	--	51.6	65.5	58.6	--
CP3099A	39	1	55.3	10.0	62.8	54.4	60.3	57.3	59.2
CP3119A	39	1	56.8	11.5	--	58.3	67.3	62.8	--
CP3188	36	3	58.9	12.0	58.7	56.4	47.3	51.9	54.2
CP3322	34	1	57.8	12.7	--	53.6	56.5	55.1	--
CP3360AX	33	1	62.1	12.2	--	--	60.9	--	--
CP3915	34	1	61.4	13.7	--	--	61.5	--	--
Driver	35	1	61.7	13.7	57.0	56.9	67.5	62.2	60.5
Elgin-ND	44	1	60.8	12.6	--	41.8	67.7	54.8	--
Faller	38	1	61.0	12.9	--	--	63.8	--	--
Glenn	41	1	62.5	14.6	54.6	45.9	59.7	52.8	53.4
Lanning	34	1	59.6	14.2	56.0	52.3	60.9	56.6	56.4
LCS Ascent	36	1	61.5	12.9	54.9	45.6	69.1	57.4	56.5
LCS Boom	34	1	62.2	13.3	--	47.0	62.8	54.9	--
LCS Buster	38	1	58.7	12.3	69.5	59.0	70.2	64.6	66.2
LCS Cannon	34	1	61.9	12.8	56.6	45.1	66.4	55.7	56.0
LCS Dual	34	1	60.2	13.2	55.1	45.2	61.7	53.4	54.0
LCS Hammer AX	35	1	60.9	13.5	62.8	51.7	61.5	56.6	58.7
LCS Trigger	37	1	61.0	11.4	70.4	60.3	73.0	66.6	67.9
MN Rothsay	32	1	60.0	13.9	63.5	56.8	64.5	60.6	61.6
MN Torgy	39	1	60.9	14.4	65.7	60.7	71.6	66.1	66.0
MS Charger	33	1	60.3	11.9	61.6	46.9	64.0	55.5	57.5
MS Cobra	34	1	60.2	13.9	62.1	50.7	69.2	59.9	60.6
MS Nova	34	1	60.3	14.0	--	--	64.1	--	--

Table continued on next page

Hard Red Spring Wheat - 2024 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	---------- Bushels per acre ----------				
Table continues from previous page									
MS Ranchero	42	1	60.3	12.8	64.3	66.6	68.8	67.7	66.6
MT Carlson	34	1	60.7	13.2	--	--	64.3	--	--
MT Dutton	38	1	59.5	13.9	--	--	65.5	--	--
MT Ubet	35	1	60.0	13.7	--	--	64.7	--	--
ND Frohberg	38	1	60.9	14.2	57.9	47.9	60.3	54.1	55.3
ND Heron	37	1	62.2	13.9	54.2	44.2	62.8	53.5	53.7
ND Stampede	35	1	59.8	13.4	55.1	49.1	67.5	58.3	57.2
ND Thresher	34	1	58.7	13.7	54.4	53.2	58.8	56.0	55.4
ND VitPro	36	1	61.9	15.2	51.1	47.5	58.7	53.1	52.4
PFS Buns	32	1	58.3	12.0	--	63.9	63.8	63.8	--
PFS Rolls	36	1	59.5	13.5	--	--	67.3	--	--
PG Predator	32	1	60.1	13.7	--	--	64.3	--	--
Rocker	36	1	61.0	13.1	--	--	62.3	--	--
Shelly	34	1	60.7	13.0	60.9	51.5	68.1	59.8	60.1
SY 611 CL2	32	1	60.7	13.8	60.7	57.4	69.6	63.5	62.6
SY Ingmar	34	1	60.6	14.8	54.3	49.9	63.6	56.8	55.9
SY Longmire	33	1	61.0	14.2	55.2	52.5	58.8	55.6	55.5
SY Valda	34	1	60.5	13.7	60.8	60.3	66.1	63.2	62.4
TCG Badlands	34	1	60.2	14.3	--	--	65.8	--	--
TCG Teddy	30	1	60.1	13.7	--	40.6	65.8	53.2	--
TCG Wildcat	35	1	60.4	13.6	63.9	55.5	65.3	60.4	61.6
TCG Zelda	32	1	60.5	14.2	--	--	66.9	--	--
WB9590	31	1	60.3	13.6	57.2	45.7	64.4	55.0	55.8
WB9719	31	1	62.6	13.2	--	53.0	56.0	54.5	--
Trial Mean	35	1	60.4	13.4	59.4	52.4	64.9	58.3	59.1
C.V. %	4.1	184.6	0.8	4.8	6.5	9.2	7.1	--	--
LSD 5%	1.7	0.1	0.6	0.8	4.5	5.6	5.4	--	--
LSD 10%	1.3	0.1	0.5	0.6	3.5	4.4	4.2	--	--

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

Planting Date: May 17

Harvest Date: September 6

Previous Crop: Soybean

2024 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2021	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
WB 9590	61	14,790	29	57.7	14.8	19.8	44.1	70.5	57.3	44.8
AP Murdock	64	16,283	33	57.8	14.7	15.9	41.6	69.3	55.5	42.3
Sy Valda	64	17,297	31	57.7	14.8	15.5	55.6	63.1	59.3	44.7
Sy Ingmar	64	17,754	34	59.1	14.8	16.2	49.8	65.1	57.4	43.7
MN Torgy	64	16,000	34	59.8	14.9	17.3	53.4	66.3	59.9	45.7
Shelly	64	15,906	33	58.9	14.3	--	51.6	66.5	59.1	--
WB 9719	65	16,108	32	61.4	14.2	--	52.9	71.0	61.9	--
Faller	65	18,428	36	55.6	14.4	--	--	51.7	--	--
AP Elevate	65	17,369	33	58.4	15.0	--	--	67.4	--	--
AP Gunsmoke CL2	62	16,909	34	57.1	15.1	22.7	53.0	67.0	60.0	47.6
AP Smith	64	19,558	33	56.8	14.2	19.5	53.1	57.7	55.4	43.4
Ascend-SD	65	19,312	36	58.9	15.0	20.2	48.6	66.4	57.5	45.1
Bolles	66	16,486	35	56.4	16.6	14.3	45.7	58.5	52.1	39.5
Boost	65	16,311	36	58.5	14.6	--	45.6	63.2	54.4	--
Brawn-SD	65	17,574	38	59.8	14.2	--	50.1	66.8	58.5	--
CAG Ceres	62	16,505	34	56.8	13.8	--	--	61.7	--	--
CAG Justify	66	20,337	36	52.8	14.7	16.1	61.2	64.4	62.8	47.2
CAG Reckless	63	17,495	37	58.8	14.1	19.0	45.5	69.8	57.6	44.7
CAG Recoil	67	16,196	31	57.4	15.2	--	--	69.1	--	--
CP 3360AX	61	16,422	34	59.7	13.6	--	--	62.8	--	--
CP 3055	70	16,292	36	56.4	14.5	--	--	65.0	--	--
CP 3099A	69	15,717	38	55.5	13.3	12.6	54.7	65.9	60.3	44.4
CP 3119A	70	12,640	37	55.3	14.2	--	--	62.0	--	--
CP 3188	64	18,507	35	54.6	13.9	24.4	54.3	51.8	53.1	43.5
CP 3322	69	20,819	35	56.8	13.7	--	62.5	64.5	63.5	--
CP 3915	63	18,016	33	58.9	14.7	--	--	62.3	--	--
Ambush	61	14,618	34	59.9	15.2	--	--	68.5	--	--
Ballistic	64	17,970	32	56.1	14.1	--	--	62.5	--	--
Commander	62	15,708	33	58.5	14.2	--	--	70.0	--	--
Rocker	65	17,408	33	59.3	14.8	--	--	67.3	--	--
Driver	66	17,429	37	59.0	14.7	21.0	46.5	67.8	57.2	45.1
Glenn	62	15,600	40	61.7	15.4	19.6	45.6	67.6	56.6	44.3
Lanning	62	14,897	34	57.2	15.4	19.4	47.4	70.7	59.0	45.8
LCS Ascent	60	17,328	33	59.7	13.7	--	54.3	72.9	63.6	--
LCS Boom	61	14,217	32	61.1	14.7	--	46.5	76.8	61.6	--
LCS Buster	67	18,125	38	55.2	13.1	12.2	59.6	58.2	58.9	43.3
LCS Cannon	60	15,466	33	60.4	14.4	21.0	54.3	70.5	62.4	48.6
LCS Dual	63	18,554	35	56.9	14.0	--	48.9	59.7	54.3	--
LCS Hammer AX	63	15,820	34	58.9	14.2	--	49.8	72.7	61.2	--
LCS Trigger	67	19,994	32	56.2	13.9	14.7	54.1	59.2	56.6	42.7
MN Rothsay	66	19,285	32	57.6	14.4	20.7	51.4	63.2	57.3	45.1

Table continued on next page

2024 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2021	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Table continues from previous page										
MS Charger	63	20,566	35	55.8	13.3	--	52.7	59.1	55.9	--
MS Cobra	65	17,362	33	59.2	14.9	20.3	45.7	71.2	58.5	45.7
MS Nova	62	17,104	34	58.9	14.3	--	--	70.4	--	--
MS Ranchero	65	16,403	38	58.2	14.4	19.3	59.4	64.9	62.1	47.8
MT Carlson	63	14,737	34	57.5	14.0	--	--	73.2	--	--
MT Dutton	64	16,488	35	56.8	14.3	--	--	69.5	--	--
MT Ubet	64	16,394	35	56.4	14.4	--	--	66.4	--	--
ND Frohberg	65	14,326	37	60.0	15.0	16.8	44.2	71.1	57.7	44.0
ND Heron	61	15,436	35	59.5	15.1	22.0	45.2	65.1	55.2	44.1
ND Stampede	63	17,746	33	56.6	14.3	--	49.7	60.9	55.3	--
ND Thresher	65	19,389	33	54.8	14.9	17.7	46.3	57.9	52.1	40.6
ND VitPro	61	15,564	35	59.7	15.6	19.2	42.9	63.5	53.2	41.9
PFS Buns	73	21,709	32	51.9	14.8	5.0	57.4	42.5	49.9	34.9
PFS Rolls	66	16,414	36	58.1	14.5	--	--	63.0	--	--
SY 611 CL2	64	16,606	31	59.3	15.0	20.8	49.4	69.6	59.5	46.6
SY Longmire	63	16,397	32	59.6	14.7	15.0	45.1	66.1	55.6	42.1
TCG Badlands	64	16,725	33	58.6	14.6	--	--	73.2	--	--
TCG-Teddy	65	15,013	30	59.1	14.8	--	50.6	75.2	62.9	--
TCG-Wildcat	65	15,901	35	58.9	14.4	19.0	50.5	69.1	59.8	46.2
TCG Zelda	64	16,244	30	57.5	14.6	--	--	66.9	--	--
Trial Mean	64	16,975	34	57.9	14.5	17.9	49.8	65.6	57.9	44.2
CV %	2	4	5	1.3	2.7	20.9	10.3	6.3	--	--
LSD 0.10	1	668	1	0.7	0.4	4.4	4.7	3.8	--	--

Planting Date: April 23, 2024
Harvest Date: August 16, 2024
Protein adjusted to 12% moisture
[1] 2022 crop hailed out so previous year was used in averages
Previous Crop: Pea hay
Seeding Rate: 1.2 million live seeds/ac

NDSU Dickinson Research Extension Center

2024 Glen Ullin Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield 2022	Grain Yield 2023	Grain Yield 2024	Average Yield 2 Year	Average Yield 3 Year
		lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AP Gunsmoke CL2	14,210	61.5	11.8	--	40.5	60.5	50.5	--
AP Smith	16,015	61.4	12.3	--	--	70.7	--	--
Ascend-SD	15,941	62.6	11.2	43.7	42.6	73.3	58.0	53.2
Brawn-SD	14,375	63.2	10.1	--	37.9	63.9	50.9	--
CP3322	17,966	61.7	10.6	--	44.9	68.3	56.6	--
LCS Buster	13,752	60.5	10.1	--	--	69.3	--	--
LCS Dual	14,835	62.5	11.1	--	--	64.1	--	--
MN Rothsay	15,360	61.7	11.6	48.3	38.8	66.3	52.5	51.1
MT Carlson	13,722	61.5	11.3	--	--	59.7	--	--
MT Dutton	14,885	60.6	11.3	--	--	68.5	--	--
ND Heron	14,888	62.6	12.0	39.2	35.1	68.5	51.8	47.6
ND Stampede	14,260	62.0	11.3	--	--	70.7	--	--
ND Thresher	16,933	60.4	11.7	34.1	33.4	56.6	45.0	41.4
Trial Mean	15,165	61.7	11.2	41.4	39.4	66.2	52.2	48.3
CV %	3.9	0.8	3.1	10.1	6.6	13.8	--	--
LSD 0.10	551	0.5	0.3	5.0	2.4	8.4	--	--

Planting Date: May 10, 2024
Harvest Date: August 29, 2024
Seeding Rate: 1.2 million live seeds/ac

2024 Organic Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2022	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	%		-----bu/ac-----		----bu/ac----	
Bolles	51	20,802	30	55.7	14.5	48.8	13.6	14.0	13.8	25.5
Ascend SD	51	25,352	32	55.7	13.7	--	--	17.7	--	--
Brawn SD	51	22,728	28	56.9	12.9	--	--	17.7	--	--
Ceres	49	19,151	35	56.7	13.4	52.9	14.9	18.7	16.8	28.8
Dagmar	49	18,515	28	56.8	13.5	66.8	16.7	19.3	18.0	34.3
Dapps	50	20,656	32	55.9	14.5	54.9	18.8	16.0	17.4	29.9
Driver	52	21,235	30	56.6	13.2	51.9	18.8	15.6	17.2	28.8
Elgin-ND	49	21,155	31	54.8	13.3	52.8	17.3	18.5	17.9	29.6
Faller	51	21,129	28	54.5	13.5	59.9	21.5	16.7	19.1	32.7
FBC Dylan	50	19,309	31	56.7	13.8	59.2	14.8	18.2	16.5	30.7
Glenn	49	21,948	32	58.2	13.4	56.3	13.8	16.7	15.2	28.9
Mida	50	16,923	37	56.7	12.7	45.8	14.3	17.5	15.9	25.9
MN Rothsay	52	23,013	26	55.9	13.7	--	--	15.6	--	--
MN Torgy	50	21,746	29	57.4	13.7	69.0	16.5	17.6	17.0	34.4
ND Frohberg	51	21,903	31	55.3	14.6	51.6	11.9	16.7	14.3	26.8
ND Heron	49	20,870	30	57.1	13.8	63.3	14.5	19.3	16.9	32.3
ND Stampede	49	21,081	28	55.4	13.5	--	--	20.1	--	--
ND Thresher	52	23,844	26	53.3	14.0	--	--	15.8	--	--
ND VitPro	49	21,081	28	57.2	14.0	62.2	20.5	16.9	18.7	33.2
Prosper	49	18,566	28	56.3	13.6	68.0	15.8	17.9	16.9	33.9
Red Fife	54	18,570	35	56.7	13.7	51.6	14.8	14.9	14.8	27.1
Shelly	52	22,148	26	55.7	13.3	59.6	14.9	16.0	15.4	30.1
Trial Mean	50	20,988	30	56.2	13.7	57.5	16.4	17.2	16.6	29.9
CV %	1.3	4.1	4.7	1.1	3.4	14.1	26.1	8.2	--	--
LSD 0.10	1	802	1	0.6	0.4	9.6	NS	1.3	--	--

Planting Date: May 13, 2024
Harvest Date: August 9, 2024
Protein adjusted to 12% moisture
Previous Crop: Buckwheat Hay
Seeding Rate: 1.5 million live seeds/ac

Hard Red Winter Wheat - 2024 — Hettinger, ND

Variety	Spring Stand	Heading Date	Plant Height	Plant Lodge	Test Weight	Grain Protein	---- Grain Yield ---- 2022	2023	2024	Average Yield 2 yr	3 yr
	%	Julian	inches	1-9[1]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Goldrush	90	163	29	1	63.3	10.7	--	54.5	68.4	61.4	--
AAC Overdrive	90	162	29	1	61.4	10.9	--	--	63.8	--	--
AAC Vortex	90	163	31	1	62.7	11.4	101.4	55.3	70.6	62.9	75.8
AAC Wildfire	90	165	31	1	62.6	11.0	93.8	58.6	73.4	66.0	75.3
AC Emerson	90	163	31	1	63.1	11.9	87.3	46.4	62.5	54.5	65.4
CP7017AX	90	159	28	1	62.6	10.3	88.4	44.4	65.7	55.1	66.2
CP7266AX	90	160	30	1	63.9	10.8	--	40.8	65.9	53.4	--
CP7909	90	157	28	1	62.9	10.3	93.0	28.9	55.9	42.4	59.3
Goldrush	90	163	31	1	61.7	11.5	--	--	60.3	--	--
Jerry	90	162	35	1	61.2	10.8	88.3	48.5	57.0	52.8	64.6
Keldin	90	163	31	1	61.8	11.1	98.4	58.9	74.1	66.5	77.1
LCS Chrome	90	161	29	1	61.9	11.2	--	--	58.8	--	--
LCS Steel AX	90	163	31	1	60.5	9.8	--	--	60.4	--	--
MS Maverick	90	161	29	1	62.7	11.5	97.8	45.2	62.3	53.7	68.4
ND Noreen	90	163	34	1	63.4	11.3	94.1	55.5	66.4	61.0	72.0
Northern	90	164	31	1	62.3	11.6	94.5	58.0	71.4	64.7	74.6
SD Andes	90	163	29	1	63.6	11.4	99.2	58.7	71.7	65.2	76.5
SD Midland	90	162	30	1	62.8	11.1	96.8	58.9	69.2	64.1	75.0
SD Pheasant	90	162	30	1	60.4	10.3	--	59.4	54.4	56.9	--
SY Monument	90	161	30	1	59.0	10.2	89.7	44.6	58.0	51.3	64.1
WB4309	90	161	30	1	61.7	11.1	81.3	35.7	55.9	45.8	57.6
WB4422	90	161	30	1	60.6	10.8	--	--	59.6	--	--
Winner	90	160	30	1	63.8	11.1	95.1	44.1	69.1	56.6	69.4
Trial Mean	90	161.73	31	1	62.0	11.0	90.1	49.1	63.1	56.9	69.0
C.V. %	--	0.6	4.3	--	1.1	3.1	7.0	7.1	8.1	--	--
LSD 0.05	--	1.1	1.6	--	0.8	0.4	6.7	5.7	6.1	--	--
LSD 0.10	--	0.8	1.2	--	0.6	0.3	5.4	4.8	4.7	--	--

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

Previous Crop: Oats

Planting Date: September 21

Harvest Date: July 29

NDSU Dickinson Research Extension Center

2024 Winter Wheat - Recrop **Dickinson, ND**

Variety	Heading Date	Seeds per Pound	KWT (g/1000)	Plant Height	Test Weight	Protein	Grain Yield 2021	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
	from 1/1			in	lbs/bu	%	-----bu/ac-----			bu/ac	bu/ac
AAC Coldfront	162	17,694	25.7	30.1	56.3	11.1	--	--	74.2	--	--
AAC Overdrive	160	17,608	25.8	29.8	56.0	10.8	--	--	81.2	--	--
AAC Vortex	163	17,030	26.8	29.6	54.4	12.6	--	47.1	71.7	59.4	--
AAC Wildfire	165	16,876	27.1	30.0	53.0	12.1	21.9	55.8	70.9	63.3	49.5
AC Emerson	163	20,210	22.5	31.3	54.7	12.8	17.4	40.2	63.4	51.8	40.3
Goldrush	163	16,388	27.9	31.1	54.3	12.5	--	47.5	70.4	58.9	--
Jerry	163	17,902	25.5	32.2	53.2	12.2	21.2	42.3	54.7	48.5	39.4
Keldin	163	12,897	35.2	30.6	58.7	10.4	22.1	33.0	95.5	64.2	50.2
LCS Chrome	158	15,219	29.9	30.8	59.5	11.0	--	--	82.5	--	--
LCS Steel AX	161	16,115	28.2	33.0	57.7	10.3	--	--	88.3	--	--
MS Maverick	162	14,182	32.0	29.3	57.7	11.6	--	32.4	78.9	55.6	--
ND Noreen	164	15,406	29.7	31.7	57.4	12.7	22.6	52.1	53.8	52.9	42.8
Northern	163	13,567	33.6	30.3	57.3	11.5	25.5	54.7	87.6	71.1	55.9
SD Andes	161	14,366	31.6	29.5	60.5	10.8	26.4	56.6	99.3	77.9	60.8
SD Midland	162	14,297	32.1	30.3	57.6	11.0	--	47.9	86.9	67.4	--
SD Pheasant	162	18,009	25.5	30.6	55.1	10.6	--	37.7	70.7	54.2	--
SY Monument	163	18,851	24.2	25.7	51.1	11.8	20.8	32.3	64.4	48.4	39.2
WB4309	159	17,826	25.6	29.7	58.8	11.1	16.0	25.9	88.0	56.9	43.3
WB4422	159	15,886	28.7	32.0	58.0	9.9	--	--	86.7	--	--
Winner	160	14,843	30.9	26.8	57.5	11.5	23.2	37.0	83.4	60.2	47.9
Trial Mean	162	16,460	28.1	30.2	56.5	11.3	19.3	41.0	77.4	59.4	46.9
CV %	0.7	8.0	8.0	8.0	3.3	7.5	18.1	15.0	11.1	--	--
LSD 0.10	1	1,200	2.1	2.2	1.7	0.8	4.8	7.3	7.8	--	--

[1] 2022 crop hailed out so previous year was used in averages

Planting Date: September 14, 2023

Harvest Date: July 31, 2024

Protein adjusted to 12% moisture

Previous Crop: oat

Seeding Rate: 1 million live seeds/ac

Winter Rye - 2024 **Hettinger, ND**

Variety	Spring Stand	Heading Date	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2021	2023	2024	Average Yield 2 yr	3 yr
	%		inches	0-9[1]	lbs/bu	---------- Bushels per acre ----------				
Aroostok	90	6/1	43	0	55.3	28.4	35.8	58.2	47.0	40.8
Danko	90	6/1	43	0	56.3	31.8	67.7	60.9	64.3	53.5
Hazlet	90	6/1	46	0	55.2	29.7	56.4	56.0	56.2	47.4
ND Dylan	90	6/1	49	0	54.9	28.4	38.3	57.2	47.8	41.3
ND Gardner	90	5/26	48	0	54.5	32.1	40.2	42.8	41.5	38.4
Rymin	90	5/31	45	0	54.7	29.7	52.1	51.7	51.9	44.5
Spooner	90	5/29	48	0	54.9	29.9	49.8	45.1	47.5	41.6
SU Bebop	90	6/1	40	0	55.7	--	60.5	75.1	67.8	--
SU Cossani	90	5/31	40	0	55.1	--	70.6	79.1	74.9	--
SU Karlsson	90	6/1	39	0	55.0	--	71.4	75.4	73.4	--
SU Performer	90	6/2	40	0	54.9	--	71.4	77.8	74.6	--
SU Perspectiv	90	6/1	38	0	55.5	--	68.3	85.7	77.0	--
Trial Mean	90	5/31	43	0	55.2	32.7	59.3	63.7	60.3	43.9
C.V. %	--	0.8	4.3	--	0.7	9.0	12.4	6.1	--	--
LSD 0.05	--	1.6	2.3	--	0.5	3.5	10.5	4.7	--	--
LSD 0.10	--	1.2	1.8	--	0.4	2.7	8.7	4.0	--	--

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

Planting Date: September 21

Harvest Date: July 30

Previous Crop: Oats

Durum Wheat - 2024 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield -----			Average Yield	
						2022	2023	2024	2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Stronghold	63	31	1	56.7	13.2	64.5	76.9	50.1	63.5	63.8
Alkabo	62	31	1	57.2	11.8	72.3	76.9	55.6	66.3	68.3
Carpio	64	31	1	56.5	12.1	71.9	77.6	57.1	67.3	68.8
CDC Defy	61	34	1	57.7	12.3	72.1	83.6	58.8	71.2	71.5
CDC Wistin	64	32	1	56.6	12.3	--	--	52.9	--	--
Divide	63	30	1	56.4	12.9	68.1	75.2	54.2	64.7	65.8
Joppa	62	32	1	57.0	11.6	75.3	80.1	58.0	69.0	71.1
Maier	63	31	1	57.2	12.4	71.2	67.8	55.1	61.4	64.7
Mountrail	64	33	1	57.2	11.6	72.7	77.4	55.8	66.6	68.6
MT Blackbeard	64	35	1	56.7	12.3	--	81.0	57.1	69.0	--
ND Grano	63	30	1	57.1	12.1	71.2	76.1	56.3	66.2	67.9
ND Riveland	63	33	1	56.2	13.0	69.2	75.2	51.4	63.3	65.3
ND Stanley	63	31	1	57.5	13.2	73.9	74.3	58.7	66.5	68.9
Strongfield	64	32	1	56.8	12.4	68.9	74.5	56.4	65.5	66.6
Trial Mean	63	32	1	56.9	12.5	70.8	78.3	55.7	66.9	68.3
C.V. %	1.4	5.2	--	1.1	6.2	3.7	4.7	6.5	--	--
LSD 5%	1.0	2.0	--	0.7	0.9	3.1	4.4	4.2	--	--
LSD 10%	0.8	1.5	--	0.6	0.7	2.4	3.4	3.3	--	--

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

[2] 1 = no lodging, 9 = 100% lodged.

Planting Date: April 24

Harvest Date: August 15

Previous Crop: Canola

Durum Wheat - 2024 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	inches	0-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Stronghold	31	1	58.8		--	--	29.1	--	--
CDC Defy	35	1	59.8		--	--	26.9	--	--
Joppa	33	1	57.5		28.8	57.4	29.7	43.5	38.6
ND Grano	33	1	58.5		30.9	59.5	25.5	42.5	38.6
ND Riveland	36	1	58.5		30.3	62.3	23.0	42.6	38.5
ND Stanley	33	1	58.2		29.1	59.4	28.4	43.9	38.9
		1							
Trial Mean	34	1	58.6		29.4	58.7	27.1	43.1	38.7
C.V. %	3.5	--	0.8		10.4	4.6	8.5	--	--
LSD 5%	1.7	--	0.7		3.8	3.3	3.4	--	--
LSD 10%	1.3	--	0.5		2.9	2.6	2.6	--	--

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

Planting Date: May 14

Harvest Date: August 29

Previous Crop: Flax

Durum Wheat - 2024 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2020	2021	2023	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	---------- Bushels per acre ----------				
AAC Stronghold	33	1	55.9		--	--	28.5	--	--
CDC Defy	35	1	57.0		--	--	29.5	--	--
Joppa	34	1	54.0		37.1	44.5	28.8	36.6	36.8
ND Grano	33	1	56.0		36.6	45.3	27.7	36.5	36.5
ND Riveland	36	1	56.8		32.1	51.0	28.3	39.7	37.1
ND Stanley	33	1	54.9		33.7	46.8	26.1	36.4	35.5
Trial Mean	34	1	55.8		34.8	47.8	28.2	37.3	36.5
C.V. %	3.4	--	1.5		5.6	6.6	6.0	--	--
LSD 5%	1.4	--	1.1		2.9	3.9	2.1	--	--
LSD 10%	1.1	--	0.8		2.4	3.0	1.6	--	--

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

Planting Date: May 14

Harvest Date: August 23

Previous Crop: Sunflower

2024 Durum - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2021	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Maier	64	14,636	36	58.2	16.2	13.5	48.1	63.7	55.9	41.8
Mountrail	65	13,625	36	58.6	14.6	11.4	58.2	65.8	62.0	45.1
Alkabo	64	13,934	35	59.2	14.9	13.9	56.9	58.7	57.8	43.1
Divide	65	13,791	38	58.2	15.8	12.4	51.8	61.5	56.7	41.9
Carpio	67	13,178	35	58.1	15.6	12.9	57.1	60.2	58.7	43.4
Joppa	66	14,661	36	57.9	15.0	11.5	49.2	59.7	54.4	40.1
ND Grano	64	14,049	34	58.7	15.6	11.3	57.6	61.0	59.3	43.3
ND Riveland	65	13,152	37	56.8	15.8	15.3	48.2	58.5	53.4	40.7
ND Stanley	65	13,678	36	59.1	15.7	13.8	54.3	61.5	57.9	43.2
Strongfield	65	14,649	35	57.5	16.8	9.9	47.4	57.7	52.5	38.3
AAC Stronghold	65	13,296	40	58.0	16.1	--	--	59.3	--	--
MT Blackbeard	67	12,786	39	58.4	15.6	--	45.4	60.5	52.9	--
CDC Defy	65	13,418	39	58.3	16.0	--	--	62.5	--	--
Trial Mean	65	13,538	36	58.4	15.7	12.7	52.9	61.0	56.5	42.1
CV %	1.7	3.7	5.0	0.8	3.0	19.0	11.1	5.5	--	--
LSD 0.10	1	466	2	0.4	0.4	2.8	5.3	3.1	--	--

Planting Date: April 24, 2024
Harvest Date: August 16, 2024
Previous Crop: Pea hay
Seeding Rate: 1.2 million live seeds/ac

[1] 2022 crop hailed out so previous year was used in averages

NDSU Hettinger Research Extension Center

Barley - 2024 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	DAP[1]	inches	0-9[2]	%	lbs/bu	%	---------- Bushels per acre ----------				
TWO ROW											
AAC Connect	67	26	1	69	47.0	11.9	94.6	121.8	76.7	99.3	97.7
AAC Synergy	66	25	1	82	47.8	11.3	103.4	134.7	83.7	109.2	107.3
ABI Cardinal	65	28	1	88	47.7	12.9	93.9	124.2	85.6	104.9	101.3
Brewski	64	28	1	91	47.1	11.9	105.1	132.3	87.0	109.6	108.1
CDC Fraser	67	27	1	82	46.9	11.8	101.2	125.8	54.9	90.4	94.0
CDC Praire	67	26	1	86	45.8	12.2	--	111.0	81.6	96.3	--
Conlon	59	29	1	92	48.5	12.5	95.2	94.4	75.4	84.9	88.3
Explorer	65	23	1	89	46.6	11.5	105.3	124.2	76.4	100.3	101.9
ND Genesis	63	30	1	89	47.9	10.7	95.6	140.8	89.5	115.2	108.6
Pinnacle	61	28	1	88	46.2	11.0	85.7	96.2	80.4	88.3	87.4
SIX ROW											
ND Treasure	61	28	1	78	47.8	11.6	108.5	132.1	82.5	107.3	107.7
Tradition	61	30	1	83	47.5	11.8	101.6	115.8	80.6	98.2	99.3
Trial Mean	62	27	1	86	47.2	11.4	98.0	119.5	79.6	98.7	99.4
C.V. %	1.5	4.7	--	4.6	1.4	6.1	5.2	6.9	8.4	--	--
LSD 5%	1.1	1.5	--	4.7	0.8	0.8	6.1	9.8	8.0	--	--
LSD 10%	0.9	1.2	--	3.7	0.6	0.6	4.7	7.6	6.2	--	--

[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 12

Previous Crop: Canola

NDSU Dickinson Research Extension Center

2024 Barley - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	% Plump	------- Grain Yield--------			Average Yield[1]	
										2	3
			in	lbs/bu	%	>6/64	2021	2023	2024	Year	Year
							----------bu/ac----------			----bu/ac----	
Six Row											
ND Treasure	62	12,704	25	47.2	12.5	86	18.5	62.6	91.1	76.9	57.4
Tradition	62	12,147	28	48.8	13.7	86	22.2	57.6	87.8	72.7	55.9
Two Row											
ND Genesis	62	10,683	26	50.2	11.9	87	19.2	70.5	88.3	79.4	59.4
AAC Synergy	62	11,721	27	47.9	13.3	82	11.4	65.1	79.3	72.2	51.9
CDC Fraser	69	13,515	25	44.5	14.2	58	9.2	62.9	72.4	67.6	48.2
Explorer	62	10,922	20	48.4	12.5	89	20.1	63.4	89.5	76.4	57.7
AAC Connect	68	12,811	25	46.0	14.5	53	10.9	59.2	75.2	67.2	48.4
Brewski	62	10,862	25	49.6	11.8	86	23.8	67.0	90.6	78.8	60.5
CDC Prairie	67	12,730	27	45.6	15.2	52	--	66.7	67.4	67.0	--
ABI Cardinal	67	13,400	24	45.0	14.3	72	12.3	64.3	73.5	68.9	50.0
Trial Mean	63	11,716	25	47.9	12.8	80	18.9	63.1	84.2	72.7	54.4
CV %	0.9	2.5	5.5	0.7	3.2	4.2	13.1	11.4	7.4	--	--
LSD 0.10	1	275	1	0.3	0.4	3	2.9	6.6	5.8	--	--

Planting Date: April 23, 2024
Harvest Date: August 2, 2024
Previous Crop: Pea hay
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis
[1] 2022 crop hailed out so previous year was used in averages

2024 Glen Ullin Barley - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	% Plump	Protein	Grain Yield 2022	Grain Yield 2023	Grain Yield 2024	Average Yield 2 Year	Average Yield 3 Year
		lbs/bu	>6/64	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Six Row									
ND Treasure	11,956	46.4	92	10.2	--	62.9	101.2	82.0	--
Two Row									
AAC Connect	9,789	48.8	94	12.0	62.1	55.0	96.7	75.8	71.3
ABI Cardinal	9,716	49.4	97	11.0	68.3	61.3	98.4	79.8	76.0
Brewski	9,880	48.5	95	10.1	74.0	57.5	103.7	80.6	78.4
ND Genesis	10,059	49.5	95	9.7	67.6	62.9	100.6	81.7	77.0
CDC Fraser	10,203	47.4	95	11.1	--	--	96.3	--	--
CDC Prairie	10,316	49.3	94	12.1	--	--	83.5	--	--
Trial Mean	10,556	48.3	94	10.8	60.7	65.7	96.0	80.0	75.7
CV %	2.2	1.1	1.6	4.2	8.3	13.7	8.5	--	--
LSD 0.10	215	0.5	1	0.4	6.1	9.9	7.6	--	--

Planting Date: May 10, 2024
Harvest Date: August 29, 2024
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis

NDSU Hettinger Research Extension Center

Oat - 2024 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	----- Grain Yield ----- 2022	2023	2024	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	---------- Bushels per acre ----------				
AAC Douglas	62	35	1	36.3	179.5	174.6	125.9	150.3	160.0
Beach	62	35	1	37.8	153.3	135.0	87.5	111.2	125.3
CDC Endure	67	37	1	34.5	--	160.7	104.6	132.7	--
CS Camden	66	35	1	33.4	165.3	164.3	122.1	143.2	150.6
Deon	67	37	1	35.3	165.8	130.5	101.4	116.0	132.6
HiFi	65	37	1	34.9	165.5	119.7	101.0	110.3	128.7
Jury	62	41	1	35.5	165.1	126.2	115.2	120.7	135.5
Killdeer	62	34	1	36.9	180.1	140.8	119.8	130.3	146.9
Leggett	64	35	1	36.1	165.3	133.8	107.8	120.8	135.6
MN Pearl	65	38	1	35.4	176.6	141.8	94.5	118.2	137.6
ND Carson	66	38	1	35.0	175.1	140.2	112.0	126.1	142.4
ND Heart	63	37	1	37.2	163.2	113.4	97.1	105.2	124.6
ND Spindle	65	40	1	33.2	181.0	130.3	117.3	123.8	142.9
Newburg	67	36	1	34.2	164.5	143.2	114.7	128.9	140.8
ORE3541M	62	35	1	37.8	184.0	134.2	115.3	124.7	144.5
Otana	66	40	1	35.7	168.0	131.7	113.4	122.5	137.7
Rockford	64	38	1	37.1	162.9	134.2	106.3	120.2	134.5
SD Buffalo	61	38	1	37.6	176.1	126.1	116.0	121.1	139.4
SD Momentum	65	43	1	38.6	--	--	107.8	--	--
SD Titan	63	42	1	37.3	--	--	116.6	--	--
ND Crema (hull-less)	67	41	1	40.6	113.1	101.8	71.3	86.6	95.4
Paul (hull-less)	69	42	1	38.6	121.9	106.6	77.4	92.0	102.0
Trial Mean	64.4	38	1	36.4	163.4	134.7	107.2	120.2	134.4
C.V. %	1.4	4.1	--	2.3	4.3	8.7	6.4	--	--
LSD 5%	1.1	1.9	--	1.0	8.2	13.7	8.1	--	--
LSD 10%	0.8	1.4	--	0.8	6.4	10.7	6.3	--	--

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

[2] 1 = no lodging, 9 = 100% lodged.

Planting Date: April 25

Harvest Date: August 2

Previous Crop: Oat Hay

2024 Oat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Grain Yield 2021	Grain Yield 2023	Grain Yield 2024	Average Yield[1] 2 Year	Average Yield[1] 3 Year
			in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Douglas	67	15,422	34	33.4	--	172.4	123.3	147.8	--
Beach	66	14,547	35	37.3	18.4	123.1	120.7	121.9	87.4
Cs Camden	68	15,217	36	33.0	15.3	161.2	125.0	143.1	100.5
Deon	70	16,203	37	34.6	18.5	132.3	119.8	126.1	90.2
Endure	71	15,620	37	32.8	--	175.5	131.4	153.5	--
HiFi	69	18,594	37	34.6	13.6	145.1	121.3	133.2	93.3
Jury	66	17,754	40	33.4	27.5	138.3	128.4	133.4	98.1
Killdeer	66	17,309	33	34.0	21.7	149.3	122.1	135.7	97.7
Leggett	69	16,086	33	34.6	15.6	151.6	116.3	133.9	94.5
MN Pearl	68	16,044	36	33.4	--	155.3	117.9	136.6	--
ND Carson	70	17,523	36	33.2	22.4	153.8	108.5	131.1	94.9
ND Crema	71	19,631	39	43.0	3.2	95.7	70.8	83.2	56.6
ND Heart	67	15,983	37	35.7	25.1	124.3	112.2	118.2	87.2
ND Spilde	67	15,637	38	32.9	25.1	127.2	138.3	132.7	96.9
Newburg	71	17,458	34	32.5	16.0	160.8	127.5	144.1	101.4
Otana	68	19,064	39	34.6	17.0	122.0	127.6	124.8	88.9
Paul	70	22,114	37	39.5	9.5	107.5	80.2	93.8	65.7
Rockford	69	17,918	37	36.0	17.1	131.9	122.5	127.2	90.5
SD Buffalo	66	15,803	37	35.1	--	146.5	113.9	130.2	--
SD Momentum	69	16,947	41	36.2	--	--	114.7	--	--
SD Titan	66	15,202	41	35.9	--	--	115.1	--	--
Trial Mean	68	16,381	37	35.2	20.2	139.2	117.1	129.0	89.6
CV %	2.3	5.2	5.1	1.8	30.5	9.4	5.9	--	--
LSD 0.10	1	771	2	0.6	7.2	11.9	6.3	--	--

Planting Date: April 23, 2024
Harvest Date: August 2, 2024
Previous Crop: Pea hay
Seeding Rate: 1 million live seeds/ac

[1] 2022 crop hailed out so previous year was used in averages

NDSU Hettinger Research Extension Center

Oil Type Sunflower - 2024 **Hettinger, ND**

Company/Brand	Hybrid	Oil Type & Traits[1]	Days to Bloom	Plant Height	Test Weight	Oil Content	Grain Yield		
							2024	2-Year	3-Year
			DAP[2]	inches	lbs/bu	%	----------lbs/ac----------		
CROPLAN	CP4255E	HO EX	65	48	30.1	41.1	1508	--	--
CROPLAN	CP4475E	HO EX	65	55	30.1	44.3	1710	--	--
CROPLAN	CP455E	HO EX	67	48	29.3	40.0	1492	2334	2741
CROPLAN	CP5249CL	HO CL	66	42	29.2	40.4	1512	--	--
Dynagro	H45HO10EX	HO EX	66	48	28.9	39.7	1430	1934	2259
Dynagro	H45NS16CL	NS CL	65	48	30.3	41.6	1543	2110	2325
Dynagro	H47HO11EX	HO EX	68	57	30.5	40.5	1538	2141	2432
Dynagro	H49HO19CL	HO CL	71	47	30.2	41.0	1640	2351	2731
Dynagro	H50HO20CP	HO CP	70	49	29.2	43.1	1459	--	--
Dynagro	XH41H56CL	HO CL	55	37	31.7	39.5	1528	--	--
Dynagro	XH41H90EX	HO EX	72	47	30.0	39.8	1311	--	--
Lidea	LS001	MO EX	65	47	28.3	40.3	1379	--	--
Lidea	LS002	HO EX	65	51	29.8	41.6	1565	--	--
Lidea	LS003	HO EX	72	49	28.3	37.9	1340	--	--
Lidea	LS004	HO EX	69	55	27.9	37.1	1353	--	--
Lidea	LS005	HO CP	69	49	29.8	40.4	1640	--	--
Lidea	LS006	HO EX	69	48	29.1	39.6	1257	--	--
Lidea	LS007	HO EX	71	59	30.4	40.1	1431	--	--
Nuseed	N4H205 E	HO EX	69	43	28.6	41.9	1369	--	--
Nuseed	N4H337 E	HO EX	70	45	28.8	40.7	1406	--	--
Nuseed	N4H422 CL	HO CL	68	57	30.9	43.7	1794	2246	2654
Nuseed	N4H462 E	HO EX	70	46	30.7	42.5	1473	--	--
Nuseed	N4H470 CLP	HO CP	69	44	30.3	43.4	1514	2261	2791
Nuseed	N4H490 E	HO EX	72	47	30.2	39.3	1320		--
Proseed	2508 CP	HO CP	71	63	29.6	36.9	1243	--	--
Proseed	2534 E	HO EX	71	49	30.7	42.8	1502	--	--
Proseed	2591 CP	HO CP	68	50	30.8	43.8	1666	--	--
Proseed	50068 CL	HO CL	70	52	28.9	40.9	1483	--	--
Proseed	E-2446 E	HO EX	72	53	28.9	38.5	1321	--	--
RAGT	AC2101	HO CP	66	53	26.8	39.5	1435	1797	2296
RAGT	AC2201	HO CL	68	52	29.2	40.6	1290	1868	--
RAGT	AC2202	HO CL	70	54	29.1	42.0	1374	--	--
Sunrich	4415	HO CP	68	51	29.4	41.2	1320	1951	2284
Sunrich	4425 CL	MO CL	69	53	29.2	37.1	1586	2197	2743
Thunder	TEX2403SF	HO EX	72	50	27.3	39.2	1182	--	--
Thunder	TEX2404SF	HO EX	71	57	29.9	40.3	1664	--	--
USDA (Check)	894	Conv	67	53	29.4	38.4	1358	1798	2145
CROPLAN (Check)	559CL	NS CL	70	51	28.4	41.4	1537	2404	2758
USDA (Check)	Honeycomb	NS	60	47	27.9	40.6	1125	1284	1113
Mycogen (Check)	8N270CLDM	NS CL	62	46	29.9	41.6	1232	1739	1777
Trial Mean			68	50	29.3	40.4	1431	2028	2361
C.V. %			1.3	8.2	4.2	5.2	14.4	--	--
LSD 5%			1.1	4.8	1.4	2.5	243	--	--
LSD 10%			0.8	3.8	1.1	1.9	188	--	--

[1] Type: TR-Traditonal, NS-NuSun, MO-Mid Oleic, HO-High Oleic, CL=Clearfield, CP=Clearfield Plus, EX=ExpressSun.

[2] Days after planting.

Planting Date: June 3 Harvest Date: October 11 Previous Crop: Wheat

Canola - Roundup Ready - 2024 **Hettinger, ND**

Brand	Cultivar	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Oil Content	Yield	
							2024	2-Yr. Avg.
		DAP[1]	days	DAP[1]	inches	%	---------lbs/a---------	
BrettYoung	BY 6219TF	44	26	86	37	40.6	1097	--
Canterra	CS3100 TF	48	25	89	40	41.5	916	1633
Canterra	CS3200 TF	46	22	86	40	42.4	1063	--
Canterra	CS3300 TF	44	27	85	38	43.7	1275	--
CROPLAN	CP9978TF	45	25	85	39	40.6	1080	--
CROPLAN	CP9221TF	45	23	84	35	40.2	1034	1503
Dekalb	DK902TF	45	25	85	36	42.1	1259	--
Nuseed	NC527CR TF	45	25	86	35	42.9	1118	1629
Proseed	TR 23127	46	24	84	37	42.8	1135	1707
Star	StarFlex	45	25	84	36	42.4	1038	1762
Trial Mean		45	25	84	38	41.7	1068	1647
C.V. %		4.1	6.9	1.1	4.8	1.3	8.1	--
LSD 5%		1.9	2.3	1.1	2.2	0.7	105	--
LSD 10%		1.5	1.7	0.8	1.7	0.5	80	--

[1] Days after planting.

Planting Date: May 10

Harvest Date: August 19

Previous Crop: Oat Hay

Canola - Liberty Link - 2024 **Hettinger, ND**

Brand	Cultivar	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Oil Content	Seed Yield	
							2024	2-Yr. Avg.
		DAP[1]	days	DAP[1]	inches	%	---------lbs/a---------	
BrettYoung	BY 7204LL	47	23	85	41	43.5	1145	--
Canterra	CS4000 LL	46	24	83	41	42.2	1211	1854
Canterra	CS4100LL	46	25	83	41	44.0	1285	--
CROPLAN	CP7130LL	46	24	83	42	42.1	1108	--
CROPLAN	CP7250LL	48	23	85	41	40.9	1106	1852
Trial Mean		46	24	84	42	41.9	1138	1853
C.V. %		1.2	2.1	0.3	4.7	1.0	8.8	--
LSD 5%		0.7	0.7	0.3	2.3	0.5	122	--
LSD 10%		0.5	0.5	0.2	1.8	0.4	94	--

[1] Days after planting.

Planting Date: May 10

Harvest Date: August 19

Previous Crop: Oat Hay

NDSU Hettinger Research Extension Center

Flax - 2024 **Hettinger, ND**

Variety	Days to Bloom	Plant Height	Plant Lodge	Oil Content	-------Grain Yield--------			Average Yield	
					2021	2023	2024	2-Yr	3-Yr[1]
	DAP [2]	inches	1-9[3]	%	---------- bu per acre ----------				
AAC Bright	53	21	1	43.6	18.3	31.9	16.8	24.4	22.3
AAC Marvelous	53	22	1	41.9	17.9	29.9	18.8	24.4	22.2
Carter 4	52	22	1	41.4	18.5	27.9	15.1	21.5	20.5
CDC Dorado [4]	47	21	1	42.8	18.2	30.9	14.2	22.5	21.1
CDC Glas	55	22	1	40.6	17.1	31.1	16.9	24.0	21.7
CDC Kernen	52	23	1	40.3	--	31.9	18.4	25.2	--
CDC Neela	54	23	1	41.2	17.5	35.8	18.9	27.4	24.1
CDC Rowland	53	21	1	40.2	17.5	34.3	15.8	25.1	22.5
Gold ND [4]	54	25	1	42.7	17.3	30.0	17.6	23.8	21.6
ND Hammond	53	22	1	41.1	18.3	28.5	16.2	22.4	21.0
Omega [4]	53	21	1	41.1	18.1	29.3	14.7	22.0	20.7
Webster	54	23	1	41.3	18.4	30.1	16.7	23.4	21.7
York	51	23	1	40.9	17.5	32.2	17.2	24.7	22.3
Trial Mean	53	22	1	41.6	18.0	30.3	16.7	24.2	21.9
C.V. %	1.3	6.6	--	2.5	5.6	10.4	12.0	--	--
LSD 5%	0.8	1.7	--	1.2	1.2	3.7	2.4	--	--
LSD 10%	0.7	1.4	--	1.0	0.9	2.9	1.8	--	--

[1] Average of 2021, 2023 and 2024

[2] Days after planting.

[3] 1 = no lodging, 9 = 100% lodged.

[4] Yellow seed type.

Planting Date: May 10

Harvest Date: September 3

Previous Crop: Peas

2024 Flax - Recrop **Dickinson, ND**

Variety	Days to Flower	Days to Mature	Plant Height	Test Weight	Oil Content	-- Grain Yield-- 2021	2023	2024	Average Yield[1] 2 Year	3 Year
			in	lbs/bu	%	------bu/ac------			----bu/ac----	
Gold ND	52	87	22	55.9	46.4	13.4	29.1	19.7	24.4	20.7
Carter	50	87	21	55.3	44.6	10.4	27.6	20.2	23.9	19.4
Omega	52	89	21	55.1	45.3	12.2	25.2	20.5	22.9	19.3
AAC Bright	51	89	22	53.4	46.6	13.4	24.2	22.1	23.2	19.9
ND Hammond	52	91	22	54.5	43.7	11.3	27.2	19.1	23.2	19.2
York	53	85	21	54.4	43.8	11.0	26.6	18.7	22.7	18.8
Webster	51	85	23	55.1	44.8	11.4	27.1	19.9	23.5	19.5
CDC Neela	50	89	20	54.7	44.2	12.2	29.0	21.3	25.1	20.8
AAC Marvelous	52	85	22	55.1	45.6	10.9	28.4	22.7	25.6	20.7
CDC Rowland	49	89	20	54.7	45.2	10.8	28.5	21.5	25.0	20.3
CDC Dorado	48	85	18	54.2	45.8	9.2	25.8	20.6	23.2	18.5
CDC Glass	53	85	21	53.8	45.3	8.6	28.4	21.8	25.1	19.6
CDC Kernen	50	85	22	55.2	44.1	--	31.5	20.7	26.1	--
Trial Mean	52	88	21	54.9	44.9	11.3	28.1	20.6	24.1	19.7
CV %	3.3	2.8	5.2	0.6	1.7	24.4	12.3	10.6	--	--
LSD 0.10	2	3	1	0.3	0.8	NS	3.7	2.3	--	--

Planting Date: May 2, 2024
Harvest Date: August 19, 2024
Previous Crop: Wheat
No Lodging observed
Oil content reported on 9% moisture basis
[1] 2022 crop hailed out so previous year was used in averages

Dry Bean - 2024 **Hettinger, ND**

Variety	Type	Days to Mature	Plant Height	Seed Weight	Grain Yield 2022	Grain Yield 2023	Grain Yield 2024	Average Yield 2 yr	Average Yield 3 yr
		DAP[1]	inches	g/100	lbs per acre	lbs per acre	lbs per acre	lbs per acre	lbs per acre
Cowboy	Pinto	104	18	36.5	1230	1788	1094	1441	1371
LaPaz	Pinto	107	17	35.3	965	2044	984	1514	1331
Lariat	Pinto	107	19	35.8	1177	1765	1007	1386	1317
Monterrey	Pinto	106	18	34.8	1129	2183	1132	1658	1481
ND Falcon	Pinto	108	18	32.2	1115	1979	1051	1515	1382
ND Palomino	Pinto	108	17	34.8	1072	1579	815	1197	1155
ND Rodeo	Pinto	109	15	34.0	1160	1839	1021	1430	1340
Torreon	Pinto	104	17	37.3	1250	1709	1231	1470	1397
USDA Diamondback	Pinto	108	17	34.8	--	1922	1020	1471	--
USDA Rattler	Pinto	106	15	36.1	--	2016	1179	1598	--
Vibrant	Pinto	103	18	30.4	908	2045	1098	1572	1350
Windbreaker	Pinto	103	15	36.4	560	1652	827	1240	1013
Blizzard	Navy	109	16	17.6	894	1583	656	1119	1044
HMS Medalist	Navy	110	16	16.8	868	1819	500	1159	1062
ND Polar	Navy	110	16	16.1	964	1925	546	1235	1145
T9905	Navy	111	16	16.7	1078	1720	857	1289	1219
Merlot	Red	108	17	32.9	782	1292	826	1059	966
Viper	Red	110	17	22.1	--	--	1102	--	--
ND Rosalind	Pink	108	12	26.9	--	2132	1017	1575	--
Rosetta	Pink	107	16	29.7	736	1599	1211	1405	1182
Black Tails	Black	109	15	18.4	946	1826	857	1341	1210
Eclipse	Black	106	15	21.7	983	2007	853	1430	1281
ND Twilight	Black	108	15	21.2	1018	1956	683	1319	1219
ND Pegasus	Great Northern	109	18	33.4	1404	2049	1243	1646	1565
Powderhorn	Great Northern	104	16	33.3	--	1778	1122	1450	--
Trial Mean		107	16	28.9	1016	1804	929	1395	1245
C.V. %		--	9.7	5.0	12.8	16.4	13.7	--	--
LSD 5%		--	1.9	1.7	178	348	149	--	--
LSD 10%		--	1.4	1.3	138	270	116	--	--

[1] Days after planting.

Planting Date: May 28

Harvest Date: September 25

Previous Crop: Spring Wheat

NDSU Hettinger Research Extension Center

Field Pea - 2024 **Hettinger, ND**

Variety	Brand	Days to Flower	Days to Mature	Canopy Height	Lodging	Seed Protein	1,000 Seed Wt.	Seeds Lb	Test Weight	Yield		
										2024	2-Yr. Avg.	3-Yr. Avg.
		DAP[1]	DAP[1]	inches	1 - 9[2]	%	gm	seeds	lb/bu	Bushels per acre		
Yellow Cotyledon Type												
2119	Valesco Genetics	54	88	26	3	29.3	184	2472	61.8	24.4	--	--
2822	Valesco Genetics	53	88	23	3	29.4	186	2447	61.6	25.6	48.1	--
5206	Valesco Genetics	55	87	27	3	28.3	201	2276	62.9	31.8	53.7	--
AAC Beyond	Meridian Seeds	55	87	22	4	27.7	184	2484	62.4	26.2	46.8	--
AAC Carver	Meridian Seeds	52	87	28	3	26.6	210	2177	62.9	30.4	--	--
AAC Chrome	Valesco Genetics	54	87	22	3	27.1	202	2250	61.9	28.4	50.9	46.6
AAC Julius	Valesco Genetics	54	87	24	3	28.1	198	2292	62.4	29.3	47.8	45.7
AAC Profit	Premier Genetics	54	87	27	3	29.6	184	2483	62.2	28.8	47.2	45.7
Caphorn	NDCISA	52	87	24	3	28.9	221	2075	61.2	31.6	--	--
CDC Boundless	NDCISA	55	88	25	3	28.4	190	2403	62.5	29.6	--	--
CDC Inca	Meridian Seeds	55	87	25	2	27.8	190	2385	61.5	27.7	50.1	48.4
CDC Specturm	Meridian Seeds	54	87	24	3	29.2	205	2224	62.0	30.7	50.7	48.9
CP5222Y	CROPLAN	51	87	26	4	27.4	199	2284	61.7	27.1	46.3	44.6
CP5244Y	CROPLAN	51	87	24	3	28.3	240	1893	61.5	27.9	41.7	40.6
DS Admiral	Pulse USA	52	86	23	4	27.7	217	2092	61.2	28.3	44.9	46.1
EP_6381	Equinom	52	88	24	3	29.5	178	2557	62.0	25.9	--	--
EP_6816	Equinom	53	87	25	3	28.7	198	2295	62.1	28.9	--	--
EP_8971	Equinom	53	87	25	3	31.1	202	2250	61.1	23.0	38.3	--
Iconic	NDCISA	53	87	26	4	29.0	246	1848	61.4	29.8	--	--
Lacross	Valesco Genetics	54	89	30	6	26.2	163	2780	62.7	23.4	--	--
McMurphy	Valesco Genetics	55	88	26	2	28.8	208	2189	61.7	30.5	--	--
MS Growpro	Meridian Seeds	55	87	26	2	28.0	179	2533	62.8	33.6	47.0	44.1
MS ProStar	Meridian Seeds	52	87	26	4	29.5	255	1779	60.9	29.7	49.4	--
MS23-Y1	Meridian Seeds	53	88	24	4	28.5	207	2197	60.9	24.4	--	--
ND Dawn	NDSU	54	87	23	3	27.3	207	2195	61.5	32.3	46.9	46.1
Orchestra	Premier Genetics	52	87	23	4	29.6	242	1874	62.1	29.6	44.0	42.1
PG Bank	Premier Genetics	53	87	28	3	28.5	223	2035	60.5	30.3	--	--
PG Cash	Premier Genetics	53	87	25	3	28.3	227	2001	61.1	30.6	48.4	--
PG Prairie	Premier Genetics	53	87	26	4	27.8	212	2144	61.4	29.8	--	--
Green Cotyledon Type												
Aragorn	Pulse USA	51	87	20	4	27.6	180	2529	61.1	20.9	30.7	31.3
Arcadia	Pulse USA	52	86	21	4	27.3	193	2349	60.8	24.9	38.7	37.9
CDC Striker	Pulse USA	54	87	23	4	29.4	200	2283	61.2	19.0	39.3	38.5
MS22-G1	Meridian Seeds	55	88	24	4	27.5	181	2516	61.2	17.6	--	--
ND Victory	NDSU	56	89	27	4	28.7	139	3281	61.5	19.9	41.4	41.0
PG Greenback	Premier Genetics	55	87	27	3	26.8	208	2181	62.3	33.4	--	--
Shamrock	Valesco Genetics	55	88	24	3	26.9	209	2169	61.5	23.9	42.9	40.8
Mean		53	87	25	3	28.3	201	2295	61.7	27.5	45.2	43.0
C.V. %		1.6	0.8	7.5	17.7	1.7	5.4	5.5	1.0	11.2	--	--
LSD 5%		1.0	0.9	2.2	0.7	0.6	13	149	0.7	3.6	--	--
LSD 10%		0.8	0.7	1.7	0.6	0.5	10	116	0.5	2.8	--	--

[1] Days after planting.

[2] Lodging: 1 = none, 9 = lying flat on ground.

Planting Date: May 3

Harvest Date: August 9

Previous Crop: Corn

NDSU Dickinson Research Extension Center

2024 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 2024	Average Yield 2 Year	Average Yield 3 Year
				gm		in	lbs/bu	%		--bu/ac--	
Yellow Cotyledon Type											
DS Admiral	Pulse USA	56	88	214	2,118	27	62.9	26.8	50.0	37.1	39.4
ND Dawn	NDSU	57	89	212	2,140	25	62.7	27.2	51.1	37.2	38.1
AAC Profit	Premier Genetics	57	90	195	2,334	28	64.5	29.4	43.8	41.4	--
EP_6816	Equinom	53	89	188	2,420	28	63.0	28.5	47.7	37.8	--
EP_8971	Equinom	55	90	209	2,180	28	63.7	30.5	41.9	31.8	--
EP_6381	Equinom	57	90	185	2,456	30	62.7	29.4	42.7	--	--
CDC Inca	Meridian Seeds	58	90	210	2,166	29	64.3	27.8	45.9	36.6	38.2
CDC Spectrum	Meridian Seeds	56	90	219	2,074	27	63.9	28.1	46.8	39.1	39.2
MS GrowPro	Meridian Seeds	55	90	278	1,632	31	63.4	28.3	48.0	38.5	36.3
AAC Beyond	Meridian Seeds	58	89	198	2,292	25	64.3	27.3	45.7	40.9	--
MS Prostar	Meridian Seeds	58	90	222	2,046	30	63.1	28.4	53.9	42.7	--
AAC Carver	Meridian Seeds	56	88	211	2,153	26	63.4	25.6	51.3	--	--
GTPC001	GeneTech	57	88	205	2,213	23	62.9	27.5	51.4	--	--
GTPR004	GeneTech	58	90	206	2,197	22	63.0	28.8	51.0	--	--
GTPR005	GeneTech	58	90	208	2,176	23	63.0	29.1	53.5	--	--
CP5222Y	CROPLAN	53	90	214	2,116	26	65.6	26.1	40.8	34.3	36.6
CP5244Y	CROPLAN	52	88	241	1,885	26	64.7	27.0	51.2	38.4	38.8
AAC Julius	Valesco Genetic	58	88	184	2,467	27	63.5	27.9	49.2	41.4	42.7
Caphorn	NDCISA	57	90	247	1,837	30	63.8	28.0	45.4	--	--
PS17100022	NDCISA	55	88	232	1,952	22	63.7	27.1	56.0	43.3	--
Iconic	NDCISA	57	89	248	1,833	30	64.0	27.8	49.6	--	--
Orchestra	Premier Genetics	55	90	248	1,827	27	63.7	29.2	53.4	39.4	--
PG Cash	Premier Genetics	56	89	225	2,017	27	63.9	28.0	51.1	43.1	--
PG Prairie	Premier Genetics	57	90	242	1,871	27	64.4	26.0	38.8	--	--
Green Cotyledon Type											
Aragorn	Pulse USA	54	88	182	2,495	22	62.2	27.2	37.2	29.4	31.1
Arcadia	Pulse USA	57	88	181	2,502	22	62.6	26.4	45.6	35.5	37.2
CDC Striker	Pulse USA	59	89	220	2,060	26	63.5	28.5	37.4	30.0	34.6
ND Victory	NDSU	60	92	153	2,961	32	64.3	27.7	23.0	23.7	26.5
PG Greenback	Premier Genetics	59	90	209	2,173	33	65.1	26.4	49.9	41.4	--
Trial Mean		56	89	210	2,190	27	63.7	27.8	46.8	37.3	36.6
CV %		2.7	0.7	2.8	2.8	7.3	0.5	1.6	7.7	--	--
LSD 0.10		1	1	5	56	2	0.3	0.4	3.3	--	--

Planting Date: April 25, 2024
Harvest Date: July 26, 2024 for all except ND Victory was harvested July 29, 2024
Previous Crop: cover crop forage
Seeding Rate: 325,000 live seeds/ac
Grain protein percentages reported on 0% moisture basis

Soybean - Roundup Ready - 2024 **Hettinger, ND**

Company /Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Seed Oil	Seed Protein	Yield 2024	Yield 2-Yr	Yield 3-Yr
				inches	lbs/bu	%	%			
NDSU	ND17009GT	00.9	9/10	27	56.1	17.8	32.6	20.2	32.1	30.4
Xitavo	XO 0094E	00.9	9/15	20	54.3	18.0	30.2	22.4	36.7	--
Thunder	TE7502N	0.2	9/15	22	53.2	17.6	31.8	20.2	--	--
Thunder	TX8402N	0.2	9/15	26	54.6	17.0	30.5	27.6	--	--
Xitavo	XO 0234E	0.2	9/16	22	55.1	17.5	31.6	26.2	38.5	--
Thunder	TX8304N	0.4	9/14	26	54.2	17.9	30.4	25.3	--	--
Thunder	TX8305N	0.4	9/20	24	55.1	17.4	31.6	25.3	--	--
Thunder	TE7405N	0.5	9/17	23	54.8	18.4	29.4	24.1	--	--
Xitavo	XO 0554E	0.5	9/18	23	54.4	18.5	29.2	24.8	39.3	--
Xitavo	XO 0602E	0.5	9/16	22	55.8	17.1	31.0	26.0	41.7	38.2
Xitavo	XO 0731E	0.6	9/18	20	55.0	18.1	30.3	23.7	40.9	36.8
NDSU	ND2108GT73	0.7	9/16	22	55.8	18.0	30.0	27.3	42.7	37.8
Trial Mean			9/15	23	54.9	17.8	30.7	24.4	38.8	35.8
C.V. %			0.9	7.0	1.0	2.5	2.9	7.0	--	--
LSD 5%			1.2	1.9	0.6	0.5	1.1	2.0	--	--
LSD 10%			0.9	1.5	0.5	0.4	0.8	1.6	--	--

Planting Date: May 28
Harvest Date: September 25
Previous Crop: Spring Wheat

Soybean - Conventional - 2024 **Hettinger, ND**

Company /Brand	Variety	Maturity	Mature Date	Plant Height	Test Weight	Protein	Oil	Yield 2024	Yield 2-Yr	Yield 3-Yr
				inches	lbs/bu	%	%			
NDSU	ND Rolette	00.9	9/14	19	55.0	30.2	18.5	23.4	36.5	34.5
NDSU	ND Benson	0.4	9/19	20	54.7	32.6	17.7	20.8	37.3	34.9
NDSU	ND Dickey	0.7	9/21	21	54.6	31.0	16.9	22.4	41.0	36.7
Trial Mean			9/18	20	54.8	31.2	17.7	22.2	38.2	35.4
C.V. %			0.0	6.8	1.7	2.5	6.1	11.7	--	--
LSD 5%			2.5	2.3	1.6	1.4	0.6	4.5	--	--
LSD 10%			2.0	1.9	1.3	1.1	0.5	3.5	--	--

Planting Date: May 28
Harvest Date: September 25
Previous Crop: Spring Wheat

NDSU Hettinger Research Extension Center

Soybean - Roundup Ready - 2024 **Mandan, ND**

Company/Brand	Variety	Maturity	Plant Height	Test Weight	Seed Oil	Seed Protein	Yield 2024	Yield 2-Yr	Yield 3-Yr
			inches	lbs/bu	%	%	------ Bushels per acre ------		
NDSU	ND17009GT	00.9	37	57.6	16.9	35.9	46.3	47.2	45.0
Xitavo	XO 0094E	00.9	26	55.2	16.0	34.7	52.7	51.0	--
Thunder	TE7502N	0.2	28	54.5	16.3	35.0	53.8	--	--
Thunder	TX8402N	0.2	34	55.3	15.6	33.8	53.5	--	--
Xitavo	XO 0234E	0.2	28	55.1	15.8	35.9	55.1	55.0	--
Thunder	TX8304N	0.4	34	55.5	16.1	34.8	52.3	--	--
Thunder	TX8305N	0.4	30	55.5	15.6	36.2	56.1	--	--
Thunder	TE7405N	0.5	31	53.8	16.3	34.4	55.9	--	--
Xitavo	XO 0554E	0.5	28	55.1	16.5	34.2	55.2	58.4	--
Xitavo	XO 0602E	0.5	30	54.8	15.0	36.0	56.5	60.1	54.7
Xitavo	XO 0731E	0.6	30	55.6	15.8	35.6	55.4	57.9	54.7
NDSU	ND2108GT73	0.7	31	54.7	16.4	34.4	51.7	56.5	53.8
Trial Mean			31	55.2	16.0	35.1	53.7	55.2	52.1
C.V. %			6.0	1.6	1.6	1.5	4.7	--	--
LSD 5%			2.2	1.0	0.3	0.6	2.9	--	--
LSD 10%			1.7	0.8	0.2	0.5	2.2	--	--

Planting Date: May 31
Harvest Date: October 3
Previous Crop: Spring Wheat

NDSU Hettinger Research Extension Center

Lupin - 2024 **Hettinger, ND**

Variety	Days to Flower	Canopy Height	Lodging	1,000 Seed Wt.	Seeds Lb	Seed Yield 2024	Seed Yield 3-Yr. Avg.
	DAP[1]	inches	1 - 9[2]	gm	seeds	lb/ac	lb/ac
NR55-BAER	46	19	1	262	1737	549	1180
LND0127	47	19	1	249	1820	639	1213
LND0212	47	18	1	247	1837	654	1151
LND0229	47	18	1	223	2034	560	1076
LND0431	47	18	1	237	1917	527	999
LND0614	48	18	1	236	1924	540	1240
LND0617	48	18	1	223	2032	522	997
LND0619	48	18	1	232	1955	501	1118
LND0727	48	18	1	223	2037	521	1113
LNDA210	48	17	1	236	1925	470	1087
LND0704	48	18	1	218	2081	503	--
LND0733	49	17	1	228	1989	508	--
LUPRO2085	47	17	1	240	1899	547	--
Trial Mean	48	18	1	235	1941	546	1118
C.V. %	1.4	5.7	--	4.0	3.8	8.9	--
LSD 5%	0.9	1.4	--	13	104	67	--
LSD 10%	0.7	1.1	--	10	80	52	--

[1] Days after planting.

[2] Lodging: 1 = none, 9 = lying flat on ground.

Planting Date: May 3

Harvest Date: September 3

HRSW Fungicide - 2024 **Hettinger, ND**

Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Yield
	DAP[1]	inches	1-9[2]	lbs/bu	bu/ac
Variety					
ND Vitpro	57	30	1	53.8	52.8
Shelly	60	30	1	55.3	55.2
WB9590	55	27	1	56.9	59.8
LSD 5%	0.1	1.3	NS	1.1	6.7
Fungicide					
Untreated	57	29	1	55.0	55.1
Prosaro	57	29	1	55.3	56.0
Miravis Ace	57	29	1	55.9	56.6
Prosaro Pro	57	29	1	55.3	56.0
Sphaerex	57	29	1	55.5	56.6
LSD 5%	NS	NS	NS	NS	NS
Variety x Fungicide					
ND Vitpro					
Untreated	57	30	1	53.8	52.4
Prosaro	57	30	1	53.3	53.5
Miravis Ace	57	29	1	54.5	52.5
Prosaro Pro	57	31	1	53.5	53.1
Sphaerex	57	30	1	54.4	53.9
Shelly					
Untreated	60	30	1	54.1	54.6
Prosaro	60	30	1	56.1	55.6
Miravis Ace	60	30	1	56.1	56.3
Prosaro Pro	60	30	1	55.2	54.5
Sphaerex	60	29	1	55.4	55.2
WB9590					
Untreated	55	28	1	57.2	58.2
Prosaro	55	28	1	56.6	58.9
Miravis Ace	55	27	1	57.2	60.9
Prosaro Pro	55	27	1	57.3	60.4
Sphaerex	55	27	1	56.7	60.9
LSD 5%	NS	NS	NS	NS	2.9
Average	57	29	1	55.4	56.0
CV	0.1	2.7	--	1.8	3.6

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

[2] 1 = no lodging, 9 = 100% lodged.

Planting Date: May 2

Harvest Date: August 15

Feeks 10.51 Application: July 3

Durum Fugicide - 2024 **Hettinger, ND**

Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Yield
	DAP[1]	inches	1-9[2]	lbs/bu	
Untreated	59	35	1	55.9	50.6
Prosaro	59	35	1	55.6	50.9
Miravis Ace	59	34	1	55.2	52.5
Prosaro Pro	59	35	1	55.3	52.9
Sphaerex	59	34	1	55.5	51.9
Trial Mean	59	34	1	55.4	51.7
C.V. %	--	3.9	--	1.7	3.2
LSD 5%	--	1.7	--	1.1	2.1
LSD 10%	--	1.3	--	0.9	1.6

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

[2] 1 = no lodging, 9 = 100% lodged.

Variety: ND Riveland

Planting Date: May 2

Harvest Date: August 15

Feeks 10.51 Application: July 3

Canola Planting Date - 2024 **Hettinger, ND**

Treatment	Start Flower	End Flower	Start Flower	End Flower	Bloom Duration	Mature	Plant Height	Test Weight	Seed Oil	Grain Yield
	date	date	DAP[1]	DAP[1]	days	DAP[1]	inches	lbs/bu	%	bu/ac
Planting Date										
4/25	6/14	7/9	51	76	25	94	37	47.0	40.9	1284
5/1	6/18	7/11	49	72	23	91	38	48.3	40.5	1233
5/9	6/24	7/16	47	69	22	85	38	47.4	39.9	960
5/16	6/27	7/18	43	64	21	78	39	47.9	39.6	912
5/22	7/4	7/21	44	61	17	72	38	.	38.0	529
6/3	7/14	7/28	42	56	14	68	32	.	.	48
LSD 5%	0	0	0	0	1	0	2	--	0.9	127
Date X Variety										
4/25 - L340PC	6/14	7/8	51	75	24	94	39	46.6	40.9	1422
4/25 - CP7250LL	6/16	7/12	53	79	26	97	37	48.4	41.4	1466
4/25 - DKTFLL21SC	6/13	7/7	50	74	24	92	36	45.3	40.5	966
5/1 - L340PC	6/19	7/11	50	72	22	92	40	47.8	40.4	1422
5/1 - CP7250LL	6/20	7/13	51	74	23	92	39	48.8	41.1	1310
5/1 - DKTFLL21SC	6/16	7/10	47	71	24	89	35	48.4	40.0	966
5/9 - L340PC	6/24	7/16	47	69	22	85	40	47.1	39.1	1010
5/9 - CP7250LL	6/25	7/18	48	71	23	87	39	48.2	40.3	979
5/9 - DKTFLL21SC	6/22	7/13	45	66	21	82	36	46.6	40.3	891
5/16 - L340PC	6/27	7/18	43	64	21	77	41	47.7	39.8	1020
5/16 - CP7250LL	6/29	7/19	45	65	20	79	40	48.3	39.7	970
5/16 - DKTFLL21SC	6/26	7/17	42	63	21	77	36	.	39.4	747
5/22 - L340PC	7/4	7/20	44	60	16	71	40	.	37.7	574
5/22 - CP7250LL	7/5	7/23	45	63	18	74	40	.	37.1	498
5/22 - DKTFLL21SC	7/3	7/19	43	59	17	70	35	.	39.3	514
6/3 - L340PC	7/14	7/28	42	56	14	68	36	.	.	34
6/3 - CP7250LL	7/15	7/28	43	56	13	68	31	.	.	44
6/3 - DKTFLL21SC	7/12	7/28	40	56	16	68	29	.	.	65
LSD 5%	1	1	1	1	2	2	3	--	NS	210
Trial Mean	6/27	7/17	46	66	20	81	37	47.6	39.8	828
C.V. %	0.1	0.1	0.5	0.1	1.2	0.1	5.8	--	2.6	12.4

[1] Days after planting

Harvest Dates: All Dates 8/19

Previous Crop: Oats

Sulfur Fertilizer for Canola Production in Southwest North Dakota

Introduction

Sulfur is the fourth most important macronutrient after Nitrogen, Phosphorous and Potassium for crop growth and development. Sulfur is a component of amino acids such as cysteine and methionine that serve as building block of proteins and enzymes, essential for chlorophyll production and also driver of tolerance to biotic pests and abiotic stressors. By activating enzymes, notably acetyl-CoA carboxylase, it supports oil formation in oilseed crops like canola through its role in lipid metabolic pathways. Current NDSU sulfur recommendation is 20 lb/ac for canola production in regions south/west of the Missouri Coteau in North Dakota. However, this recommendation is based on research conducted decades ago in north/east of the Missouri Coteau which is cooler and wetter compared to south/west of the Coteau. Therefore, there is a need for more immediate and region-specific research for sulfur recommendation in canola to support its growing acreage in south/west North Dakota. The objectives of this project were to evaluate effects of different sulfur fertilizer sources and application rates in canola yield and quality in southwest North Dakota and assess combination of these sulfur sources and rates with different nitrogen management (rates) in canola yield and quality in the region.

Materials and Methods

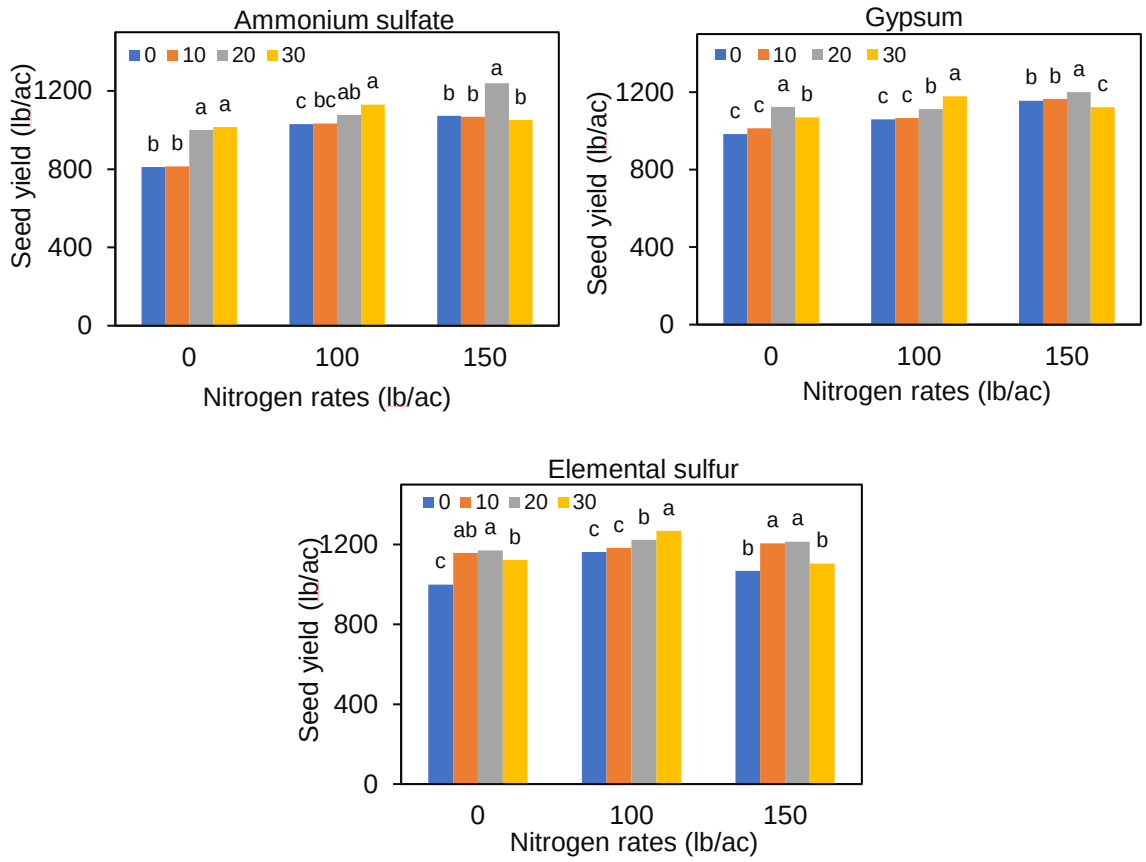
This is a second-year follow-up of the trial which was initiated in 2023. Research was conducted in three different locations across southwest North Dakota: Dickinson, Minot and Hettinger. Canola was solid seeded in May and right after planting treatments were broadcasted. We evaluated three different treatments in this study. One of our treatments was sulfur fertilizer sources which included ammonium sulfate, gypsum and elemental sulfur. Our second treatment was sulfur fertilizer rates: 0, 10, 20 and 30 lb/ac and third treatment was nitrogen rates: 0, 100 and 150 lb/ac. Nitrogen rate of 0 indeed had nitrogen equivalent to 30 lb/ac ammonium sulfate supplemented with urea. Each treatment was replicated four times and individual plot size was 30×10 ft. Our experimental design was randomized complete block design in split-split-plot arrangement. When canola reached physiological maturity, middle 5 ft across the length of each plot was harvested using plot combine for seed yield and oil content. A commercial grain tester was used to assess seed moisture content and test weight. Seed yield was adjusted to standard 8.5% moisture content.

Results

This year results identified a significant three-way interaction among sulfur fertilizer sources, sulfur and nitrogen rates. In ammonium sulfate, 20 lb/ac sulfur consistently ranked the top for seed yield across all nitrogen rates (Fig. 1). In gypsum and elemental sulfur, 20 lb/ac sulfur again ranked the top in two out of three different nitrogen rates that were evaluated in this project. Application of 20 lb/ac sulfur should produce optimum canola seed yield regardless of different nitrogen management. Within sulfur rate of 20 lb/ac, more linear increase in seed yield was observed increasing nitrogen rates for ammonium sulfate type sulfur fertilizer source than other sources. Applying 20 lb/ac ammonium sulfate along with adequate nitrogen may be a suitable fertilizer management strategy for maximizing canola production in southwest North Dakota.

However, there were some inconsistencies in results as data showed greater seed yield in case of gypsum and elemental sulfur type sulfur fertilizer sources when minimal nitrogen was applied. Results were also not consistent across the two years of the present study. Therefore, further research is imperative to establish definitive conclusions. We will continue this study in future to develop robust recommendation for sulfur fertilizer application in canola production in the southwest North Dakota.

Fig. 1. Canola seed yield affected by different sulfur rates (0, 10, 20 and 30 lb/ac), sulfur fertilizer sources (Ammonium sulfate, gypsum and elemental sulfur) and nitrogen rates (0, 100 and 150 lb/ac). Columns marked with same letter are not significantly different at $P \leq 0.05$.



Boron Impacts on Canola

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Boron has gained interest as a micro-nutrient for canola and other crops. Boron is needed for cell walls, hormone regulation, pollination, and seed production. Boron was hand applied at 0, 5, and 10 lbs B/ac after planting. The initial boron soil test was 0.3 ppm. Treatments did not impact canola yield (p-value 0.164; C.V. 35.91). The crop was a failure as the average canola seed yield was 393 lbs/ac and the coefficient of variation (C.V.) was relatively high and suggests that the data was not good. This research will be redone in 2025.

Canola Sulfur Impacts on Spring Wheat

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Introduction

A canola sulfur trial was conducted in 2023 (Augustin, 2023). Sulfate forms of sulfur are generally recommended as they are more readily plant available and more likely to provide a response for the current crop (Franzen, 2023a). However, some apply elemental sulfur for the following crop. This is difficult to assess since the standard sulfate test can be unreliable and not diagnostic (Franzen, 2023b). This project evaluated spring wheat impacts from the 2023 canola sulfur trial.

Methods

Sulfur was applied to canola in 2023 at rates of 0, 10, 20, and 30 lbs sulfate/ac. Fertilizers used were gypsum, ammonium sulfate, and elemental sulfur. The spring wheat (ND Heron) was planted at 1.1 million pure live seeds per acre on May 15, 2024. The crop was managed following integrated pest management guidelines and harvested with a plot combine. Plots were 5x30 feet.

Results

Treatments did not impact wheat grain yield (p-value 0.292; C.V. 7.57), test weight (p-value 0.481; C.V. 2.66), and protein content (p-value 0.345; C.V. 7.18). Average grain yield, test weight, and protein content were 23 bu/ac, 57.1 lbs/bu, and 14.2 % respectively. The droughty conditions negatively impacted the spring wheat. This project will be redone in 2025 due to the difficulty to develop conclusions from one year of data.

References

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Sulfur Impacts on Spring Wheat

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Introduction

Sulfur fertilizer seems to get more attention each year as the frequency of deficiencies have been increasing. Sulfur is tough to manage (Franzen, 2023a). Small grain fields that are sandy and/or have less than 2% organic matter can benefit from 10 lbs sulfate/ac (Franzen, 2023b). Sulfate forms of fertilizer tend to be the most reliable (i.e. ammonia sulfate). Whereas, elemental sulfur takes time to mineralize and become plant available (Franzen, 2023c). Elemental sulfur may not be rendered plant available to short season crops like canola or wheat when the sulfate demand is greatest.

Methods

This project evaluated sulfur fertilizer use on canola the prior year (2023) and spring applied sulfur (2024) on the current spring wheat crop. Fertilizer was hand applied at 0, 5, 10, 15, 20 lbs sulfur/ac as gypsum, ammonium sulfate, and elemental sulfur the day after planting. A broadcast fertilizer spreader applied 100 lbs nitrogen/ac on the plots. The spring wheat (ND Heron) was planted at 1.1 million pure live seeds per acre on May 13, 2024. The crop was managed following integrated pest management guidelines and harvested with a plot combine. Plots were 5x30 feet.

Results

Sulfur treatments did not improve spring wheat grain yield (p-value 0.514; C.V. 18.60), protein (p-value 0.1651; C.V. 4.68), or test weight (p-value 0.696; C.V. 2.46). The average yield, test weight, a protein content were 24 bu/ac, 47.8 lbs/bu, and 17.1 % respectively. The wheat crop was drought stressed as the wheat grains were shriveled and dull. We will continue this research in 2025 as it is difficult to draw conclusions from one year of research.

References

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Soybean Phosphorus Impacts on Spring Wheat

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Introduction

Soybeans have been found to inconsistently respond to phosphorus fertilizers (Bardella, 2016). However, many fertilize soybeans with phosphorus to prevent a yield or quality drag next to year's crop. A soybean phosphorus rate study was initiated in 2023 (Augustin, 2023) where triple-superphosphate was hand applied at 0, 23, 46, 69, and 92 lbs P_2O_5/ac. Those treatments did not impact soybean yield or quality (Augustin, 2023). Spring phosphorus treatments did not increase fall Olsen (0-6 inch depth) soil tests (Figure 1).

Methods

Spring wheat (ND Heron) was planted into the 2023 soybean phosphorus plots on May 7, 2024 at 1.1 million pure live seeds per acre. Nitrogen and potassium were broadcasted after planting. The crop was managed following integrated pest management guidelines and harvested with a plot combine. Plots were 5x35 feet.

Results

2023 fertilizer treatments on soybeans did not impact 2024 spring wheat yields (p-value 0.346; C.V. 9.93), protein (p-value 0.951; C.V. 2.37), or test weight (p-value 0.844; C.V. 1.24). Means and ranges for yield, protein, and test weight are in Table 1. The lack of a response could be due to the dry growing season paired with banded/in-furrow phosphorus fertilizers have been found to improve spring wheat yields (Alessi and Power, 1980). Wheat yield and quality was below the long-term average at the Dickinson Research Extension Center (Table 1).

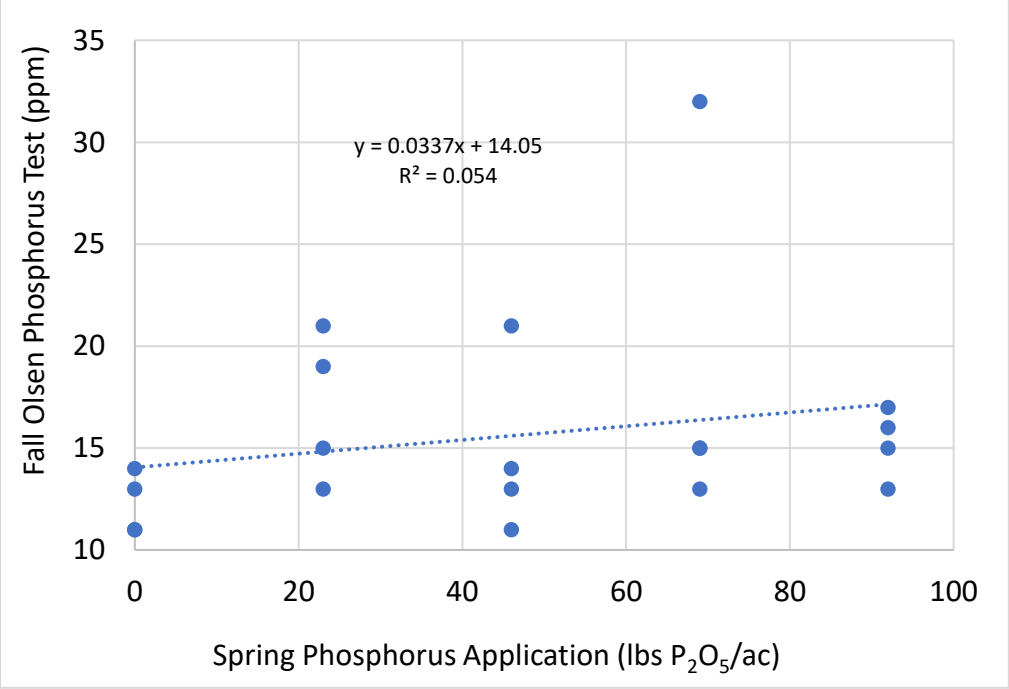

Table 1. Spring wheat yield and quality.

	Bushels/Acre	Protein %	Test Weight (lbs/bu)
Mean	25.5	18.2	48.6
Range	19.4 - 30.7	17.8 - 18.5	46.9 - 50.2

References

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Phosphorus Impacts on Soybean Grown in Southwest North Dakota

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Introduction

Soybean is an expanding crop in southwestern North Dakota and little data is available to guide soybean farmers on fertilizer management. Soybean has been found to inconsistently respond positively to phosphorus fertilizers in potentially higher yielding environments (Bardella, 2016; Lauzona and Miller, 2008; Mallarino and Borges, 2000; Mallarino and Haq, 2005; Slaton et al., 2010).

Methods

A field trial that evaluated hand applied triple-superphosphate at rates of 0, 23, 46, 69, and 92 lbs P_2O_5/ac. This research occurred at the Dickinson Research Extension Center (DREC) and nearby Beulah. The previous crop was forage-oat hay and barley at the DREC and Beulah sites respectively. Initial soil tests at the DREC were 3 ppm Olsen phosphorus, pH 6.9, and 64 lbs nitrogen/ac. Soybeans were solid seeded with a no-till drill. Beulah initial soil tests were 2 ppm Olsen phosphorus, pH 6.8, and 41 lbs nitrogen/ac and planted with a hoe-drill air-seeder.

Average yield, protein, and oil content are reported in Table 1. Phosphorus treatments did not impact soybean yield (p-value 0.421; C.V. 26.15), protein (p-value 0.648; C.V. 6.78), and oil (p-value 0.620; C.V. 3.59) content at the DREC site. Phosphorus treatments did not impact yield (p-value 0.065; C.V. 41.73) and protein (p-value 0.135; C.V. 1.69) at the Beulah experiment. However, phosphorus did impact soybean oil content (p-value 0.047; C.V. 1.82). The impact resulted in the lowest oil content from the 69 lbs P_2O_5/ac treatment.

Results

Phosphorus treatments did not impact soybean grain yields. However, fall soil tests were impacted as both sites had p-values of <0.001 (Figure 1). Phosphorus applications may not impact soybeans, but could impact the subsequent crop. Next year, the DREC site will be planted with spring wheat to see if the previous year's phosphorus treatment could impact the following year's wheat crop.

Table 1. Average soybean yield, protein, and oil.

	Yield	Protein	Oil
	-bu/ac-	---%---	
DREC	22.0	18.9	27.7
Beulah	10.0	18.0	33.4

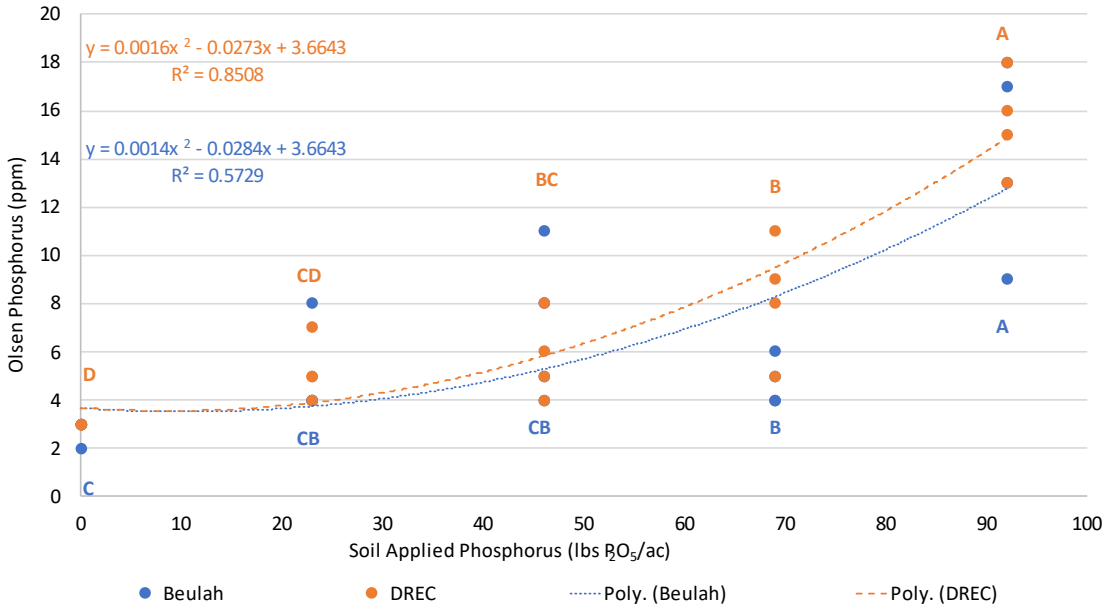

Figure 1. Spring applied phosphorus impacts on fall soil test (p-value <0.001). Different letters indicate statistical significance at the 0.05 level.

References

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Evaluation of herbicide options for postemergence weed control in spring wheat at Hettinger, ND, 2024.

A trial was conducted at Hettinger, ND in 2024 to evaluate the efficacy of herbicides for weed control in spring wheat. The primary focus of this trial was to evaluate kochia control, although we were also able to evaluate wild buckwheat, common lambsquarters, and common mallow. For years, the herbicide fluroxypyr has been instrumental for controlling kochia in spring wheat. In recent years, there has been development of some populations of kochia that have increased tolerance to fluroxypyr, which has necessitated changes in strategies for controlling this weed. Most of the herbicide treatments in this trial contain fluroxypyr as a lone treatment or as premixes or tank-mixes (Table 1). Spring wheat was planted on May 1, 2024, using a no-till drill at a depth of 2 inches. Spring wheat emerged on May 14. Herbicide treatments were applied on June 7 when weeds averaged 2 to 3 inches in height (Table 2). When evaluated 2 weeks after treatment (2 WAT), fluroxypyr alone (Starane Ultra) controlled kochia at 72%, with lesser control of other weeds. The addition of bromoxynil (Maestro 2EC) to fluroxypyr increased kochia control to 81% for 16 oz/A of Maestro 2EC, and 92% for both 24 and 32 oz/A of Maestro 2EC. All other treatments controlled kochia at 84 to 93%. Wild buckwheat control increased with combinations of fluroxypyr and bromoxynil, with the best treatments being, Starane Ultra plus Maestro (24 and 32 oz/A) and Bison (MCPA plus bromoxynil) plus Starane Ultra (2.8 and 5.6 oz/A). Common lambsquarters and common mallow control followed a similar trend with control increasing with higher amounts of bromoxynil added to fluroxypyr. Little to no injury was observed with any of these treatments. Wheat yield was lowest in the untreated control, with most treatments being statistically similar. This trial demonstrates the importance of not relying on a single herbicide or mode of action when trying to control weed in spring wheat (or any crop).

Table 1. Evaluation of postemergence options for weed control in spring wheat at Hettinger, ND, 2024.

	Treatment	Rate	Kochia	wild buckwheat	lambsquarters	mallow	Spring wheat Injury	Spring wheat Yield
		oz/A	% control				Bu/A	LB/BU
1	Untreated		0d	0f	0d	0e	0h	36.1b
2	Starane Ultra	5.6	72c	60e	41c	55d	1gh	38.5ab
3	Starane Ultra	5.6	81bc	82cd	83b	69bc	6bcd	38.0ab
	Maestro 2EC	16						
4	Starane Ultra	5.6	92a	88ab	95ab	75ab	8ab	37.6ab
	Maestro 2EC	24						
5	Starane Ultra	5.6	92a	92a	96ab	82a	9a	37.5ab
	Maestro 2EC	32						
6	Huskie FX	13.5	88ab	82cd	91ab	77ab	4def	40.4a
7	Huskie Complete	13.7	88ab	81cd	92ab	80ab	3efg	39.9ab
8	Batalium Amped	16	88ab	86bc	84ab	82ab	5c-f	38.7ab
9	Talinor	13.7	84ab	81cd	92ab	61cd	3fg	41.4a
10	Tolvera	11	85ab	79d	92ab	77ab	4def	35.9b
11	Carnivore	16	86ab	85bc	88ab	74ab	8abc	38.4ab
12	Carnivore	24	90ab	83bcd	89ab	72abc	7abc	38.5ab
13	Bison	24	85ab	84bcd	92ab	79ab	6b-e	39.0ab
14	Bison	24	93a	88ab	91ab	80ab	7abc	38.9ab
	Starane Ultra	2.8						
15	Bison	24	90ab	88ab	97a	81ab	8ab	39.0ab
	Starane Ultra	5.6						
LSD P=.05			9.1	6.0	12.9	11.3	2.6	3.70
Standard Deviation			6.4	4.2	9.0	7.9	1.8	2.58
CV			7.9	5.42	11.42	11.45	32.6	7.09
Treatment F			52.358	116.292	32.962	27.195	10.418	2.615
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0106

Table 2. Application environment and equipment for postemergence application of herbicide treatments for weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-7-2024	Equipment Type	Tractor mounted
Start Time	8:19 AM	Operation Pressure	42 PSI
Stop Time	9:18 AM	Nozzle Model	11002DG
Air Temperature Start, Stop	67.7, 66.7 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	42.5, 36.9	Boom Length	100 IN
Wind Velocity+Dir. Start	4.1 MPH, SSE	Boom Height	20 IN
Wind Velocity+Dir. Stop	9.9 MPH, SSE	Ground Speed	4.2 MPH
Wind Velocity+Dir. Max	12.1 MPH, SSE	Carrier	WATER
Wet Leaves (Y/N)	N, no	Application Amount	10 GAL/AC
Soil Temperature	46 F	Propellant	CO2
% Cloud Cover	25	Tank Mix (Y/N)	Yes

Evaluation of Huskie FX compared with other herbicides for weed control in spring wheat at Hettinger, ND, 2024

A trial was conducted at Hettinger, ND to evaluate weed control with the herbicide Huskie FX (fluroxypyr plus bromoxynil plus pyrasulfotole) compared with other herbicides used for weed control in spring wheat. Huskie FX is a relatively new herbicide registered for weed control in wheat, although it is essentially a new premix of herbicides that have been previously labelled. It has been demonstrated in the past to control many common broadleaf weeds that are problematic in spring wheat production in North Dakota. Wheat was seeded using a no-till drill on April 29, 2024 at a depth of 2 inches. One week prior to planting, glyphosate was applied to the entire plot area to control emerged weeds. Wheat emerged on May 13. Herbicide treatments (Table 1) were applied on June 7 when weeds were 2 to 3 inches in height on average. Weeds present included kochia, common lambsquarters, and wild buckwheat. Control of kochia resulting from application of Huskie FX at 2 WAT was greater when comparing rates of 18 oz/A with 15.5 oz/A. This difference was not seen at the 4 WAT evaluation. Kochia control with Huskie FX was greater than what was seen when compared with Widearmatch (fluroxypyr plus clopyralid plus halauxifen) plus MCPA, Talinor (bromoxynil plus bicyclopyrone), and Bison (bromoxynil plus MCAP). At 4 WAT, there were no differences in common lambsquarters control when comparing all treatments, with the exception of Talinor (79% control), and control ranged from 95-97%. At 4 WAT, wild buckwheat control was great when comparing Huskie FX applied at 18 oz/A with 15.5 oz/A. Control of wild buckwheat resulting from Widearmatch application (84%) was similar to the 18 oz/A rate of Huskie FX (86%). Wild buckwheat control was less with other herbicide treatments. No difference in wheat yield was observed due to herbicide treatment. Drought conditions occurred in late June through August in southwest North Dakota. This limited wheat yield and resulted in greater variability among treatments. Wheat yield in all herbicide treatments was numerically greater than that of the untreated control. Test weight in the control treatment was also less when compared with other herbicide treatments.

Table 1. Evaluation of Huskie FX and other herbicides for weed control in spring wheat at Hettinger, ND, 2024.

			Kochia		Lambsquarters		Wild buckwheat		Wheat	
Treatment		Rate	2 WAT	4 WAT	2 WAT	4 WAT	2 WAT	4 WAT	Yield	Test wt
		oz/A	% control						Bu/A	LB/BU
1	Non-Treated		0e	0d	0c	0c	0d	0e	30.8-	56.6b
2	Huskie FX	15.5	84b	84a	90a	95a	85ab	79b	37.3-	60.2a
3	Huskie FX	18	90a	87a	89a	97a	88a	86a	36.5-	58.5ab
4	Widearmatch	14	80c	80b	80b	99a	82b	84ab	38.7-	58.4ab
	MCPA Ester	8								
5	Talinor	13.7	72d	79bc	88a	79b	72c	64d	36.0-	57.7ab
6	Bison	16	72d	76c	89a	97a	71c	71c	34.6-	59.1ab
LSD P=.05			2.4	3.3	3.0	3.1	3.7	5.4	7.02	2.52
Standard Deviation			1.5	2.2	1.9	1.9	2.3	3.4	4.66	1.58
CV			2.26	3.26	2.56	2.51	3.48	5.19	13.06	2.7
Treatment F			1938.251	911.893	1480.656	1574.124	816.868	368.541	1.392	4.307
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2826	0.0281

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Herbicide treatments were tank-mixed with adjuvants according to label guidelines.

Table 2. Application environment and equipment for postemergence application of herbicide treatments for weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-7-2024	Equipment Type	Tractor mounted
Start Time	8:02 AM	Operation Pressure	42 PSI
Stop Time	8:10 AM	Nozzle Model	11002DG
Air Temperature Start, Stop	65, 66 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	45.1, 42.7	Boom Length	100 IN
Wind Velocity+Dir. Start	5.4 MPH, SSE	Boom Height	20 IN
Wind Velocity+Dir. Stop	2.6 MPH, SSE	Ground Speed	4.2 MPH
Wind Velocity+Dir. Max	7.3 MPH, SSE	Carrier	WATER
Wet Leaves (Y/N)	N, no	Application Amount	10 GAL/AC
Soil Temperature	46 F	Propellant	CO2
% Cloud Cover	25	Tank Mix (Y/N)	Yes

Evaluation of Tolvera compared with other herbicides for weed control in spring wheat at Hettinger, ND.

A trial was conducted at Hettinger, ND to evaluate weed control with the herbicide Tolvera (tolpyralate plus bromoxynil) along with other herbicides used for weed control in spring wheat. Tolvera is a newly labelled herbicide registered for weed control in wheat in 2024. It has been demonstrated in the past to control many common broadleaf weeds as well as some annual grass, such as green and yellow foxtail, and barnyardgrass, that are problematic in spring wheat production in North Dakota. Wheat was seeded using a no-till drill on April 29, 2024 at a depth of 2 inches. One week prior to planting, glyphosate was applied to the entire plot area to control emerged weeds. Wheat emerged on May 13. Herbicide treatments (Table 1) were applied on June 7 when weeds were 2 to 3 inches in height on average. Weeds present included kochia, common lambsquarters, and wild buckwheat. At 2 weeks after treatment, kochia control with Tolvera was higher when 14.7 oz/A was applied compared with 11 oz/A. However, there was no difference in kochia control when comparing these two rates at 4 WAT. At 4 WAT, kochia control was improve when either OpenSky (fluroxypyr plus pyroxsulam) or Axial Star (fluroxypyr plus pinoxaden) compared with Tolvera alone. Kochia control with Tolvera was similar to Huskie FX (bromoxynil plus fluroxypyr plus pyrasulfotole) and Batalium Amped (fluroxypyr plus flucarbazone plus bromoxynil) and was greater than control with Talinor. Common lambsquarters control was similar for all treatments except Talinor and Battalium Amped where control was less when compared with other treatments. Similar to kochia, wild buckwheat control was greater when comparing Tolvera at 14.7 oz/A with 11 oz/A, but only at the 2 WAT evaluation. Again, wild buckwheat control was improved with the addition of OpenSky or Axial Star. Also wild buckwheat control was greater when either Huskie FX or Battalium Amped were applied compared with Tolvera alone. Control of buckwheat resulting from Talinor application was less than Tolvera at 14.7 oz/A. Hot and dry conditions occurred in the weeks following herbicide application in this trial. These environmental conditions are known to reduce the effects of herbicides for weed control. The impact of these drought conditions can also be seen in the resulting wheat yields, which were greatly impacted by the dry conditions. Under these conditions, we didn't observe any differences in wheat yield when comparing treatments. Tolvera should be a good addition to the herbicide options for weed control in spring wheat in North Dakota, especially given its reported control of green and yellow foxtail in addition to common broadleaf weeds.

Table 1. Evaluation of herbicides for weed control in spring wheat at Hettinger, ND, 2024.

			Kochia		Lambsquarters		Wild buckwheat		Wheat	
Treatment		Rate	2 WAT	4 WAT	2 WAT	4 WAT	2 WAT	4 WAT	Yield	Test wt
		oz/A	% control						Bu/A	LB/BU
1	Untreated		0e	0e	0e	0e	0f	0f	15.7-	57.9-
2	Tolvera	11	79cd	84bc	90ab	96a	75de	77de	16.0-	58.7-
3	Tolvera	14.7	87a	85bc	93a	99a	83bc	79cd	18.7-	59.1-
4	Tolvera	11	82bc	88a	85c	91b	81cd	89ab	17.1-	59.2-
	OpenSky	16								
5	Tolvera	11	84ab	90a	90ab	96a	85abc	90a	18.0-	59.0-
	Axial Star	16.4								
6	Tolvera	11	82bc	83c	90ab	98a	84abc	80c	17.9-	59.4-
	Harmony SG	0.3								
	Express 50 SG	0.3								
7	Huskie FX	15.5	83abc	84bc	93a	95ab	87ab	87b	21.7-	58.3-
8	Talinor	13.7	78d	77d	87bc	84c	72e	76e	18.5-	59.2-
9	Batalium Amped	16	82bc	87ab	78d	77d	90a	89ab	19.2-	59.3-
LSD P=.05			4.1	3.7	4.0	4.9	5.3	3.1	2.45	1.97
Standard Deviation			2.8	2.5	2.7	3.3	3.7	2.1	1.65	1.35
CV			3.81	3.35	3.52	4.07	5.01	2.87	10.61	2.29
Treatment F			389.644	508.406	466.913	358.063	232.516	711.323	1.532	0.474
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2147	0.8625

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Herbicide treatments were tank-mixed with adjuvants according to label guidelines.

Table 2. Application environment and equipment for postemergence application of herbicide treatments for weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-7-2024	Equipment Type	Tractor mounted
Start Time	7:30 AM	Operation Pressure	42 PSI
Stop Time	7:50 AM	Nozzle Model	11002DG
Air Temperature Start, Stop	62.9, 64.4 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	47.8, 47.9	Boom Length	100 IN
Wind Velocity+Dir. Start	4.2 MPH, S	Boom Height	20 IN
Wind Velocity+Dir. Stop	5.2 MPH, S	Ground Speed	4.2 MPH
Wind Velocity+Dir. Max	5.6 MPH, S	Carrier	WATER
Wet Leaves (Y/N)	No	Application Amount	10 GAL/AC
Soil Temperature	45 F	Propellant	CO2
% Cloud Cover	30	Tank Mix (Y/N)	Yes

Evaluation of fall and spring applied herbicide treatments for weed control in dry peas at Hettinger, ND

A trial was conducted to evaluate fall and spring herbicide treatments for weed control in dry peas. In the fall, on November, 15, 2023, herbicides were applied to a field with a known infestation of downy brome. Fall applied herbicides included glyphosate alone (Roundup PowerMax 3 at 22 oz/A) and tank-mixed with Anthem Flex (carfentrazone plus pyroxasulfone) at 4 oz/A, and Fierce (flumioxazin plus pyroxasulfone) at 6, 7.5, and 9 oz/A (Table 1 and 2). Dry peas were planted using a no-till drill on May 1, 2024 at a depth of 2 inches. The prior crop was spring wheat. Spring herbicide treatments were applied on the same day after planting. Spring herbicide treatments included glyphosate alone and tank-mixed with Anthem Flex (4 oz/A), and Spartan Elite (sulfentrazone plus s-metolachlor) at 32 oz/A. There were also treatments with combined fall and spring applications. These included fall application of Anthem Flex (2.5 oz/A) followed by spring application of Anthem Flex (2 oz/A), and fall Anthem Flex (4 oz/A) followed in spring with Spartan Charge (sulfentrazone plus carfentrazone) (5 oz/A). All treatments were applied with AMS (8.5 LB/100gal) and an HSMOC (1% v/v).

A fall application of glyphosate alone controlled downy brome at 96%, but did not control any other spring emerging weeds. A spring application of glyphosate controlled downy brome at 86% and controlled some of the broadleaf weeds that had emerged prior to application. Fall application of Anthem Flex plus glyphosate controlled downy brome at 100% at either 4 or 2.5 oz/A. At 34 DAT, fall application of Anthem Flex provided better control of both kochia and green foxtail, but not common lambsquarters, when compared with spring application of glyphosate alone. A spring application of Anthem Flex resulted in better control of kochia, common lambsquarters, and green foxtail compared with fall application. The winter of 2023-24 had little snow cover and may have resulted in increased degradation of Anthem Flex applied in the fall which reduced weed control with this timing. The sequential application of Anthem Flex in fall and spring resulted in similar weed control when compared with the spring application. The sequential application of fall Anthem Flex followed by spring Spartan Charge resulted in similar weed control to the spring Anthem Flex treatment. Spring application of Spartan Elite resulted in the best weed control for all three spring annual weeds evaluated in this trial, along with 95% control of downy brome. Fall application of Fierce plus glyphosate controlled downy brome 96 to 100%. Control of spring weeds was generally similar to the fall application of Anthem Flex for kochia and green foxtail, but control was greater for common lambsquarters when Fierce was applied at 9 oz/A. Weed competition reduced dry pea stand in the untreated and fall glyphosate alone treatments compared with other treatments. Pea height was also reduced in the untreated control and in fall and spring glyphosate alone treatments. It was also less in treatments applied only in the spring, likely due to competition with downy brome that was present at time of planting. This was also evident when looking at pea yields. The highest yielding treatments included a combination of fall and spring applied herbicides. Fall application, by them self, had slightly reduced yield comped with the combination treatments likely due to reduced control on spring weeds. Spring applications alone also yielded slightly less than the combination treatments likely due to the competition from downy brome at time of planting, even though spring treatments were all effective at controlling downy brome. Downy brome was able to remove water and nutrient resources prior to treatment, which reduced access of these resources for the pea crop. This shows the importance of controlling downy brome in the fall.

Table 1. Comparison of fall and spring herbicide applications for weed control in dry pea at Hettinger, ND, 2024

				Downy brome		Kochia		Lambsquarters		Green foxtail		Dry Pea		
		Rate	Timing	0 DAT	21 DAT	21 DAT	34 DAT	21 DAT	34 DAT	21 DAT	34 DAT	Stand	Height	Yield
Treatment		oz/A		% control								plt/ft^2	IN	LB/A
1	Untreated	-	-	0	0	0	0	0	0	0	0	3.7c	7e	4d
2	Glyphosate	22	Fall	96b	96bcd	0e	0	0d	0e	0e	0e	4.8c	18cd	947c
3	Glyphosate	22	Spring	0	86e	81d	47e	81bc	66bcd	0e	0e	6.6ab	18cd	1672abc
4	Anthem Flex	4	Fall	100a	100a	85d	71d	75c	62d	67d	75bcd	7.1ab	21abc	1734abc
	Glyphosate	22	Fall											
5	Anthem Flex	4	Spring	0c	93d	95ab	89ab	100a	86a	90a	83ab	6.4ab	19bcd	1234bc
	Glyphosate	22	Spring											
6	Anthem Flex	2.5	Fall	100a	100a	94abc	88abc	92ab	78ab	81b	79abc	6.7ab	22ab	2224a
	Glyphosate	22	Fall											
	Anthem Flex	2	Spring											
	Glyphosate	22	Spring											
7	Anthem Flex	4	Fall	100a	99abc	95ab	86bc	88b	78ab	79b	76bcd	7.8a	23a	2005ab
	Glyphosate	22	Fall											
	Spartan Charge	5	Spring											
	Glyphosate	22	Spring											
8	Glyphosate	22	Spring	0c	95cd	98a	97a	101a	89a	94a	88a	7.0ab	18d	1649abc
	Spartan Elite	32	Spring											
9	Fierce	6	Fall	99a	100a	90a-d	82bcd	85bc	63cd	71cd	70cd	6.3b	19bcd	1082bc
	Glyphosate	22	Fall											
10	Fierce	7.5	Fall	98a	96bcd	87bcd	75d	89b	68bcd	70cd	66d	6.9ab	21ab	1528abc
	Glyphosate	22	Fall											
11	Fierce	9	Fall	100a	99abc	85cd	79cd	90ab	76abc	76bc	67d	7.4ab	21ab	1748abc
	Glyphosate	22	Fall											
LSD P=.05				2.1	4.1	9.5	9.4	11.1	14.2	7.4	10.6	1.19	2.42	788.6
Standard Deviation				1.4	2.8	6.5	6.4	7.6	9.8	5.1	7.3	0.96	1.81	540.4
CV				2.09	2.87	8.06	9.05	9.56	14.63	8.16	12.15	14.95	10.44	32.2
Treatment F				4396	10.62	79.07	79.46	52.28	26.55	178.6	78.92	3.50	4.60	3.57
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0052	0.0022	0.0061

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

Table 2. Application environment and equipment for preemergence application of herbicide treatments for weed control in dry peas.

Application Description			Application equipment		
Date	Nov-15-2023	May-1-2024	Equipment Type	Tractor mounted	Tractor mounted
Start Time	2:15 PM	10:41 AM	Operation Pressure	44 PSI	38 PSI
Stop Time	2:30 PM	10:51 AM	Nozzle Model	11002DG	DG11002
Temperature Start, Stop	62.2, 63.5 F	59.7, 50.8 F	Nozzle Spacing	20 IN	20.0 IN
% Relative Humidity Start, Stop	25.9, 28.2	35.2, 40.5	% Coverage	100	100
Wind Velocity+Dir. Start	6.3 MPH, WSW	1.1 MPH, ENE	Boom Length	100 IN	100 IN
Wind Velocity+Dir. Stop	4.6 MPH, WSW	2.7 MPH, ENE	Boom Height	20 IN	20 IN
Wind Velocity+Dir. Max	6.3 MPH, WSW	4.8 MPH, ENE	Ground Speed	4.2 MPH	4 MPH
Wet Leaves (Y/N)	N, no	N, no	Carrier	WATER	WATER
Soil Temperature	38 F	47 F	Application Amount	10 GAL/AC	10 GAL/AC
Soil Moisture	DRY	DRY	Mix Size	2.0 L	2.0 L
% Ground Cover	80	95	Propellant	CO2	CO2
% Cloud Cover	80	95	Tank Mix (Y/N)	Y, yes	Y, yes

Weed control and dry pea response to preemergence application of metribuzin and sulfentrazone.

A trial was conducted at Hettinger, ND, to evaluate weed control and dry pea response to preemergence applications of metribuzin and sulfentrazone applied alone and in combination (Table 1). Field pea "Pizzaz" was planted on May 1, 2024 at a depth of 2 inches using a John Deere no-till drill. Herbicide treatments were applied after planting on May 2 (Table 2). Peas emerged on May 14. Herbicide treatments included metribuzin (Tricor 75DF) at 4, 5.3, and 8 oz/A (product rate) and sulfentrazone (Spartan 4F) at 3.75, 5.25, and 6.75 oz/A (product). Dry pea were evaluated at 21 and 43 days after treatment (DAT); no visible injury was observed at either evaluation. Kochia, common lambsquarters, and green foxtail were evaluated for control at 43 DAT. Control of all three increased when metribuzin rate increased from 4 to 8 oz/A. Increasing the rate of sulfentrazone from 3.75 to 6.75 oz/A did not result in increased weed control for these three weeds. Combinations of metribuzin and sulfentrazone in most cases increased control of all three weeds compared with when these herbicides were applied alone. Dry pea stand was not affected by any of the herbicide treatments and was similar to the untreated control. There were slight differences in pea height when measured 8 WAT, but all treatments resulted in heights similar to the untreated control. Dry pea yield was greater in nearly all combination treatments compared with the untreated control. From this trial, it appears that under these growing conditions and soil, both metribuzin and sulfentrazone were not injurious to the pea variety tested in this trial. Some pea varieties are known to be sensitive to either metribuzin and/or sulfentrazone. If using these herbicides, check with seed supplier to verify that the pea variety you are planting have a known tolerance to these herbicides. The soil type in this trial is a loam with 37% sand, 39% silt, and 24% clay, with a pH of 5.9 and organic matter of 3.0%. Metribuzin should not be used for weed control in peas grown in coarse soils (sand, sandy loam, or loamy sand) with organic matter of 2% or less. Lower rates of metribuzin are recommended for all soils with organic matter of 2% or less. Similarly, the rate of sulfentrazone labelled for use in dry peas is dependent both on soil texture and organic matter. It is important to know these soil parameters in fields where these herbicides will be used for weed control in dry peas in order to apply the correct labelled rate and to minimize risk of injury to the dry pea crop.

Table 1. Weed control and dry pea response to preemergence application of metribuzin and sulfentrazone at Hettinger, ND, 2024

Treatment		Rate	Kochia	Lambsquaters	Green foxtail	Dry pea Stand	Dry pea Height	Dry pea Yield
		oz/A	% control			plts/ft^2	IN	LB/A
1	Untreated		0	0	0	6.6-	19ab	2341cd
2	Metribuzin	4	77f	91c	67f	6.9-	19ab	2149d
3	Metribuzin	5.3	85de	99ab	74ef	6.6-	19ab	2715a-d
4	Metribuzin	8	97ab	96b	82cd	7.6-	18b	2321cd
5	Spartan	3.75	84def	99ab	78de	7.6-	19ab	2603bcd
6	Spartan	5.25	80ef	100ab	82cd	6.0-	20a	2847abc
7	Spartan	6.75	80ef	99ab	82cd	6.8-	20a	2803abc
8	Metribuzin Spartan	4 3.75	89cd	98ab	76de	6.7-	19ab	2583bcd
9	Metribuzin Spartan	4 5.25	90bcd	100a	86bc	6.4-	20a	2747abc
10	Metribuzin Spartan	4 6.75	86cde	100ab	82cd	6.2-	20a	2956ab
11	Metribuzin Spartan	5.3 3.75	93abc	100ab	88bc	6.6-	20ab	3006ab
12	Metribuzin Spartan	5.3 5.25	89cd	100a	92ab	6.7-	19ab	3182a
13	Metribuzin Spartan	5.3 6.75	89cd	100ab	89bc	6.6-	20ab	3145ab
14	Metribuzin Spartan	8 3.75	94abc	100a	92ab	7.1-	19ab	3125ab
15	Metribuzin Spartan	8 5.25	94abc	100ab	88bc	5.9-	19ab	2805abc
16	Metribuzin Spartan	8 6.75	98a	100ab	97a	6.3-	20ab	2843abc
LSD P=.05			7.2	4.0	6.6	1.13	1.6	557.00
Standard Deviation			5.1	2.8	4.6	0.80	1.1	391.56
CV			5.75	2.84	5.4	11.94	5.93	14.18
Treatment F			6.098	2.544	9.286	1.439	1.984	3.072
Treatment Prob(F)			0.0001	0.0121	0.0001	0.1709	0.0403	0.0017

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

Table 2. Application environment and equipment for preemergence application of herbicide treatments for weed control in dry peas.

Application Description		Application equipment	
Date	May-2-2024	Equipment Type	Tractor mounted
Start Time	7:33 AM	Operation Pressure	38 PSI
Stop Time	8:26 AM	Nozzle Model	11002DG
Air Temperature Start, Stop	40.6, 42.2 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	69.4, 75.8	Boom Length	100 IN
Wind Velocity+Dir. Start	4.1 MPH, W	Boom Height	20 IN
Wind Velocity+Dir. Stop	5.2 MPH, W	Ground Speed	4 MPH
Wind Velocity+Dir. Max	10.8 MPH, W	Carrier	WATER
Wet Leaves (Y/N)	Y, yes	Application Amount	10 GAL/AC
Soil Temperature	42 F	Propellant	CO2
% Cloud Cover	100	Tank Mix (Y/N)	Y, yes

Weed control in soybean with preemergence application of metribuzin and sulfentrazone.

A trial was conducted to evaluate weed control resulting from the application of metribuzin and sulfentrazone (Spartan) in soybean. Soybean were planted on May 20, 2024 using a John Deere no-till planter at a depth of 1.5 inches and a seeding rate of 110,000 seeds/A. Plots were four rows of soybean planted in 30-inch rows. Rows 1 and 2 were planted using soybean variety "AG07XF4; Rows 3 and 4 were planted with soybean variety "AG07XF2". Two soybean varieties were used to compare varietal tolerance to metribuzin and sulfentrazone. Plot size in this trial was 10 feet wide and 40 feet long. Four replications of treatments were randomized in a randomized complete block. Herbicide treatments were applied after soybean were planted, also on May 20. Soybean was evaluated for injury at 31 days after planting; no visual injury was observed for either soybean variety (Table 1). Soybean stand was measured from one meter in a random location within each row of each plot, no differences in soybean stand was observed. Kochia, common lambsquarters, and green foxtail were evaluated from control at 31 and 47 days after treatment (DAT). Control of all three weeds increased when metribuzin rate increased from 5.33 to 10.7 oz/A. There was no increase in weed control when the rate of sulfentrazone increased from 4 to 8 oz/A. Kochia control was increased when combinations of metribuzin and sulfentrazone were applied, with 100% kochia control at 47 DAT with the combination of metribuzin at 10.7 oz/A and sulfentrazone at 8 oz/A. Common lambsquarters control was 92 to 100% with sulfentrazone alone and was similar for the combination treatments. Green foxtail control was also best when sulfentrazone and metribuzin were tank-mixed. Weed biomass was measured at 35 and 57 DAT. All treatments reduced weed biomass compared to the untreated, but there were no statistical differences among treatments. Soybean yield was not collected in this trial due to the drought conditions that reduced yield in trial to near zero.

Table 1. Efficacy of weed control and soybean response to preemergence application of metribuzin and Spartan (sulfentrazone) applied alone and as a tank mix at Hettinger, ND, 2024.

			Spybean	Kochia		C. lambsquarters		Green foxtail		Weed biomass	
		Injury	Stand	31 DAT	47 DAT	31 DAT	47 DAT	31 DAT	47 DAT	35 DAT	57 DAT
Herbicide	Rate	— % —	plants/A	——— % control ———						— LB/A —	
1 Non-treated		0	111552-	0	0	0	0	0	0	102a	2195a
2 Metribuzin	5.33	0	115599-	80de	78e	88c	88b	79d	75c	10c	860b
3 Metribuzin	10.7	0	104912-	88bc	82cd	96b	90b	84cd	82b	18bc	788b
4 Spartan	4	0	110888-	83cd	78e	100a	92ab	85c	80b	53b	733b
5 Spartan	8	0	120848-	76e	79de	100a	100a	86c	83b	36bc	1003b
6 Metribuzin Spartan	5.33 4	0	111552-	82d	80de	100a	93ab	88bc	83b	14c	266b
7 Metribuzin Spartan	10.7 4	0	118255-	88b	85bc	99ab	95ab	92ab	88a	16bc	973b
8 Metribuzin Spartan	5.33 8	0	116864-	88bc	86b	100a	100a	91ab	88a	20bc	742b
9 Metribuzin Spartan	10.7 8	0	109560-	95a	100a	100a	99a	94a	91a	18bc	990b
LSD P=.05		.	6107.5	4.6	3.2	2.7	8.2	5.1	4.0	37.4	912.5
Standard Deviation		0.0	4164.8	3.1	2.1	1.9	5.6	3.5	2.7	25.5	626.6
CV		0.0	7.38	4.14	2.92	2.15	6.67	4.5	3.68	77.67	65.0
Treatment F		NaN	1.258	342.243	703.957	1245.56	129.608	285.607	429.683	5.070	3.202
Treatment Prob(F)		NaN	0.3140	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0010	0.0121

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

Table 2. Application environment and equipment for preemergence application of herbicide treatments for weed control in soybean.

Application Description		Application equipment	
Date	May-20-2024	Equipment Type	Tractor mounted
Start Time	4:56 PM	Operation Pressure	42 PSI
Stop Time	5:28 PM	Nozzle Model	11002DG
Temperature Start, Stop	62.3, 61.7 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	37.7, 37.6	% Coverage	100
Wind Velocity+Dir. Start	3.2 MPH, E	Boom Length	100 IN
Wind Velocity+Dir. Stop	1.5 MPH, E	Boom Height	20 IN
Wind Velocity+Dir. Max	4.8 MPH, E	Ground Speed	2.8 MPH
Wet Leaves (Y/N)	N, no	Carrier	WATER
Soil Temperature	67 F	Application Amount	15 GAL/AC
Soil Moisture	DRY	Mix Size	3.0 L
% Ground Cover	100	Propellant	CO2
% Cloud Cover	100	Tank Mix (Y/N)	Y, yes

Soybean tolerance to preemergence application of metribuzin and sulfentrazone.

A trial was conducted to evaluate soybean tolerance to the application of metribuzin and sulfentrazone (Spartan) in soybean. Soybean were planted on May 20, 2024 using a John Deere no-till planter at a depth of 1.5 inches at a seeding rate of 110,000 seed/A. Plots were four rows of soybean planted in 30-inch rows. Rows 1 and 2 were planted using soybean variety "AG07XF4; Rows 3 and 4 were planted with soybean variety "AG07XF2". Two soybean varieties were used to compare varietal tolerance to metribuzin and sulfentrazone. Plot size in this trial was 10 feet wide and 40 feet long. Four replications of treatments were randomized in a randomized complete block. Herbicide treatments were applied after soybean were planted, also on May 20. All soybean plots were maintained weed free throughout the growing season by way of postemergence applications of glyphosate when weeds emerged in soybean plots. Soybean was evaluated for injury at 31 days after planting; no visual injury was observed for either soybean variety (Table 1). Soybean stand was measured 35 days after treatment (DAT) from one meter in a random location within each of the center two rows of each plot, no differences in soybean stand was observed. Soybean height was measured at 56 DAT by measuring height of 10 random soybean plants within each plot. No differences in soybean height were observed due to herbicide treatment. Soybean was harvested with a small plot combine on September 24. Due to drought conditions, soybean seed were unable to accumulate size and mass and therefore, yields were very low. For soybean variety AG07XF2, there were statistical differences in both yield and test weight of soybean, however, herbicide treatments were always equal to or greater than the untreated control. For variety AG07XF4, no differences were observed in yield or test weight of soybean. From this trial, it appears that under these growing conditions and soil, both metribuzin and sulfentrazone were not injurious to the two soybean varieties tested in this trial. Some soybean varieties are known to be sensitive to either metribuzin and/or sulfentrazone. If using these herbicides, check with seed supplier to verify that the soybean varieties you are planting have a known tolerance to these herbicides. The soil type in this trial is a loam with 34% sand, 45% silt, and 21% clay, with a pH of 5.6 and organic matter of 3.3%. Metribuzin should not be used for weed control in soybean in coarse soils (sand, sandy loam, or loamy sand) with organic matter of 2% or less. Lower rates of metribuzin are recommended for all soils with organic matter of 2% or less. Similarly, the rate of sulfentrazone labelled for use in soybean is dependent both on soil texture and organic matter. It is important to know these soil parameters in fields where these herbicides will be used for weed control in soybean in order to apply the correct labelled rate and to minimize risk of injury to the soybean crop.

Table 1. Soybean response to preemergence application of metribuzin and sulfentrazone at Hettinger, ND, 2024.

					AG07XF2		AG07XF4	
		Injury	Stand	Height	Yield	Test wt	Yield	Test wt
Herbicide	Rate	— % —	plants/A	cm	BU/A	LB/BU	BU/A	LB/BU
1 Untreated		0	106729-	23-	6.4b	47.0b	6.0-	44.0-
2 Metribuzin	5.33	0	108974-	23-	6.8ab	50.9ab	6.4-	47.7-
3 Metribuzin	10.7	0	106352-	23-	6.6ab	49.3ab	6.5-	47.4-
4 Spartan	4	0	109761-	22-	6.9ab	51.9ab	6.6-	48.6-
5 Spartan	8	0	119901-	23-	7.5a	55.0a	6.7-	50.0-
6 Metribuzin Spartan	5.33 4	0	108383-	24-	7.2ab	53.5a	7.0-	52.2-
7 Metribuzin Spartan	10.7 4	0	114512-	23-	7.0ab	52.4ab	6.5-	47.8-
8 Metribuzin Spartan	5.33 8	0	99898-	23-	7.0ab	52.3ab	6.4-	48.0-
9 Metribuzin Spartan	10.7 8	0	107546-	23-	6.7ab	49.6ab	6.5-	48.2-
LSD P=.05		.	10337.1	1.3	0.88	6.04	0.85	6.52
Standard Deviation		0.0	7112.0	0.8	0.59	4.06	0.57	4.39
CV		0.0	6.52	3.74	9.12	8.33	9.26	9.48
Treatment F		NaN	1.935	2.161	2.539	2.817	1.679	1.763
Treatment Prob(F)		NaN	0.0972	0.0833	0.0480	0.0324	0.1718	0.1512

Table 2. Application environment and equipment for preemergence application of herbicide treatments for weed control in soybean.

Application Description		Application equipment	
Date	May-20-2024	Equipment Type	Tractor mounted
Start Time	4:27 PM	Operation Pressure	42 PSI
Stop Time	4:50 PM	Nozzle Model	11002DR
Temperature Start, Stop	64.3, 62.2 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	37.9, 39.1	% Coverage	100
Wind Velocity+Dir. Start	4.8 MPH, E	Boom Length	100 IN
Wind Velocity+Dir. Stop	5.1 MPH, E	Boom Height	20 IN
Wind Velocity+Dir. Max	7.3 MPH, E	Ground Speed	2.8 MPH
Wet Leaves (Y/N)	N, no	Carrier	WATER
Soil Temperature	67 F	Application Amount	15 GAL/AC
Soil Moisture	DRY	Mix Size	3.0 L
% Ground Cover	100	Propellant	CO2
% Cloud Cover	100	Tank Mix (Y/N)	Y, yes

Evaluation of weed control options for soybean in SW North Dakota at Hettinger, 2024.

A trial was conducted near Hettinger, ND to evaluate weed control options for soybean. Soybean were planted on May 20, 2024, into wheat stubble using a no-till planter at a depth of 1.5 inches at a seeding rate of 110,000 seeds/A. Soybean emerged on June 3. One weeks prior to planting, the entire plot area was treated with glyphosate (Roundup PowerMax) plus carfentrazone (Aim EC) to control emerged weeds. Treatments were applied either at planting (preemergence, PRE), after emergence of soybean at the V1 growth stage (early postemergence, EPOST), at the V2 soybean growth stage (postemergence, POST), or at the R1 growth stage (late postemergence LPOST) (Table 2). Weed control was evaluated at 5 and 8 weeks after the PRE treatment timing (WAT), with the 8 WAT evaluation occurring 1 weeks after the LPOST application. Weed evaluated in this trial included kochia, common lambsquarters, green foxtail, wild oat, and barnyardgrass. Herbicides applied at the PRE timing contain active ingredients that are active in the soil on seedling weeds. Herbicides applied at all postemergence timings were primarily foliar active on controlling emerged weeds. At 5 WAT, only PRE and EPOST treatments had been applied. At this evaluation, the only PRE treatment that resulted in good kochia control (89-91%) was Authority MTZ (sulfentrazone plus metribuzin). All others controlled kochia at 69-76%. Common lambsquarters was controlled at 88-100% by metribuzin, Authority MTZ, and Authority Supreme (sulfentrazone plus pyroxasulfone). Green foxtail and barnyardgrass were controlled 89-96% by Authority MTZ, Zidua (pyroxasulfone), and Authority Supreme. No PRE treatment provided good control of wild oat. EPOST treatments evaluated at this time included glyphosate, Liberty (glufosinate), glyphosate plus Xtendimax (dicamba), and Zalo (glufosinate plus quizalofop). For kochia control, products containing glufosinate provided better control that glyphosate. Glyphosate controlled wild oat better than glufosinate containing products.
At 8 WAT, the POST application of glyphosate improved weed control compared with PRE herbicides alone in nearly all cases. The best overall control occurred with sequential applications of Zalo (EPOST and LPOST), and with Authority MTZ (PRE) followed by glyphosate (POST). Plant stands and heights were not affected by herbicide treatments. The entire trial was treated with glyphosate two weeks after the LPOST timing to control weeds not controlled by earlier applications. Soybean yield was affected by drought conditions that occurred in July and August. Yields were very low and not commercially viable. However, the same two treatments have the best overall weed control 8 WAT also had the highest soybean yield. It would be interesting to evaluate these same treatments under better rainfall conditions. These herbicides show the importance of using multiple applications for weed control and not relying on a single herbicide or mode of action for weed control in soybean.

Table 2. Application environment and equipment for application of herbicide treatments for weed control in soybean.

Application Description					Application equipment				
	PRE	EPOST	POST	LPOST		PRE	EPOST	POST	LPOST
Date	May-21-	Jun-19-24	Jun-26-24	Jul-10-24	Type	Tractor	Tractor	Tractor	Tractor
Start Time	8:24 AM	8:45 AM	5:58 PM	12:10 PM	Pressure	42 PSI	42 PSI	42 PSI	20 PSI
Stop Time	8:49 AM	9:00 AM	6:23 AM	12:15 PM	Nozzle[a]	11002DG	11002DG	11002DG	11002DG
Air Temperature	56 F	60 F	78.3 F	85.4 F	Spacing	20 IN	20 IN	20 IN	20 IN
% RH	59.3	50	43.4	42.9	Length	100 IN	100 IN	100 IN	100 IN
Wind Spped	7.1 MPH	0.9 MPH	6.2 MPH	2.9 MPH	Height	20 IN	28.0 IN	28.0 IN	36.0 IN
Wet Leaves (Y/N)	No	No	No	No	Speed	2.8 MPH	2.8 MPH	2.8 MPH	3 MPH
Soil Temperature	53 F	43 F	66 F	F	Volume	15 GAL/A	15 GAL/A	15 GAL/A	15 GAL/A
% Cloud Cover	100	5	10	5	Propellant	CO2	CO2	CO2	CO2

[a]Treaments containing Xtendimax were applied with TTI 11002 nozzles.

Table 1. Evaluation of herbicide options for weed control in soybean at Hettinger, ND, 2024

				Kochia[1,2]		Lambsquarters		Green foxtail		Wild oat		Barnyardgrass		Soybean[3]		
		Rate	Timing	5 WAT	8 WAT	5 WAT	8 WAT	5 WAT	8 WAT	5 WAT	8 WAT	5 WAT	8 WAT	Stand	Height	Yield
Treatment[4]		oz/A		% control										plants/A	inches	BU/A
1	Untreated			0h	0g	0f	0h	0i	0h	0g	0h	0i	0h	107393-	7.1-	1.6ef
2	Roundup PowerMAX3	22	EPOST	81def	61e	100a	96ab	100ab	83de	96a	96ab	100ab	83de	115634-	8.3-	3.7ab
3	Liberty	28	EPOST	100a	87bc	100a	82def	100ab	77ef	84bc	82def	100ab	77ef	110462-	8.1-	2.9bcd
4	Xtendimax	22	PRE	72fg	0g	63e	0h	0i	0h	0g	0h	0i	0h	110235-	7.7-	1.2f
5	Roundup PowerMAX3	22	EPOST	85cde	87bc	100a	87cde	99ab	84cde	94a	87cde	99ab	84cde	110393-	8.0-	2.8bcd
	Xtendimax	22	EPOST													
6	Xtendimax	22	PRE	76efg	87bc	73de	94abc	40h	92abc	0g	94abc	40h	92abc	97954-	8.0-	3.1abc
	Roundup PowerMAX3	22	POST													
	Xtendimax	22	POST													
7	Zalo® Herbicide	32	EPOST	96ab	100a	100a	97ab	100a	100a	94a	97ab	100a	100a	106666-	8.0-	4.1a
	Zalo® Herbicide	32	LPOST													
8	Zalo® Herbicide	32	EPOST	97ab	83bcd	99ab	80ef	100ab	84cde	91ab	80ef	100ab	84cde	116609-	7.6-	2.0def
	Dual II Magnum	21	PRE													
9	Zalo® Herbicide	32	EPOST	95ab	89b	100a	82def	100ab	90bcd	92ab	82def	100ab	90bcd	105606-	7.7-	2.1c-f
	Dual II Magnum	1.33	EPOST													
10	Metribuzin	5.33	PRE	72fg	52e	90bc	70g	81f	60g	68de	70g	81f	60g	101214-	8.2-	2.0c-f
11	Metribuzin	5.33	PRE	75fg	86bcd	88cd	96ab	74g	90bcd	66e	96ab	74g	90bcd	100531-	7.7-	3.8ab
	Roundup PowerMAX3	22	POST													
12	Authority MTZ	18	PRE	89bcd	81bcd	100ab	78f	89de	80ef	52f	78f	89de	80ef	97881-	8.3-	2.9bcd
13	Authority MTZ	18	PRE	91abc	91ab	100a	100a	93cd	95ab	53f	100a	93cd	95ab	111197-	8.6-	4.1a
	Roundup PowerMAX3	22	POST													
14	Zidua SC	5	PRE	69g	22f	71e	79f	91cd	73f	75de	79f	91cd	73f	115858-	7.5-	2.3cde
15	Zidua SC	5	PRE	70g	75d	82cd	100a	83ef	95ab	75cd	100a	83ef	95ab	108792-	7.9-	3.4ab
	Roundup PowerMAX3	22	POST													
16	Authority Supreme	9.8	PRE	72fg	55e	97ab	90bcd	96abc	89bcd	50f	90bcd	96abc	89bcd	104186-	8.1-	2.9bcd
17	Authority Supreme	9.8	PRE	76efg	78cd	96ab	100a	94bcd	96ab	49f	100a	94bcd	96ab	104908-	7.7-	3.5ab
	Roundup PowerMax3	20	POST													
LSD P=.05				9.1	10.7	9.9	9.7	8.0	6.5	8.5	7.8	6.2	8.6	12627.3	0.93	0.98
Standard Deviation				6.4	7.6	6.9	6.8	5.6	4.6	5.9	5.5	4.4	6.0	8848.8	0.65	0.69
CV				8.21	11.31	8.32	9.62	6.91	6.19	8.88	7.04	5.5	7.9	8.02	7.84	22.41
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.1440	0.0824	0.0001

Abbreviations: weeks after treatment, WAT; preemergence, PRE; early postemergence, EPOST; postemergence, POST; late post emergence, LPOST; acre, A; bushel, BU.

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

[2]Weed control evaluations were taken 5 and 8 weeks after the preemergence (PRE) herbicide application timing; Application timings were: PRE, at planting; early postemergence (EPOST), 29 days after planting at the V1 soybean growth stage; postemergence (POST), 36 days after planting; and late postemergence (LPOST) 50 days after planting.

[3]Soybean stand was measure 5 WAT; height was measured 8 WAT, and harvested 18 WAT

[4]Adjuvants were added to treatment mixtures according with label guidelines for each herbicide.

Express Safflower Tolerance at Hettinger, ND, 2024

A trial was conducted to evaluate herbicide tolerance in two varieties of safflower that had been selected for tolerance to the herbicide tribenuron-methyl (Express), a herbicide belonging to the sulfonylurea family which inhibits the ALS enzyme. Safflower was planted on May 16, 2024 into a field that had been previously treated in a combination of pendimethalin, sulfentrazone, and glyphosate to control weeds prior to planting. Safflower was planted using a no-till plot drill at a depth of 1.75 inches and a seeding rate of 20 LB/A. Safflower emerged on May 31. The herbicide tribenuron-methyl (Express) was applied at a rate of 0.0625 lbs active ingredient per acre (2 oz product per acre); a rate that is 4 times the labelled rate when used for weed control in sunflower. This high rate was used to verify the tolerance of safflower beyond what will typically be applied, but what may result in areas of a field where spray overlap occurs. Express was tank-mixed with the herbicide clethodim (Select Max) at 6 oz/a, and methylated seed oil (MSO) at 1%v/v. Treatments were applied to safflower plots on two application dates; June 26 and July 8. Safflower was evaluated for injury two weeks after each treatment timing. Safflower height was also measured two weeks after each herbicide application timing. At maturity, safflower was harvested using a small plot combine to record seed yield. No visible injury was observed during either visual injury evaluation. While there were differences in safflower height, this was mostly due to differences between varieties. Within variety two, safflower height was slightly less when comparing the earlier treatment with the later treatment. However, these treatments were not statistically shorter in height when compared with the untreated control. Safflower yield was numerically lowest in the untreated control, but in most cases, these differences were not significant. Safflower test weight was greater in Variety One compared with Variety Two. Also seed test weight was less in the untreated safflower control compared with the later application timing. Seed yield of safflower was lower than what is typically expected in southwest North Dakota due to the hot and dry weather that occurred during the summer of 2024. The months of July and August were exceptionally hot and dry. From this trial, we saw no adverse effect of applying tribenuron-methyl to these two safflower varieties.

Table 1. Evaluation of the herbicide tribenuron-methyl (Express) on two safflower varieties that have been selectively bred for tolerance to this same herbicide at Hettinger, ND, 2024

Rating Date			Jul-8-2024	Jul-22-2024	Jul-11-2024	Jul-22-2024	Sep-25-2024	Sep-25-2024
Rating Type			Injury	Injury	height	height	YIELD	Test
Rating Unit			%	%	cm	cm	LB/A	LB/BU
Trt-Eval Interval			12 DA-A	14 DA-B	15 DA-A	14 DA-B		
No.	Name	Rate						
1	Variety One		0	0na	66ab	70ab	621bc	43.2b
	Untreated							
2	Variety One		0	0na	65ab	67bc	730a	47.4a
	Express	2oz/a						
	Select Max	6oz/a						
	MSO	1%v/v						
3	Variety One		0	0na	67a	71a	696ab	45.5ab
	Express	2oz/a						
	Select Max	6oz/a						
	MSO	1%v/v						
4	Variety Two		0	0na	61cd	63de	534c	36.8d
	Untreated							
5	Variety Two		0	0na	58d	60e	570c	39.1cd
	Express	2oz/a						
	Select Max	6oz/a						
	MSO	1%v/v						
6	Variety Two		0	0na	63bc	66cd	681ab	39.7c
	Express	2oz/a						
	Select Max	6oz/a						
	MSO	1%v/v						
LSD P=.05			.	.	3.3	3.3	107.9	2.83
Standard Deviation			0.0	0.0	2.2	2.2	71.6	1.88
CV			0.0	0.0	3.48	3.3	11.21	4.48
Analyzed as			RCB	RCB	RCB	RCB	RCB	RCB
Replicate F			NaN	NaN	21.537	27.158	26.067	38.621
Replicate Prob(F)			NaN	NaN	0.0001	0.0001	0.0001	0.0001
Treatment F			NaN	NaN	9.035	14.498	4.585	18.892
Treatment Prob(F)			NaN	NaN	0.0004	0.0001	0.0097	0.0001

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

Evaluation of common buckwheat tolerance to two preemergence herbicides at Hettinger, ND, 2024.

A trial was conducted near Hettinger, ND, to evaluated the effects of two preemergence herbicides, in common buckwheat. As neither of these herbicides are labelled for use in buckwheat, they will only be identified as Herbicide 1 and 2. Buckwheat was planted on June 12, 2024 at a depth of 2 inches using a John Deere no-till drill with 7.5 inch row spacings. Herbicide treatments (Table 1) were applied on June 13, 2024 using a tractor-mounted research plot sprayer (Table 2). In the 10 days after herbicide treatments were applied, 1.16 inches of rainfall occurred. Buckwheat emerged on June 18. Buckwheat was visually evaluated for injury (bleaching or stunting) at 2, 3, and 5 weeks after treatment (WAT) at a rate from 0 to 100%, where 0% is no injury and 100% is complete plant death (Table 1). Stand count was measured two weeks after buckwheat emergence (WAE) by counting all buckwheat plants within two randomly placed 0.5 m^2 quadrats in each plot. Heights of 10 random buckwheat plants were measured within each plot 5 WAE. Buckwheat was swathed to dry down and then was harvested using a small plot combine on September 12, 2024.

Neither of the two herbicides evaluated caused visual injury exceeding 10% when evaluated 2, 3, and 5 weeks after treatment. The combination of both herbicides at the highest rates (treatment 9) resulted in injury of 11, 23, and 15%, at 2, 3, and 5 WAT, respectively. There was no significant reduction in buckwheat stand count when measured 2 weeks after emergence. Buckwheat height was lowest (69 to 70 cm) 5 WAE with Herbicide 2 alone (both rates) and with the combination of Herbicide 1 and 2, compared with Herbicide 1 applied alone at 1X, 2X, and 3X rates (77, 78, and 73 cm, respectively). However, buckwheat in the untreated control was also similar in height to treatments having the lowest buckwheat height. July and August of 2024 were hot and dry with only 50% of normal rainfall. These hot and dry conditions reduced buckwheat growth and yield potential. Yield of buckwheat was much lower than typical due to these growing conditions and was also quite variable (CV 29). Due to the low yield and variable yield, there were no significant differences in yield when comparing herbicide treatments. While yield differences were not significant, all herbicide treatments resulted in buckwheat yields that were numerically higher than the untreated control. Also, the two treatments where buckwheat height was reduced most (6 and 9) had the highest numerical yield of all treatments.

This trial demonstrates that buckwheat has good tolerance to both herbicides evaluated in this trial at this location, whether applied alone or in combination.

Table 1. The effect of preemergence application of the herbicides Balance Flex (isoxaflutole) and Zidua SC (pyroxasulfone) and their combinations on injury, stand, height, and yield at Hettinger, ND, 2024.

			Injury[a]					
			2 WAT	3 WAT	5 WAT	Stand count[b]	Height[c]	Yield[d]
	Treatment	Rate	——————— % ———————			— #/m² —	— cm —	– LB/acre –
1	Untreated	–	0c	0d	0c	211-	72cd	98-
2	Herbicide 1	1X	0c	3cd	0c	190-	77ab	112-
3	Herbicide 1	2X	4bc	7bc	2c	197-	78a	110-
4	Herbicide 1	3X	6b	3cd	1c	185-	73bc	134-
5	Herbicide 2	1X	0c	3cd	0c	191-	69d	126-
6	Herbicide 2	2X	0c	7bc	8b	172-	69d	153-
7	Herbicide 1 Herbicide 2	1X 1X	1bc	6bc	9b	189-	70cd	136-
8	Herbicide 1 Herbicide 2	2X 1X	3bc	11b	5bc	179-	70cd	120-
9	Herbicide 1 Herbicide 2	3X 1X	11a	23a	15a	201-	69d	141-
LSD P=.05			4.5	5.2	5.1	33.0	3.4	53.2
Standard Deviation			3.0	3.5	3.5	22.5	2.2	36.4
CV			110.12	49.87	83.9	11.79	3.1	29.02
Treatment Prob(F)			0.0010	0.0001	0.0001	0.4343	0.0009	0.5297

[a] Injury was evaluated visually for symptoms of bleaching and/or stunting at 2, 3, and 5 weeks after treatments were applied (treatments were applied at planting).
[b] Buckwheat stand count was measured using two quadrats (0.5 m^2) from each plot on July 2, 2024, 2 weeks after buckwheat emergence.
[c] Buckwheat height was measured on July 24, 2024, with 10 height measurements recorded from each plot.
[d] Buckwheat yield was recorded using a small plot combine, buckwheat was swathed with a small plot swather equipped with a 5-foot header 10 days prior to combining.

Table 2. Application environment and equipment used for herbicide treatment.

Application environment		Application Equipment	
Date	Jun-13-2024	Equipment Type	Tractor-mounted
Start Time	6:39 AM	Operation Pressure	43 PSI
Stop Time	7:00 AM	Nozzle Model	11002
Air Temperature Start, Stop	56, 62 F	Nozzle Type	Drift reduction
% Relative Humidity Start, Stop	54, 56	Nozzle Spacing	20 IN
Wind Velocity+Dir. Start	0 MPH, SW	Boom Length	100 IN
Wind Velocity+Dir. Stop	1.6 MPH, SW	Boom Height	28.0 IN
Wind Velocity+Dir. Max	2.9 MPH, SW	Ground Speed	4.2 MPH
Wet Leaves (Y/N)	N/A	Carrier	WATER
Soil Temperature	50 F	Application Amount	10 GAL/AC
Soil Moisture	Dry	Mix Size	2 L
% Cloud Cover	10	Propellant	CO2

Evaluation of herbicides for Canada thistle control in non-crop area near Bucyrus, ND, 2023-24.

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 20, 2023 using a backpack research sprayer with a 5 foot spray boom using a spray volume of 15 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 88% or more for all treatments except dicamba plus Venue (81%). At 1 YAT, eight of the 13 treatments continued to control Canada thistle at 90% or more. These included Milestone (aminopyralid), Tordon (picloram), Method (aminocyclopyrachlor), Plainview (indaziflam plus imazapyr plus aminocyclopyrachlor), and Venue (pyraflufen) plus Method. Glyphosate alone, even at 40 oz/A, provided poor control of Canada thistle (61 to 72%). Dicamba alone at 32 oz/A also provided little control (54%). While aminocyclopyrachlor alone and in combination provided the most consistent control, 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. Canada thistle control with different herbicide treatment in a non-crop location near Bucyrus, ND, 2023-24. Canada thistle was in late-bud to early bloom stage at application.

				1 WAT	2 WAT	4 WAT	8 WAT	1 YAT
Treatment[a]		Rate		Percent control				
1	Roundup PowerMax 3	26.7	oz/a	25 f	71 cde	87 cd	89 d	61 bc
	AMS	8.5	lb/100 gal					
2	Roundup PowerMax 3	40	oz/a	42 de	80 b	95 ab	98 a	72 b
	AMS	8.5	lb/100 gal					
3	Milestone	7	oz/a	45 cd	76 bc	85 cde	93 bcd	100 a
4	Tordon	32	oz/a	52 bc	79 b	86 cde	97 ab	99 a
5	Method	8	oz/a	42 de	76 bc	87 cd	97 ab	99 a
6	Method	12	oz/a	42 de	71 c-f	83 de	99 a	100 a
7	Dicamba (Sterling Blue)	32	oz/a	42 de	74 bcd	81 e	88 d	54 c
8	Plainview SC	32	oz/a	43 cd	69 def	89 c	98 a	99 a
9	Plainview SC	48	oz/a	55 ab	78 b	90 bc	100 a	100 a
10	Roundup PowerMax 3	26.7	oz/a	62 a	88 a	96 a	100 a	96 a
	Plainview SC	32	oz/a					
	AMS	8.5	lb/100 gal					
11	Venue	3.5	oz/a	43 cd	65 fg	81 e	88 d	35 d
	2,4-D LV6	23	oz/a					
12	Venue	3.5	oz/a	43 cd	66 efg	89 c	96 abc	93 a
	Method	8	oz/a					
13	Venue	3.5	oz/a	33 ef	63 g	74 f	81 e	0 f
	Dicamba (Sterling Blue)	16	oz/a					
LSD P=.05				8.5	6.1	5.2	5.3	11.1
Standard Deviation				5.1	3.7	3.1	3.2	6.6
CV				11.63	5.09	3.72	3.47	9.65
Treatment F				10.890	23.645	38.815	31.690	99.420
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001

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

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	Jul-20-2023	Equipment Type	Backpack
Start Time	1:30 PM	Operation Pressure	28 PSI
Stop Time	2:57 PM	Nozzle Model	11015
Timing	POST	Nozzle Type	Flat fan
Air Temperature Start, Stop	76.5, 75.5 F	Nozzle Spacing	19 IN
% Relative Humidity Start, Stop	46.3, 46.4	Boom Height	60 IN
Wind Velocity+Dir. Start	3.2 MPH, NNW	Ground Speed	2.7 MPH
Wind Velocity+Dir. Stop	2.7 MPH, NW	Carrier	WATER
Wind Velocity+Dir. Max	6.2 MPH, WNW	Application Amount	15 GAL/AC
Wet Leaves (Y/N)	N, no	Propellant	CO2
Soil Temperature	75 F		
% Cloud Cover	50		

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