DECEMBER 2025

Forty-Second Annual Western Dakota Crops Day Research Report

Ag. Report No. 42

NDSU NORTH DAKOTA STATE UNIVERSITY

NDSU HETTINGER RESEARCH EXTENSION CENTER

NDSU DICKINSON RESEARCH EXTENSION CENTER

42nd Annual Western Dakota Crops Day

December 9, 2025

Hettinger REC Classroom

MST

1:00 PM Opening Announcements

1:00 Weed Control Update for the Western Dakota's
Joe Ikley, NDSU Extension weed specialist, Fargo, ND.

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

2:30 Entomology Update and Sunflower Survey Results
Patrick Wagner, Entomology Field Specialist, SDSU West River Research and Extension.

3:00 Coffee & Doughnut Break- provided by Sponsors

3:00 Adams County Commodity Elections

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

3:45 Hettinger REC Agronomy Research and Varieties Update
John Rickertsen, Research Agronomist, NDSU Hettinger Research Extension Center.

4:15 Wrap up, Drawing for Door Prizes

Certified Crop Advisor (CCA) Credits have been applied for.

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.

2025 Western Dakota Crops Day Sponsors

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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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Allen Tellmann, New Salem
Aaron and Evan Friesz, New Leipzig, ND
Nathan Thomas, Lefor, ND

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2025 Table of Contents

Fungicide Trials

Special Reports

Weed Control

<u>Trials Not Published</u>

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

Trial	Average Yield
Hettinger Field Pea Variety Trial	30 bu/ac
Lupin Variety Trial	Terminated due to poor stands and heavy weed pressure.

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 2025 Hettinger HRSW variety trial was 4.5% meaning that there was a 4.5% 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 2025, the variety “ND Roughrider” averaged 75.7 bu/ac compared to “ND Stampede” at 67.2 bu/ac. Did the yield difference between these varieties differ significantly? Compare the yield difference of 8.5 bu/ac between the varieties (75.7 – 67.2) to the LSD 5% value of 3.6 bu/ac. Since the 8.5 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	April 29	May 22	May 20
Date of First Frost	October 12	September 6	September 16
Frost Free Days	**166**	**107**	**119**

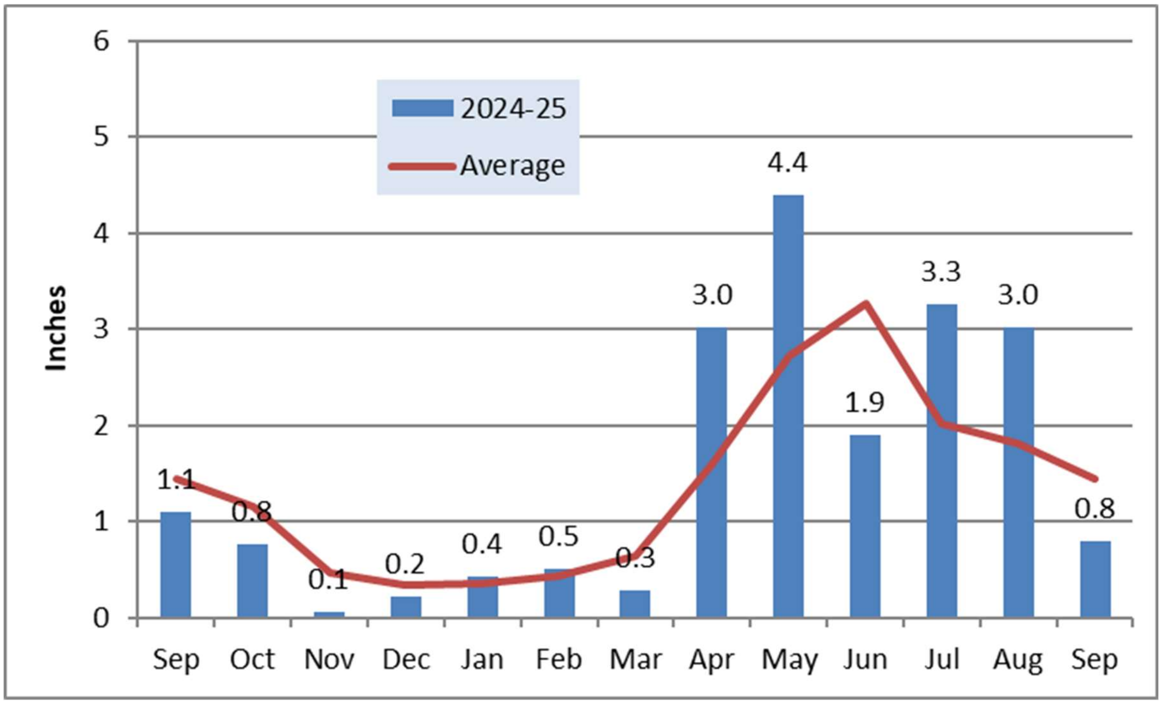
Precipitation (inches)

Month	2020-21	2021-22	2022-23	2023-24	2024-25	70 Year Average
October	0.6	3.9	0.2	0.2	0.8	1.2
November	0.0	0.1	0.4	0.4	0.1	0.5
December	0.0	0.8	0.3	0.3	0.2	0.3
January	0.0	0.1	0.2	0.3	0.4	0.3
February	0.0	0.4	0.6	0.3	0.5	0.4
March	0.1	0.1	1.0	1.0	0.3	0.6
April	0.6	4.0	0.2	1.1	3.0	1.6
May	4.5	2.3	5.5	1.9	4.4	2.7
June	0.5	3.8	5.3	2.6	1.9	3.3
July	1.2	2.6	1.2	0.7	3.3	2.0
August	2.7	0.4	3.7	1.4	3.0	1.8
September	0.4	1.0	2.9	1.1	0.8	1.4
April-August	**6.7**	**9.4**	**13.1**	**15.9**	**15.6**	**11.4**
Total	**11.2**	**10.6**	**19.4**	**21.4**	**18.7**	**16.3**

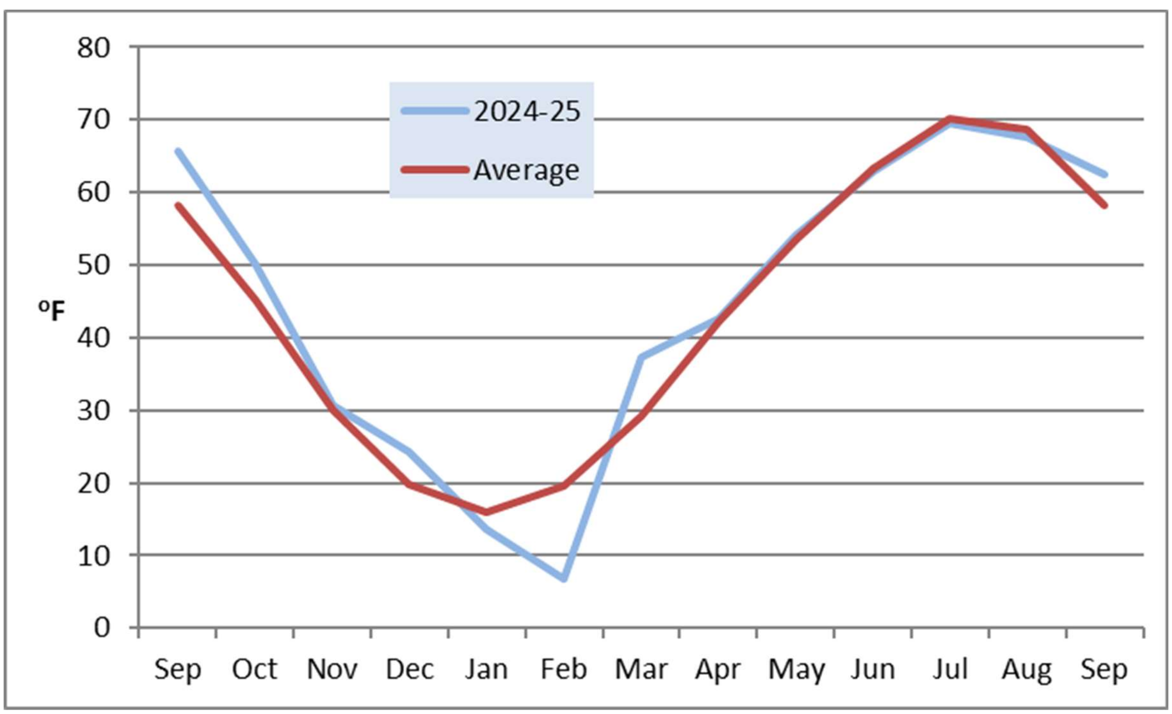
Air Temperature (ºF)

Month	2020-21	2021-22	2022-23	2023-24	2024-25	70 Year Average
October	37.0	48.0	46.2	42.3	50.1	45.2
November	36.1	35.2	22.4	33.5	30.7	30.1
December	27.3	19.6	10.4	29.1	24.2	19.7
January	24.7	18.5	18.4	15.9	13.6	15.9
February	9.4	17.4	21.0	29.5	6.8	19.6
March	36.3	30.6	18.6	27.2	37.2	29.2
April	40.9	34.3	39.8	44.0	42.7	42.2
May	50.8	51.3	58.9	53.5	54.2	53.6
June	67.7	61.8	65.8	62.4	62.9	63.4
July	74.6	69.7	66.7	70.6	69.5	70.2
August	68.5	71.1	67.5	68.1	67.6	68.6
September	62.2	62.0	60.8	65.7	62.5	58.2
Average	**39.4**	**44.6**	**43.3**	**41.4**	**43.5**	**43.0**

Hettinger Monthly Precipitation



Hettinger Average Monthly Temperature



2025 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	Term	Year	Term	Year	Term	year	Term	year	Term	year
	----------°F ----------		---------- °F ----------		----- inches -----					
November - 24	39.7	38.5	19.0	18.4	0.55	0.15				
December - 24	27.2	31.5	8.1	14.7	0.48	0.92				
January	25.0	24.5	5.9	3.9	0.40	0.17				
February	28.2	16.4	8.2	-3.6	0.43	0.54				
March	40.1	50.2	18.5	22.9	0.73	0.09				
April	54.0	56.0	28.9	30.4	1.41	1.08	335	394		
May	66.4	68.3	40.6	42.1	2.70	4.64	666	721	254	295
June	76.3	76.7	50.7	50.4	3.01	2.92	945	948	412	430
July	83.7	80.1	55.8	55.0	2.34	4.99	1170	1099	612	523
August	82.6	80.0	54.1	55.5	1.97	1.70	1128	1106	570	559
September	72.2	76.4	44.5	50.1	1.58	0.72	790	938	334	440
October	56.3	60.6	31.5	36.4	1.20	0.00				
Mean	54.3	54.9	30.5	31.4						
Total					16.79	17.92	5034	5203	2182	2246

[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.

Table 1. North Dakota hard red spring wheat variety descriptions, agronomic traits, 2025.

						Reaction to Disease[5]						
Variety	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Head[4]	Stem Rust[6]	Leaf Rust	Tan Spot	Bact. Leaf Streak	Head Scab	Stripe Rust	DRI Value[8]
AAC Hockley	**Evolution Genetics**	**2022**	**31**	**4**	**57**	**2**	**2**	**3**	**7**	**4**	**NA**	**49**
AAC Hodge	**Evolution Genetics**	**2022**	**35**	**4**	**57**	**2**	**4**	**4**	**6**	**4**	**NA**	**49**
AP Dagr	**Syngenta/AgriPro**	**2024**	**29**	**5**	**60**	**2**	**2**	**3**	**6**	**5**	**NA**	**51**
AP Elevate	**Syngenta/AgriPro**	**2024**	**29**	**4**	**59**	**2**	**4**	**3**	**5**	**5**	**3**	**50**
AP Gunsmoke CL2	Syngenta/AgriPro	2021	30	6	58	2	3	6	8	5	4	62
AP Iconic	**Syngenta/AgriPro**	**2024**	**31**	**4**	**59**	**2**	**3**	**6**	**5**	**5**	**NA**	**53**
AP Murdock	Syngenta/AgriPro	2019	30	4	58	2	6	3	6	5	3	54
AP Smith	Syngenta/AgriPro	2021	29	3	60	1	4	5	5	6	4	58
Ascend-SD	SD	2022	35	5	60	2	3	6	4	5	3	51
Brawn-SD	SD	2022	33	5	58	2	2	5	5	6	6	57
CP3678	**Croplan**	**2025**	**31**	**4**	**60**	**2**	**6**	**6**	**5**	**6**	**NA**	**61**
Dagmar	MT	2019	32	4	57	1	8	7	7	8	NA	80
Driver	SD	2019	33	3	60	2	2	6	6	5	2	56
Enhance-SD	**SD**	**2025**	**33**	**4**	**56**	**2**	**3**	**3**	**6**	**6**	**NA**	**58**
Faller	ND	2007	34	7	59	2	8	3	5	5	8	53
LCS Ascent	Limagrain	2022	31	5	56	2	7	5	6	5	2	58
LCS Cannon	Limagrain	2018	30	4	55	2	6	6	7	5	4	61
LCS Rimfire	**Limagrain**	**2024**	**28**	**4**	**57**	**2**	**8**	**2**	**7**	**5**	**NA**	**57**
MN-Lang	MN	2017	32	4	60	2	2	7	4	6	NA	57
MN- Rothsay	MN	2022	29	3	61	2	7	5	6	5	6	58
MN-Torgy	MN	2020	31	4	58	1	2	4	6	4	3	47
Mott[7]	ND	2009	36	4	57	2	8	7	5	5	NA	58
MS Charger	Meridian Seeds	2022	30	7	58	1	4	5	7	5	8	58
MS Cobra	Meridian Seeds	2022	30	4	58	1	2	6	7	6	3	63

[1]Refers to agent or developer: MN = Univ of Minnesota; MT = Montana State Univ; ND = North Dakota State Univ; SD = South Dakota State Univ

Varieties in bold text are a recent release or first year entry in NDSU trials with limited data available and the potential for future ratings to change.

[2]Height data averaged from 9 locations in 2025.

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

[4]Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from 7 locations in 2025.

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

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

[7]Solid stem or semi-solid stem for increased resistance to wheat stem sawfly.

[8]Disease Risk Index Value = Value to assess overall disease risk associated with a variety. The higher the value indicates higher disease risk. Value created using a weighted formula based on ranked importance of wheat diseases. Value does not include stripe rust (incomplete data due to minimal stripe rust occurrence in 2025).

Table 1. North Dakota hard red spring wheat variety descriptions, agronomic traits, 2025. (Continued)

Variety	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Head[4]	Reaction to Disease[5]: Stem Rust[6]	Leaf Rust	Tan Spot	Bact. Leaf Streak	Head Scab	Stripe Rust	DRI Value[8]
MS Nova	**Meridian Seeds**	**2024**	**31**	**4**	**57**	**1**	**4**	**6**	**7**	**5**	**3**	**59**
MT Carlson	MT	2023	30	7	58	2	7	4	7	8	4	76
ND Frohberg	ND	2020	34	4	58	2	4	7	4	5	3	53
ND Heron	ND	2021	32	5	55	1	6	4	7	4	6	52
ND Horizon	**ND**	**2025**	**31**	**3**	**58**	**2**	**5**	**4**	**5**	**5**	**NA**	**52**
ND Roughrider	**ND**	**2025**	**32**	**6**	**60**	**2**	**4**	**3**	**6**	**6**	**NA**	**58**
ND Stampede	**ND**	**2024**	**32**	**4**	**58**	**1**	**2**	**5**	**7**	**5**	**9**	**56**
ND Thresher	ND	2023	30	4	59	2	5	4	4	4	6	44
PFS Muffins	**Peterson Farm Seeds**	**2025**	**29**	**4**	**58**	**2**	**2**	**3**	**6**	**7**	**NA**	**63**
PFS Rolls	**Peterson Farm Seeds**	**2023**	**32**	**4**	**60**	**2**	**5**	**4**	**5**	**7**	**6**	**63**
PG Predator	**Premier Genetics**	**2025**	**29**	**4**	**60**	**2**	**3**	**4**	**5**	**6**	**NA**	**56**
Shelly	MN	2016	30	4	60	1	6	6	7	5	4	60
SY 611CL2	Syngenta/AgriPro	2019	29	3	58	2	6	4	6	4	4	50
SY Ingmar	Syngenta/AgriPro	2014	30	4	59	1	4	4	6	5	4	53
SY Valda	Syngenta/AgriPro	2015	30	5	59	1	3	4	7	5	8	56
TCG-Badlands	**21st Century Genetics**	**2024**	**32**	**4**	**58**	**1**	**6**	**4**	**6**	**7**	**3**	**66**
TCG-Wildcat	21st Century Genetics	2020	31	4	59	1	7	6	6	7	6	69
TCG-Zelda	**21st Century Genetics**	**2024**	**29**	**4**	**57**	**1**	**2**	**6**	**7**	**7**	**8**	**69**
TW Olympic	**Thunder Seed**	**2021**	**32**	**4**	**58**	**2**	**8**	**7**	**6**	**5**	**NA**	**61**
TW Trailfire	**Thunder Seed**	**2022**	**31**	**8**	**56**	**2**	**7**	**6**	**6**	**6**	**NA**	**65**
WB9590	WestBred	2017	27	3	57	2	3	6	8	8	8	78

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Varieties in bold text are a recent release or first year entry in NDSU trials with limited data available and the potential for future ratings to change.

[2]Height data averaged from 9 locations in 2025.

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

[4]Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from 7 locations in 2025.

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

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

[7]Solid stem or semi-solid stem for increased resistance to wheat stem sawfly.

[8]Disease Risk Index Value = Value to assess overall disease risk associated with a variety. The higher the value indicates higher disease risk. Value created using a weighted formula based on ranked importance of wheat diseases. Value does not include stripe rust (incomplete data due to minimal stripe rust occurrence in 2025).

Hard Red Spring Wheat - 2025 **Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	------------ Bushels per acre ------------				
AAC Hockley	65	31	1	61.7	12.4	--	--	64.3	--	--
AAC Hodge VB	65	35	1	61.5	13.3	--	--	69.6	--	--
AAC Spike	64	29	1	61.1	12.5	--	--	64.0	--	--
AAC Stoughton VB	67	35	1	61.4	12.4	--	--	72.6	--	--
AAC Westking	67	33	1	61.0	13.3	--	--	67.9	--	--
AAC Westlock	67	31	1	57.9	11.7	--	--	58.0	--	--
AP Dagr	68	30	1	59.3	11.4	--	--	64.5	--	--
AP Elevate	68	29	1	60.5	13.1	--	60.4	67.8	64.1	--
AP Gunsmoke CL2	66	30	1	59.9	11.8	84.9	61.3	65.2	63.2	70.5
AP Iconic	67	32	1	60.4	12.5	--	--	70.6	--	--
AP Murdock	67	30	1	60.4	12.3	75.2	56.7	63.2	59.9	65.0
AP Smith	67	28	1	60.9	13.3	80.8	54.6	64.8	59.7	66.7
Asend-SD	68	36	1	61.4	12.5	83.4	60.2	68.8	64.5	70.8
Brawn-SD	67	33	1	61.9	12.0	89.1	64.0	71.8	67.9	75.0
CAG Justify	69	35	1	60.1	11.2	93.6	65.0	81.4	73.2	80.0
CP3055	73	32	1	58.8	11.5	88.0	57.8	70.9	64.4	72.2
CP3555	66	31	1	60.8	12.5	--	--	73.3	--	--
CP3678	69	33	1	61.0	12.7	--	--	69.0	--	--
Dagmar	66	32	1	61.1	12.4	--	--	67.9	--	--
Driver	69	33	1	61.9	13.1	86.8	61.8	66.9	64.3	71.8
Enhance-SD	64	32	1	60.9	13.2	--	59.5	70.1	64.8	--
Faller	68	34	1	60.3	12.3	--	54.5	71.2	62.8	--
Glenn	63	35	1	61.7	13.4	73.3	51.5	61.4	56.4	62.0
Lang-MN	67	33	1	61.6	13.2	--	--	64.4	--	--
LCS Ascent	64	32	1	61.5	11.8	80.0	58.0	70.9	64.5	69.6
LCS Boom	63	30	1	60.6	12.1	76.2	59.3	63.5	61.4	66.3
LCS Buster	70	32	1	59.0	11.3	90.6	58.8	70.5	64.7	73.3
LCS Cannon	63	32	1	61.4	12.7	76.3	56.9	68.3	62.6	67.2
LCS Dual	66	33	1	61.0	12.2	85.2	55.4	69.4	62.4	70.0
LCS Hammer AX	67	31	1	59.9	12.4	73.3	61.4	60.7	61.0	65.1
LCS Rimfire	65	29	1	60.5	12.5	--	--	67.4	--	--
LCS Trigger	70	33	1	60.6	11.1	93.2	57.1	69.8	63.5	73.4
MN Rothsay	70	29	1	61.2	13.2	85.1	55.5	68.9	62.2	69.8
MN Torgy	67	32	1	61.7	12.5	85.4	60.1	68.8	64.5	71.4
MS Charger	66	30	1	60.1	11.5	88.9	59.3	67.8	63.5	72.0
MS Cobra	66	30	1	60.7	12.7	76.7	60.1	63.8	62.0	66.9
MS Nova	65	32	1	60.8	12.7	--	60.8	67.4	64.1	--
MS Ranchero	66	34	1	60.1	12.4	91.4	55.5	71.3	63.4	72.8
MT Carlson	66	30	1	59.7	12.1	--	58.7	66.4	62.5	--
MT Ubet	66	32	1	59.7	12.5	--	60.8	71.4	66.1	--

Table continued on next page

Hard Red Spring Wheat - 2025	**Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	------------ Bushels per acre ------------				
Table continues from previous page										
ND Frohberg	67	34	1	61.2	12.5	78.4	56.4	63.7	60.0	66.1
ND Heron	64	32	1	61.3	13.2	75.7	54.4	65.8	60.1	65.3
ND Horizon	66	31	1	58.0	13.0	86.3	57.1	64.9	61.0	69.5
ND Nighthawk	68	34	1	60.2	13.7	--	--	62.4	--	--
ND Roughrider	67	33	1	59.7	11.9	93.4	59.5	75.7	67.6	76.2
ND Stampede	65	32	1	59.9	12.4	90.0	53.6	67.2	60.4	70.3
ND Thresher	67	31	1	59.1	12.9	82.0	58.1	61.4	59.7	67.2
PFS Muffins	67	28	1	59.9	11.9	--	--	68.4	--	--
PFS Rolls	69	31	1	60.4	12.2	--	55.7	70.1	62.9	--
PG Predator	67	29	1	60.2	13.0	--	57.3	67.6	62.4	--
Shelly	68	30	1	60.7	11.7	86.4	58.4	65.0	61.7	69.9
SY 611 CL2	67	28	1	60.8	12.2	82.9	56.6	68.0	62.3	69.2
SY Ingmar	66	30	1	61.1	13.0	70.8	53.9	63.9	58.9	62.9
SY Valda	66	30	1	60.8	12.1	86.7	56.1	66.2	61.2	69.7
TCG Arsenal	70	31	1	60.6	12.6	--	--	73.9	--	--
TCG Badlands	66	33	1	60.6	12.2	--	62.2	66.4	64.3	--
TCG Wildcat	67	30	1	60.5	13.1	78.6	57.4	66.2	61.8	67.4
TCG Zelda	66	28	1	60.4	12.6	--	55.3	69.6	62.5	--
TW Olympic	67	32	1	61.2	12.5	--	--	70.3	--	--
TW Trailfire	63	32	1	60.1	12.4	--	--	59.8	--	--
WB9590	64	27	1	60.6	13.0	79.1	56.8	69.7	63.2	68.5
WB9719	69	30	1	61.9	12.1	81.6	57.2	68.9	63.1	69.2
Trial Mean	66.6	31.5	1.0	60.6	12.5	81.5	57.7	67.6	62.9	69.5
C.V. %	1.2	2.9	--	0.9	4.1	5.5	5.3	4.5	--	--
LSD 5%	0.9	1.1	--	0.6	0.6	5.2	3.6	3.6	--	--
LSD 10%	0.7	0.8	--	0.5	0.5	4.1	2.5	2.8	--	--

[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 17

Harvest Date: August 15

Previous Crop: Oat Hay

NDSU Hettinger Research Extension Center

Hard Red Spring Wheat - 2025 **Scranton, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	------------ Bushels per acre ------------				
AP Dagr	27	5	56.0	13.8	--	--	48.5	--	--
AP Elevate	27	4	58.2	14.3	--	--	56.6	--	--
AP Iconic	28	4	57.5	13.9	--	--	56.2	--	--
AP Smith	27	1	57.3	14.7	61.2	29.8	52.7	41.2	47.9
Brawn-SD	32	5	61.1	13.2	69.5	32.9	61.6	47.2	54.7
CP3055	32	2	54.8	12.9	--	24.9	58.5	41.7	--
CP3555	29	5	57.9	14.1	--	--	57.4	--	--
CP3678	31	4	57.3	14.3	--	--	53.9	--	--
Enhance-SD	30	4	58.8	14.6	--	--	58.1	--	--
Glenn	32	4	60.4	14.8	58.1	39.4	53.3	46.3	50.3
LCS Ascent	30	6	58.7	13.2	--	--	56.0	--	--
LCS Boom	28	6	58.5	13.8	--	--	52.6	--	--
LCS Rimfire	28	6	58.3	14.1	--	--	58.5	--	--
MN Rothsay	29	1	59.2	14.6	65.7	33.4	62.4	47.9	53.8
MN Torgy	28	4	59.0	14.3	66.4	40.3	56.9	48.6	54.5
MS Nova	28	5	57.5	13.7	--	--	52.8	--	--
MT Carlson	30	6	57.6	13.9	--	41.9	55.3	48.6	--
ND Frohberg	31	4	59.6	14.5	55.9	36.9	56.3	46.6	49.7
ND Horizon	29	4	57.1	14.3	--	--	57.6	--	--
ND Nighthawk	31	7	58.4	14.8	--	--	53.9	--	--
ND Roughrider	30	4	58.5	13.8	--	--	69.7	--	--
ND Stampede	31	4	58.7	14.5	--	31.9	67.8	49.8	--
TCG Badlands	29	5	58.6	13.9	--	--	57.3	--	--
TCG Zelda	26	4	57.3	14.5	--	--	55.8	--	--
WB9590	26	4	57.4	14.6	66.7	39.8	51.0	45.4	52.5
Trial Mean	29	4	58.2	14.1	63.8	33.4	56.8	46.5	51.8
C.V. %	2.9	17.4	0.8	2.3	5.3	14.2	4.1	--	--
LSD 5%	1.0	0.9	0.6	0.4	3.9	6.5	2.8	--	--
LSD 10%	0.8	0.4	0.7	0.3	3.1	5.0	2.2	--	--

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

Planting Date: May 8

Harvest Date: August 27

Previous Crop: Spring Wheat

Hard Red Spring Wheat - 2025 **Regent, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	------------ Bushels per acre ------------				
AP Dagr	26	3	57.6	15.0	--	--	38.4	--	--
AP Elevate	26	2	58.6	16.0	--	--	46.0	--	--
AP Iconic	28	3	58.1	15.3	--	--	44.2	--	--
AP Smith	27	1	58.6	15.6	52.5	41.5	46.7	44.1	46.9
Brawn-SD	33	4	61.0	14.9	58.6	50.9	53.5	52.2	54.3
CP3055	31	2	54.7	13.8	--	47.1	46.7	46.9	--
CP3555	28	4	58.6	15.3	--	--	47.1	--	--
CP3678	31	4	58.6	15.6	--	--	56.5	--	--
Enhance-SD	30	3	59.0	15.9	--	--	47.1	--	--
Glenn	32	4	59.7	16.0	51.8	43.5	43.1	43.3	46.2
LCS Ascent	29	5	59.6	14.2	--	--	49.2	--	--
LCS Boom	29	5	59.1	15.6	--	--	40.7	--	--
LCS Rimfire	28	4	58.9	15.6	--	--	49.4	--	--
MN Rothsay	29	1	59.4	16.0	57.9	45.0	51.8	48.4	51.6
MN Torgy	29	4	59.4	16.4	53.2	47.3	42.1	44.7	47.5
MS Nova	28	4	57.2	14.8	--	--	41.3	--	--
MT Carlson	30	5	58.4	15.4	--	50.8	53.8	52.3	--
ND Frohberg	32	3	59.9	15.9	51.2	42.5	47.0	44.8	46.9
ND Horizon	30	3	58.7	15.8	--	--	53.5	--	--
ND Nighthawk	31	5	58.9	16.2	--	--	48.7	--	--
ND Roughrider	31	2	58.7	15.6	--	--	53.5	--	--
ND Stampede	30	3	58.9	16.8	--	48.4	54.7	51.5	--
TCG Badlands	28	3	58.4	15.6	--	--	44.9	--	--
TCG Zelda	26	3	57.9	15.9	--	--	43.9	--	--
WB9590	26	3	58.2	16.3	56.2	46.0	45.9	45.9	49.3
Trial Mean	29	3	58.6	15.6	53.9	44.6	47.6	47.4	49.0
C.V. %	3.1	21.0	0.9	2.3	5.6	12.9	7.4	--	--
LSD 5%	1.1	0.8	0.6	0.4	3.6	6.8	4.1	--	--
LSD 10%	0.9	0.7	0.5	0.3	2.8	5.3	3.4	--	--

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

Planting Date: May 8

Harvest Date: August 27

Previous Crop: Spring Wheat

Hard Red Spring Wheat - 2025 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	----------- Bushels per acre -----------				
AAC Hockley	29	2	58.2	13.9	--	--	55.6	--	--
AAC Hodge VB	34	2	57.7	14.7	--	--	56.5	--	--
AAC Spike	28	1	58.0	13.8	--	--	53.4	--	--
AAC Stoughton VB	31	2	57.6	13.6	--	--	51.9	--	--
AAC Westking	29	1	57.4	14.2	--	--	58.9	--	--
AAC Westlock	29	2	56.2	13.4	--	--	51.0	--	--
AP Dagr	27	1	56.6	13.0	--	--	58.7	--	--
AP Elevate	27	1	57.1	14.3	--	70.0	59.8	64.9	--
AP Gunsmoke CL2	28	3	56.9	13.5	49.4	62.2	50.0	56.1	53.9
AP Iconic	29	1	56.8	14.0	--	--	56.0	--	--
AP Murdock	28	2	56.7	13.7	52.6	68.7	54.6	61.7	58.6
AP Smith	25	1	56.5	14.5	48.8	61.3	52.6	56.9	54.2
Asend-SD	34	3	58.2	13.2	56.3	74.4	57.3	65.9	62.7
Brawn-SD	32	1	58.9	12.4	50.3	67.5	65.1	66.3	61.0
CAG Justify	31	1	56.8	12.5	50.3	69.5	65.1	67.3	61.6
CP3055	32	1	53.4	12.8	51.6	65.5	55.5	60.5	57.6
CP3555	29	2	55.3	14.1	--	--	52.0	--	--
CP3678	30	1	56.4	14.1	--	--	54.6	--	--
Dagmar	31	2	56.9	14.4	--	--	52.9	--	--
Driver	32	1	58.9	13.5	56.9	67.5	62.3	64.9	62.2
Enhance-SD	32	2	57.0	13.7	--	76.1	57.7	66.9	--
Faller	32	1	56.8	13.5	--	63.8	57.1	60.4	--
Glenn	32	3	58.2	13.9	45.9	59.7	49.1	54.4	51.5
Lang-MN	31	1	57.7	15.1	--	--	53.6	--	--
LCS Ascent	30	3	57.5	12.9	45.6	69.1	55.0	62.0	56.6
LCS Boom	28	1	58.4	13.7	47.0	62.8	52.7	57.8	54.2
LCS Buster	32	1	56.4	12.0	59.0	70.2	64.1	67.1	64.4
LCS Cannon	29	1	58.9	12.9	45.1	66.4	56.6	61.5	56.0
LCS Dual	29	1	57.4	13.8	45.2	61.7	51.1	56.4	52.7
LCS Hammer AX	29	1	56.5	14.2	51.7	61.5	53.1	57.3	55.4
LCS Rimfire	27	2	56.9	13.9	--	--	56.9	--	--
LCS Trigger	31	2	58.5	11.8	60.3	73.0	53.8	63.4	62.4
MN Rothsay	29	1	57.0	13.7	56.8	64.5	58.0	61.2	59.7
MN Torgy	31	1	58.3	14.2	60.7	71.6	62.3	66.9	64.8
MS Charger	29	2	57.3	12.5	46.9	64.0	57.3	60.7	56.1
MS Cobra	28	2	57.7	13.9	50.7	69.2	55.7	62.4	58.5
MS Nova	28	1	57.8	13.5	--	64.1	56.8	60.5	--
MS Ranchero	34	1	56.2	13.1	66.6	68.8	61.9	65.4	65.8
MT Carlson	27	5	56.6	13.3	--	64.3	50.8	57.5	--
MT Ubet	30	2	57.3	13.4	--	64.7	57.0	60.9	--

Table continued on next page

Hard Red Spring Wheat - 2025 **Mandan, ND**

Variety	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	inches	1-9*	lbs/bu	%	------------ Bushels per acre ------------				
Table continues from previous page									
ND Frohberg	33	2	58.3	14.3	47.9	60.3	58.2	59.3	55.5
ND Heron	31	2	58.7	14.0	44.2	62.8	55.0	58.9	54.0
ND Horizon	30	1	57.3	13.8	61.3	64.0	61.6	62.8	62.3
ND Nighthawk	31	4	56.2	14.6	--	--	43.4	--	--
ND Roughrider	31	1	56.9	13.7	61.3	74.7	68.4	71.5	68.1
ND Stampede	30	1	56.8	13.8	49.1	67.5	61.5	64.5	59.4
ND Thresher	29	2	55.2	15.6	53.2	58.8	45.1	51.9	52.3
PFS Muffins	28	1	56.7	13.6	--	--	58.5	--	--
PFS Rolls	29	1	56.0	13.6	--	67.3	54.3	60.8	--
PG Predator	27	1	56.7	14.4	--	64.3	58.8	61.6	--
Shelly	29	1	57.8	13.5	51.5	68.1	57.9	63.0	59.1
SY 611 CL2	27	1	58.1	14.0	57.4	69.6	56.0	62.8	61.0
SY Ingmar	28	1	57.5	14.8	49.9	63.6	52.0	57.8	55.2
SY Valda	28	2	57.6	13.1	60.3	66.1	58.0	62.1	61.5
TCG Arsenal	28	1	55.8	13.4	--	--	55.2	--	--
TCG Badlands	29	1	55.9	13.4	--	65.8	57.6	61.7	--
TCG Wildcat	29	1	57.9	14.1	55.5	65.3	58.8	62.1	59.9
TCG Zelda	26	1	56.3	13.6	--	66.9	61.5	64.2	--
TW Olympic	30	1	58.5	13.7	--	--	59.1	--	--
TW Trailfire	28	5	57.2	13.4	--	--	44.7	--	--
WB9590	26	1	56.8	13.9	45.7	64.4	56.2	60.3	55.4
WB9719	28	1	58.6	13.7	53.0	56.0	58.8	57.4	55.9
Trial Mean	30	2	57.2	13.7	52.4	64.9	56.0	61.6	58.5
C.V. %	3.4	38.3	1.3	2.6	9.2	7.1	8.2	--	--
LSD 5%	1.2	0.8	0.8	0.4	5.6	5.4	5.3	--	--
LSD 10%	0.9	0.6	0.7	0.3	4.4	4.2	4.2	--	--

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

Planting Date: May 7

Harvest Date: August 26

Previous Crop: Soybean

2025 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	-------- Grain Yield-------- 2023	2024	2025	Average Yield[1] 2 Year	3 Year
			in	lbs/bu	%	----------bu/ac----------			----bu/ac----	
AAC Concord	71	12,247	35	60.1	14.3	--	--	77.0	--	--
AP Dagr	71	13,459	28	60.2	13.8	--	--	80.4	--	--
AP Elevate	71	13,979	31	61.4	14.4	--	67.4	80.7	74.0	--
AP Gunsmoke CL2	71	13,455	31	61.1	14.3	53.0	67.0	83.2	75.1	67.7
AP Iconic	70	14,702	30	61.1	14.3	--	--	79.2	--	--
AP Murdock	70	14,119	27	60.6	14.0	41.6	69.3	74.2	71.7	61.7
AP Smith	71	13,906	28	61.5	14.5	53.1	57.7	77.2	67.4	62.6
Ascend-SD	72	14,884	35	61.8	14.3	48.6	66.4	86.7	76.5	67.2
Brawn-SD	71	13,293	31	62.8	13.1	50.1	66.8	86.6	76.7	67.8
CP 3055	77	12,937	32	59.1	12.6	--	65.0	89.7	77.3	--
CP 3555	71	13,265	31	61.0	13.8	--	--	83.6	--	--
CP 3678	72	12,340	30	61.4	14.7	--	--	88.9	--	--
Dagmar	68	11,841	30	60.9	15.0	--	--	82.3	--	--
Driver	73	13,873	31	62.1	13.9	46.5	67.8	84.0	75.9	66.1
Enhance-SD	69	13,900	32	60.8	14.0	--	73.5	76.5	75.0	--
Faller	71	12,942	32	61.0	13.6	--	51.7	85.6	68.7	68.7
Lang-MN	71	14,452	31	62.2	14.6	--	--	79.7	--	--
LCS Ascent	68	14,486	31	62.0	13.3	54.3	72.9	94.1	83.5	73.8
LCS Boom	68	13,909	28	62.7	14.3	46.5	76.8	81.9	79.4	68.4
LCS Cannon	68	13,801	29	62.8	14.0	54.3	70.5	76.1	73.3	67.0
LCS Rimfire	70	12,580	27	61.1	14.0	--	--	83.2	--	--
MN Rothsay	74	13,992	28	61.7	13.8	51.4	63.2	88.0	75.6	67.5
MN Torgy	70	13,422	29	61.6	14.1	53.4	66.3	83.5	74.9	67.7
MS Charger	71	13,586	31	60.7	12.6	52.7	59.1	91.4	75.2	67.7
MS Cobra	71	14,876	30	61.4	14.0	45.7	71.2	84.4	77.8	67.1
MS Nova	69	15,320	31	61.6	13.8	--	70.4	86.3	78.4	--
MS Ranchero	70	13,941	30	61.2	13.2	59.4	64.9	91.5	78.2	71.9
MT Carlson	71	12,938	29	60.8	13.5	--	73.2	80.4	76.8	--
ND Frohberg	71	11,983	34	62.2	14.8	44.2	71.1	79.2	75.1	64.8
ND Heron	69	13,927	30	62.4	14.5	45.2	65.1	75.9	70.5	62.1
ND Horizon	70	13,601	30	61.1	14.6	47.0	63.2	82.0	72.6	64.1
ND Nighthawk	71	11,931	33	60.8	15.3	--	--	81.9	--	--
ND Roughrider	71	14,019	31	60.7	13.3	54.1	60.9	92.7	76.8	69.2
ND Stampede	70	13,248	31	61.4	14.3	49.7	60.9	86.1	73.5	65.6
ND Thresher	73	14,042	29	60.1	14.3	46.3	57.9	77.8	67.9	60.7

Table continued on next page

2025 Hard Red Spring Wheat - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	-------- Grain Yield-------- 2023	2024	2025	Average Yield[1] 2 Year	3 Year
Table continues from previous page										
PFS Muffins	71	13,095	30	61.0	13.7	--	--	91.9	--	--
PFS Rolls	71	13,263	31	60.8	13.5	--	63.0	91.7	77.3	--
PG Predator	71	14,004	29	61.3	14.5	--	--	82.0	--	--
Shelly	72	13,080	30	61.9	13.6	51.6	66.5	88.8	77.6	69.0
SY 611 CL2	70	14,326	28	62.6	14.6	49.4	69.6	80.7	75.2	66.6
Sy Ingmar	71	14,311	29	62.0	14.7	49.8	65.1	77.5	71.3	64.1
SY Valda	70	13,395	32	61.6	13.8	55.6	63.1	85.5	74.3	68.1
TCG Arsenal	75	12,778	30	61.6	12.9	--	--	100.9	--	--
TCG Badlands	71	14,124	31	61.1	13.9	--	73.2	87.5	80.3	--
TCG Zelda	70	13,243	30	61.3	14.0	--	66.9	89.1	78.0	--
TCG-Wildcat	71	12,529	31	62.3	14.3	50.5	69.1	83.0	76.1	67.5
TW Olympic	71	13,668	32	62.2	13.7	--	--	88.7	--	--
TW Trailfire	68	14,019	32	60.8	14.3	--	--	76.0	--	--
WB 9590	69	12,901	26	61.0	14.7	44.1	70.5	79.0	74.7	64.5
Trial Mean	71	13,477	30	61.4	14.1	49.8	65.6	83.9	75.2	66.6
CV %	1	4	6	0.6	2.9	10.3	6.3	6.2	--	--
LSD 0.10	1	545	2	0.3	0.4	4.7	3.8	4.8	--	--

Planting Date: April 9, 2025
Harvest Date: August 13, 2025
Protein adjusted to 12% moisture
Previous Crop: Oat hay
Seeding Rate: 1.2 million live seeds/ac

2025 New Salem Spring Wheat - Recrop **Dickinson, ND**

Variety	Seeds per Pound	Test Weight	Protein	Grain Yield
		lbs/bu	%	bu/ac
AP Elevate	13,855	62.2	12.7	62.5
AP Gunsmoke CL2	14,462	60.9	12.6	58.9
Brawn-SD	12,897	64.1	11.4	73.1
CP 3055	12,591	59.8	11.3	69.3
Enhance-SD	13,989	61.8	12.8	59.6
LCS Rimfire	12,050	62.7	12.7	61.9
MN Rothsay	14,011	62.6	12.6	63.2
MS Nova	15,112	62.8	12.5	63.5
MT Carlson	12,857	61.5	11.9	63.5
ND Heron	13,461	63.0	13.1	56.3
ND Nighthawk	11,608	62.6	12.5	68.8
ND Roughrider	13,931	61.6	11.7	74.8
ND Stampede	13,466	62.0	12.3	68.2
ND Thresher	14,597	61.6	12.6	60.0
TCG Zelda	12,550	62.5	13.0	63.9
WB 9590	12,254	62.7	12.9	63.4
Trial Mean	13,356	62.1	12.4	64.4
CV %	3.5	0.4	4.3	6.3
LSD 0.10	445	0.3	0.5	3.8

Planting Date: May 25, 2025
Harvest Date: August 27, 2025
Previous Crop: Corn
Seeding Rate: 1.2 million live seeds/ac

2025 North Dakota hard red winter wheat variety descriptions and agronomic traits.

Variety	Agent or Origin[2]	Year	Reaction to Disease[1] Stripe Rust	Leaf Rust	Stem Rust	Scab	Tan Spot	Days to Heading[3]	Straw Strength[4]	Height[5] (inches)	Winter[6] Hardiness
AAC Coldfront	AAFC	2022	4	4	4	5	NA	0	2	33	4
AAC Goldrush	AAFC	2021	5	3	5	5	NA	1	4	33	4
AAC Overdrive	AAFC	2022	3	4	3	4	NA	0	4	30	3
AAC Vortex	Meridian	2021	4	4	4	4	8	0	3	33	2
AAC Wildfire	AAFC	2015	1	5	8	4	6	4	4	33	2
AC Emerson	Meridian	2011	1	6	1	3	5	1	3	35	5
CS Bridger CLP	**Circle S**	**2024**	**NA**	**NA**	**NA**	**NA**	**NA**	**-1**	**4**	**28**	**NA**
Jerry	ND	2001	8	3	1	8	8	0	6	38	3
LCS Steel AX	Limagrain	2022	7	7	9	8	4	-1	4	32	5
MS Maverick	Meridian	2020	2	6	5	8	4	-3	5	29	4
ND Allison	ND	2023	7	5	4	4	NA	1	4	34	4
ND Noreen	ND	2020	3	3	1	3	4	0	4	35	3
Northern	MT	2015	1	8	1	8	6	2	4	32	4
SD Andes	SD	2020	2	8	NA	5	6	-1	4	32	2
SD Midland	SD	2021	1	8	7	6	8	-2	4	33	4
SD Pheasant	SD	2023	NA	NA	NA	5	NA	-2	5	32	4
SY Monument	Agripro	2014	3	3	1	8	8	-3	4	30	4
WB 4422	WB	2022	8	6	6	8	5	-4	3	31	4
WB 4540	**WB**	**2024**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5**	**3**	**31**	**NA**
Winner	SD	2019	5	NA	3	4	5	-4	4	31	4

[1]Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible, NA = not available.
[2]MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University;
WB = WestBred; AAFC = Agriculture and Agri-Food Canada; Meridian = Meridian Seeds; Circle S = Circle S Seeds (Montana).
[3]Days to heading relative to Jerry.
[4]Straw strength: 1 = strongest, 9 = weakest. Based on field observations from limited sites.
[5]Based on the average of several environments and should be used for comparing varieties. The environment can impact the height of varieties.
[6]Relative winter hardiness rating: 1 = excellent, 10 = no survival. These values are subject to change as additional information becomes available.
Bold varieties are those recently released or the first time tested, so data are limited and rating values may change.

Hard Red Winter Wheat - 2025 — Hettinger, ND

Variety	Heading Date	Plant Height	Plant Lodge	Test Weight	Grain Protein	---- Grain Yield ---- 2023	2024	2025	Average Yield 2 yr	3 yr
	Julian	inches	1-9[1]	lbs/bu	%	---------- Bushels per acre ----------				
AAC Coldfront	159	31	1	54.1	12.5	--	--	57.7	--	--
AAC Goldrush	161	32	1	52.5	13.7	54.5	68.4	52.2	60.3	58.4
AAC Overdrive	162	30	1	50.8	13.8	--	63.8	55.6	59.7	--
AAC Vortex	161	31	1	51.8	13.8	55.3	70.6	51.9	61.2	59.3
AAC Wildfire	165	31	1	49.1	14.5	58.6	73.4	49.2	61.3	60.4
AC Emerson	162	33	1	52.7	13.6	46.4	62.5	51.4	57.0	53.4
CP7017AX	152	29	1	55.8	12.3	44.4	65.7	61.0	63.3	57.0
CP7319AX	151	29	1	56.4	12.9	--	--	53.2	--	--
CP7462	154	28	1	53.1	12.9	--	--	66.1	--	--
CP7909	151	30	1	55.2	12.5	28.9	55.9	56.6	56.2	47.1
CS Bridger CLP	159	29	1	51.7	13.8	--	--	53.9	--	--
Jerry	160	35	1	52.5	13.8	48.5	57.0	48.3	52.7	51.3
LCS Steel AX	159	32	1	54.5	12.6	--	60.4	61.8	61.1	--
MS Maverick	157	30	1	55.4	12.9	45.2	62.3	61.6	61.9	56.4
ND Allison	161	33	1	54.1	12.1	55.6	62.1	57.6	59.8	58.4
ND Noreen	160	32	1	55.3	13.5	55.5	66.4	54.0	60.2	58.6
Northern	164	31	1	53.1	13.0	58.0	71.4	57.7	64.6	62.4
SD Andes	159	31	1	55.0	13.4	58.7	71.7	60.6	66.1	63.6
SD Midland	160	33	1	54.3	13.5	58.9	69.2	60.5	64.9	62.9
SD Pheasant	158	32	1	54.4	13.6	59.4	54.4	64.7	59.6	59.5
SY Monument	159	30	1	52.1	12.9	44.6	58.0	63.0	60.5	55.2
WB4540	157	30	1	55.0	12.8	35.7	55.9	60.9	58.4	50.8
WB4422	154	31	1	54.6	12.5	--	59.6	64.6	62.1	--
Winner	154	30	1	55.2	12.2	44.1	69.1	64.5	66.8	59.2
			1						--	--
SD20B088-2	156	31	1	54.5	13.9	--	--	59.2	--	
23NORD-180	160	33	1	53.5	14.4	--	--	54.4	--	--
23NORD-184	158	30	1	52.1	12.7	--	--	59.7	--	--
23NORD-191	160	33	1	53.2	13.9	--	--	55.1	--	--
Trial Mean	158	31	1.0	53.6	13.2	49.1	63.1	57.7	61.0	57.1
C.V. %	0.6	4.1	--	1.5	4.9	7.1	8.1	5.0	--	--
LSD 0.05	1.1	1.5	--	1.0	0.8	5.7	6.1	3.4	--	--
LSD 0.10	0.9	1.2	--	0.8	0.6	4.8	4.7	2.7	--	--

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

Previous Crop: Spring Wheat

Planting Date: September 17

Harvest Date: August 4

NDSU Dickinson Research Extension Center

2025 Winter Wheat - Recrop | **Dickinson, ND**

Variety	Heading Date	Seeds per Pound	KWT (g/1000)	Plant Height	Test Weight	Protein	Grain Yield 2023	Grain Yield 2024	Grain Yield 2025	Average Yield 2 Year	Average Yield 3 Year
	Julian			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Coldfront	172	13,266	34.3	33.5	62.1	11.7	--	74.2	102.3	88.2	--
AAC Overdrive	171	15,262	29.8	33.2	58.6	12.5	--	81.2	95.3	88.3	--
AAC Vortex	172	13,103	34.7	35.8	61.2	12.6	47.1	71.7	99.2	85.4	72.7
AAC Wildfire	175	13,096	34.6	35.6	60.5	12.4	55.8	70.9	100.5	85.7	75.7
AAC Goldrush	174	14,849	30.5	34.5	60.1	12.4	47.5	70.4	93.0	81.7	70.3
AC Emerson	173	15,372	29.5	38.9	61.7	12.9	40.2	63.4	88.8	76.1	64.1
CS Bridger CLP	171	17,142	26.4	30.4	57.0	12.6	--	--	85.7	--	--
Jerry	172	12,573	36.1	43.4	60.2	12.7	42.3	54.7	92.6	73.7	63.2
LCS Steel AX	170	14,107	32.2	32.4	59.4	11.3	--	88.3	97.4	92.9	--
MS Maverick	170	12,603	36.0	31.3	59.7	12.8	32.4	78.9	75.7	77.3	62.3
ND Allison	173	14,334	31.6	36.6	61.1	11.6	48.8	88.1	98.7	93.4	78.5
ND Noreen	171	11,505	39.2	37.3	62.9	12.7	52.1	53.8	100.5	77.1	68.8
Northern	173	14,736	30.9	34.3	58.2	12.5	54.7	87.6	91.2	89.4	77.8
SD Vivian	171	13,697	33.1	34.4	60.2	12.5	--	--	107.5	--	--
SD Andes	171	13,612	33.4	34.0	61.5	12.2	56.6	99.3	96.1	97.7	84.0
SD Midland	170	12,120	37.6	34.4	61.5	11.8	47.9	86.9	98.5	92.7	77.8
SD Pheasant	170	12,196	37.3	34.5	60.9	12.7	37.7	70.7	106.8	88.7	71.7
SY Monument	170	13,915	32.6	32.2	58.6	11.8	32.3	64.4	97.3	80.8	64.7
WB4422	169	13,527	33.6	32.5	60.2	12.5	--	86.7	94.1	90.4	--
WB4540	169	13,743	33.2	32.3	58.7	11.9	--	--	96.7	--	--
Winner	169	12,632	36.0	30.0	59.9	12.4	37.0	83.4	90.9	87.1	70.4
Trial Mean	171	13,594	33.7	34.4	60.1	12.3	41.0	77.4	96.1	85.9	71.6
CV %	0.8	4.4	5.0	7.1	0.8	2.5	15.0	11.1	6.0	--	--
LSD 0.10	1	554	1.6	2.2	0.4	0.3	7.3	7.8	5.4	--	--

Planting Date: September 20, 2024
Harvest Date: August 13, 2025
Protein adjusted to 12% moisture
Previous Crop: Cover crop for hay
Seeding Rate: 1.2 million live seeds/ac

Winter Rye - 2025										**Hettinger, ND**
	Spring	Heading	Plant	Plant	Test	----- Grain Yield -----			Average Yield	
Variety	Stand	Date	Height	Lodge	Weight	2023	2024	2025	2 yr	3 yr
	%		inches	Jan-91	lbs/bu	------------ Bushels per acre ------------				
Aroostok	90	5/27	48.3	3.5	50.1	35.8	58.2	52.2	55.2	48.7
Danko	90	5/29	44.3	2.5	50.6	67.7	60.9	58.7	59.8	62.4
Hazlet	90	5/29	50.5	3.5	50.4	56.4	56.0	48.3	52.1	53.6
ND Dylan	90	5/30	53.0	4.8	49.7	38.3	57.2	52.8	55.0	49.4
ND Gardner	90	5/22	50.0	3.3	49.0	40.2	42.8	39.7	41.3	40.9
Spooner	90	5/27	50.0	3.3	49.7	49.8	45.1	46.9	46.0	47.3
Trial Mean	90	5/27	49.3	3.5	49.9	59.3	63.7	49.8	51.6	50.4
C.V. %	--	0.5	2.5	16.9	1.1	12.4	6.1	9.2	--	--
LSD 0.05	--	0.9	1.5	0.7	0.7	10.5	4.7	5.7	--	--
LSD 0.10	--	0.7	1.2	0.6	0.5	8.7	4.0	4.3	--	--

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

Planting Date: September 17

Harvest Date: August 8

Previous Crop: Spring Wheat

Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2025.

	Agent or Origin[1]	Year Released	Height (inches)[2]	Straw Strength[3]	Days to Heading[4]	Reaction to Disease[5] Stem Rust	Leaf Rust	Foliar Disease	Bact. Leaf Streak	Head Scab
AAC Schrader	**Can.**	**2024**	**37**	**4**	**60**	**NA**	**NA**	**NA**	**NA**	**NA**
AAC Spitfire	**Can.**	**2017**	**35**	**4**	**63**	**NA**	**NA**	**NA**	**NA**	**NA**
AAC Stronghold[7]	Can.	2016	34	3	62	NA	NA	NA	NA	NA
Alkabo	ND	2005	34	3	62	1	1	5	7	6
Carpio	ND	2012	35	5	64	1	1	5	6	5
CDC Defy	Can.	2019	37	3	61	NA	NA	NA	NA	NA
Divide	ND	2005	35	5	63	1	1	5	7	5
Joppa	ND	2013	35	5	63	1	1	5	7	5
Maier	ND	1998	34	4	62	1	1	5	NA	8
Mountrail	ND	1998	35	4	63	1	1	5	7	8
MT Blackbeard[6]	**MT**	**2022**	**39**	**6**	**63**	**1**	**1**	**5**	**NA**	**6**
ND Grano[6]	ND	2017	35	5	63	1	1	8	7	6
ND Riveland[6]	ND	2017	37	4	63	1	1	5	6	5
ND Stanley[6]	ND	2021	35	3	63	1	1	5	6	5
Strongfield[6]	Can.	2004	34	5	63	1	1	6	NA	8
TCG Bright	**21st Cent Gen**	**2022**	**32**	**4**	**67**	**NA**	**NA**	**NA**	**NA**	**NA**
TCG Ranger	**21st Cent Gen**	**2024**	**35**	**4**	**58**	**NA**	**NA**	**NA**	**NA**	**NA**

[1]Refers to agent or developer: Can. = Agriculture and Agri-Food Canada, ND = North Dakota State University. MT = Montana State University.
21st Cent Gen = Twenty-first Century Genetics (TCG)

Bold varieties are those recently released or new to NDSU testing, so data are limited and ratings may change.

[2]Plant height was obtained from the average of six locations in 2025.

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

[4]Days to Heading = the number of days from planting to head emergence from the boot. Averaged from six locations in 2025.

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

[6]Low cadmium accumulating variety.

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

Durum Wheat - 2025	**Hettinger, ND**

Variety	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	------------- Bushels per acre -------------				
AAC Schrader	69	35	1	60.5	11.8	--	--	59.5	--	--
AAC Spitfire	70	34	1	59.4	11.8	--	--	61.9	--	--
AAC Stronghold	69	32	1	60.5	11.8	76.9	50.1	57.3	53.7	61.4
Alkabo	69	33	1	59.5	11.0	76.9	55.6	55.8	55.7	62.8
Carpio	70	34	2	59.1	10.8	77.6	57.1	54.2	55.6	63.0
CDC Defy	67	35	1	59.7	11.1	83.6	58.8	56.5	57.6	66.3
CDC Vantta	72	29	1	60.4	11.7	--	--	61.1	--	--
CDC Wiseton	68	34	1	59.4	11.6	--	--	58.5	--	--
Divide	69	34	2	59.7	11.1	75.2	54.2	54.6	54.4	61.3
Joppa	69	34	2	58.8	10.4	80.1	58.0	56.0	57.0	64.7
Maier	68	34	2	59.9	10.6	67.8	55.1	55.5	55.3	59.4
Mountrail	70	33	2	58.3	10.8	77.4	55.8	56.0	55.9	63.1
MT Blackbeard	70	37	3	60.3	11.5	81.0	57.1	63.1	60.1	67.1
ND Grano	69	34	1	59.5	11.4	76.1	56.3	54.3	55.3	62.3
ND Riveland	69	36	1	59.8	11.3	75.2	51.4	58.1	54.8	61.6
ND Stanley	70	34	1	60.1	11.1	74.3	58.7	56.9	57.8	63.3
Strongfield	69	33	1	59.2	11.3	74.5	56.4	53.1	54.7	61.3
TCG Bright	69	34	1	59.8	10.8	--	--	55.2	--	--
TCG Ranger	68	34	1	59.9	10.4	--	--	59.6	--	--
Trial Mean	69	34	1	59.8	11.3	70.8	78.3	57.4	56.3	63.2
C.V. %	0.9	3.0	29.5	1.0	5.1	3.7	4.7	4.1	--	--
LSD 5%	0.7	1.2	0.5	0.7	0.7	3.1	4.4	2.8	--	--
LSD 10%	0.6	0.9	0.4	0.5	0.5	2.4	3.4	2.2	--	--

[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 17

Harvest Date: August 12

Previous Crop: Oat Hay

2025 Durum - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 2023	Grain Yield 2024	Grain Yield 2025	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Maier	72	12,629	32	60.9	13.5	48.1	63.7	72.1	67.9	61.3
Mountrail	74	13,299	34	60.6	12.7	58.2	65.8	77.8	71.8	67.2
Alkabo	73	12,441	32	61.1	13.0	56.9	58.7	80.4	69.5	65.3
Divide	73	12,141	31	61.1	13.0	51.8	61.5	73.8	67.7	62.4
Carpio	75	11,245	35	61.9	13.2	57.1	60.2	81.2	70.7	66.2
Joppa	73	12,004	32	61.1	12.6	49.2	59.7	80.0	69.8	62.9
ND Grano	74	12,877	33	61.3	13.7	57.6	61.0	77.4	69.2	65.3
ND Riveland	74	11,636	35	60.8	13.2	48.2	58.5	77.9	68.2	61.5
ND Stanley	74	11,858	32	61.5	13.7	54.3	61.5	78.4	70.0	64.7
Strongfield	74	11,560	32	60.9	14.2	47.4	57.7	78.3	68.0	61.1
AAC Spitfire	74	12,693	31	59.5	13.8	--	--	77.8	--	--
CDC Defy	72	12,399	37	61.6	13.5	--	62.5	83.8	73.1	--
AAC Stronghold	72	12,118	32	61.1	14.4	--	59.3	77.7	68.5	--
MT Blackbeard	74	11,092	37	61.2	14.1	45.4	60.5	79.3	69.9	61.7
TCG Bright	73	13,755	32	60.8	13.2	--	--	80.7	--	--
Trial Mean	74	11,975	33	61.1	13.6	52.9	61.0	78.6	69.5	63.6
CV %	1.2	6.4	5.3	0.5	3.8	11.1	5.5	6.1	--	--
LSD 0.10	1	703	2	0.3	0.5	5.3	3.1	4.4	--	--

Planting Date: April 9, 2025
Harvest Date: August 12, 2025
Previous Crop: Oat hay
Seeding Rate: 1.2 million live seeds/ac

Barley - 2025											Hettinger, ND
Variety	Days to Head	Plant Height	Plant Lodge	Plump	Test Weight	Grain Protein	----- Grain Yield ----- 2023	2024	2025	Average Yield 2 yr	3 yr
	DAP[1]	inches	1-9[2]	%	lbs/bu	%	------------ Bushels per acre ------------				
TWO ROW											
AAC Praire	68	29	3	81	45.2	14.0	--	--	101.4	--	--
AAC Synergy	68	30	2	96	46.1	10.8	134.7	83.7	99.7	91.7	106.1
ABI Cardinal	68	27	2	91	47.0	11.5	124.2	85.6	94.5	90.0	101.4
Brewski	67	29	2	97	44.9	11.8	132.3	87.0	89.1	88.0	102.8
CDC Churchill	68	27	2	84	46.6	11.6	--	--	98.1	--	--
CDC Praire	70	28	2	91	45.4	11.1	111.0	81.6	91.9	86.7	94.8
Conlon	61	29	5	97	45.6	12.5	94.4	75.4	93.6	84.5	87.8
Explorer	68	24	1	93	46.8	10.8	124.2	76.4	92.2	84.3	97.6
Firefoxx	69	24	1	88	45.4	11.0	--	--	100.4	--	--
ND Genesis	65	31	1	95	47.3	11.3	140.8	89.5	88.5	89.0	106.3
Pinnacle	66	30	3	95	46.6	10.9	96.2	80.4	94.7	87.6	90.4
SIX ROW											
ND Treasure	66	30	5	88	46.5	11.6	132.1	82.5	101.2	91.8	105.3
Tradition	65	31	4	89	46.1	11.8	115.8	80.6	92.3	86.4	96.2
Trial Mean	65	29	2	92	46.3	11.5	119.5	79.6	97.1	88.4	97.6
C.V. %	2.2	4.0	34.5	2.3	3.9	4.0	6.9	8.4	8.1	--	--
LSD 5%	1.7	1.3	2.5	2.5	2.1	0.6	9.8	8.0	9.3	--	--
LSD 10%	1.3	1.0	1.9		1.7	0.4	7.6	6.2	7.2	--	--

[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 16

Harvest Date: August 6

Previous Crop: Oat Hay

2025 Barley - Recrop **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	% Plump	------- Grain Yield-------- 2023	2024	2025	Average Yield 2 Year	3 Year
			in	lbs/bu	%	>6/64	----------bu/ac----------			----bu/ac----	
Six Row											
ND Treasure	71	11,953	28	48.0	11.6	93	62.6	91.1	120.6	105.9	91.5
Tradition	69	11,565	31	49.5	12.5	94	57.6	87.8	105.2	96.5	83.5
Two Row											
ND Genesis	72	10,135	30	50.3	10.9	95	70.5	88.3	123.0	105.7	94.0
AAC Synergy	71	9,836	30	49.9	11.9	95	65.1	79.3	122.4	100.8	88.9
CDC Churchill	75	10,355	29	49.9	11.9	92	--	--	134.9	--	--
CDC Fraser	76	10,207	30	48.7	11.2	95	62.9	72.4	129.9	101.2	88.4
Explorer	75	9,668	25	49.4	11.3	93	63.4	89.5	129.4	109.4	94.1
Brewski	74	9,832	29	49.6	11.3	95	67.0	90.6	130.7	110.6	96.1
AAC Prairie	75	10,862	30	49.9	12.0	91	66.7	67.4	120.3	93.9	84.8
ABI Cardinal	74	10,438	30	49.4	11.8	95	64.3	73.5	118.7	96.1	85.5
Firefoxx	75	10,157	24	46.9	10.1	91	--	--	129.6	--	--
Trial Mean	72	10,096	28	49.1	11.5	94	63.1	84.2	124.5	102.2	89.6
CV %	1.8	2.3	7.1	0.7	4.0	0.9	11.4	7.4	6.1	--	--
LSD 0.10	1	212	2	0.3	0.4	1	6.6	5.8	7.1	--	--

Planting Date: April 10, 2025
Harvest Date: August 6, 2025
Previous Crop: Oat hay
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis

2025 New Salem Barley - Recrop	**Dickinson, ND**

Variety	Seeds per Pound	Test Weight	% Plump	Protein	Grain Yield
		lbs/bu	>6/64	%	bu/ac
Six Row					
ND Treasure	11,776	45.7	96	12.1	81.1
Two Row					
ABI Cardinal	9,429	48.3	98	11.8	85.4
Brewski	10,216	46.4	95	11.7	78.2
ND Genesis	9,763	46.5	96	11.2	72.4
AAC Prairie	9,917	48.7	97	12.2	73.3
AAC Synergy	9,620	48.0	98	12.6	76.4
CDC Fraser	9,325	46.7	98	13.0	75.8
Trial Mean	10,213	47.1	97	12.1	77.9
CV %	3.0	1.4	1.0	4.5	9.9
LSD 0.10	283	0.6	1	0.5	7.2

Planting Date: May 25, 2025
Harvest Date: August 19, 2025
Previous Crop: Corn
Seeding Rate: 1.2 million live seeds/ac
Grain protein percentages reported on a 0% moisture basis

Oat - 2025										**Hettinger, ND**
	Days to	Plant	Plant	Test	Grain	----- Grain Yield -----			Average Yield	
Variety	Head	Height	Lodge	Weight	Protein	2023	2024	2025	2 yr	3 yr
	DAP[1]	inches	1-9[2]	lbs/bu	%	------------ Bushels per acre ------------				
AAC Douglas	67	35	2	36.5		174.6	125.9	134.3	130.1	145.0
Beach	66	36	8	38.0		135.0	87.5	107.7	97.6	110.1
CDC Endure	70	36	3	37.1		160.7	104.6	132.3	118.5	132.6
Deon	70	36	3	38.6		130.5	101.4	116.3	108.8	116.1
HiFi	69	37	4	38.4		119.7	101.0	117.7	109.3	112.8
Jury	66	38	7	37.1		126.2	115.2	113.1	114.1	118.1
Leggett	69	33	1	37.5		133.8	107.8	124.0	115.9	121.9
MN Pearl	69	35	6	36.7		141.8	94.5	126.2	110.3	120.8
ND Carson	68	34	1	38.1		140.2	112.0	127.6	119.8	126.6
ND Heart	65	35	5	38.1		113.4	97.1	99.6	98.4	103.4
ND Miller	70	35	5	38.7		122.7	114.9	118.7	116.8	118.8
ND Spindle	67	37	5	34.7		130.3	117.3	130.8	124.0	126.1
ND Williams	68	39	3	39.1		152.2	104.0	123.9	113.9	126.7
Newburg	66	37	6	37.8		143.2	114.7	115.6	115.1	124.5
Otana	68	38	5	38.3		131.7	113.4	124.0	118.7	123.0
Rockford	68	37	3	40.0		134.2	106.3	116.5	111.4	119.0
SD Buffalo	64	35	4	39.3		126.1	116.0	115.1	115.6	119.1
SD Momentum	70	41	2	40.7		--	107.8	136.3	122.1	--
SD Titan	67	38	2	38.9		--	116.6	122.6	119.6	--
Crema (hull-less)	72	37	2	44.9		101.8	71.3	84.1	77.7	85.7
Paul (hull-less)	71	37	2	43.4		106.6	77.4	79.1	78.3	87.7
Trial Mean	67.9	36	3	38.8		134.7	107.2	115.2	110.6	117.0
C.V. %	1.4	2.8	22.5	1.4		8.7	6.4	4.7	--	--
LSD 5%	1.1	1.2	0.9	0.7		13.7	8.1	6.4	--	--
LSD 10%	0.9	1.0	0.7	1.0		10.7	6.3	5.0	--	--

[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: 4/21/25

Harvest Date: 8/11/25

Previous Crop: Canola

2025 Oat - Recrop — **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Grain Yield 2023	Grain Yield 2024	Grain Yield 2025	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
AAC Douglas	77	12,066	36	36.0	172.4	123.3	188.5	155.9	161.4
Beach	77	10,373	35	39.5	123.1	120.7	149.3	135.0	131.0
CDC Endure	80	11,006	36	35.6	175.5	131.4	197.7	164.6	168.2
ND Crema (hull-less)	83	15,247	41	43.3	95.7	70.8	113.5	92.2	93.3
Deon	80	13,233	37	36.5	132.3	119.8	168.1	144.0	140.1
HiFi	81	13,529	38	36.6	145.1	121.3	164.7	143.0	143.7
Jury	79	13,278	41	36.5	138.3	128.4	190.7	159.6	152.5
Leggett	81	12,192	35	37.6	151.6	116.3	160.3	138.3	142.7
MN Pearl	79	12,365	35	36.4	155.3	117.9	171.6	144.7	148.3
ND Carson	82	12,937	36	35.7	153.8	108.5	177.2	142.9	146.5
ND Heart	78	12,780	35	37.1	124.3	112.2	157.2	134.7	131.2
ND Miller	81	12,467	37	36.8	135.0	113.8	165.7	139.7	138.2
ND Spilde	78	12,066	37	35.2	127.2	138.3	175.3	156.8	146.9
ND Williams	79	10,972	41	37.3	135.3	117.0	164.2	140.6	138.8
Newburg	76	12,624	37	36.1	160.8	127.5	162.8	145.1	150.4
Otana	78	14,329	38	37.9	122.0	127.6	172.2	149.9	140.6
Paul (hull-less)	82	17,730	39	42.9	107.5	80.2	128.9	104.5	105.5
Rockford	79	13,851	38	38.9	131.9	122.5	174.9	148.7	143.1
SD Buffalo	78	12,303	34	37.5	146.5	113.9	157.0	135.5	139.1
SD Momentum	78	13,276	45	39.2	--	114.7	183.7	149.2	--
SD Titan	77	11,635	41	39.2	--	115.1	172.4	143.7	--
Trial Mean	79	12,792	37	37.8	139.2	117.1	162.8	141.4	140.1
CV %	2.2	6.0	6.6	1.1	9.4	5.9	8.2	--	--
LSD 0.10	2	703	2	0.4	11.9	6.3	12.4	--	--

Planting Date: April 10, 2025

Harvest Date: August 15, 2025

Previous Crop: Field pea

Seeding Rate: 1 million live seeds/ac

NDSU Hettinger Research Extension Center

Oil Type Sunflower - 2025 | **Hettinger, ND**

Company/Brand	Hybrid	Oil Type & Traits[1]	Days to Bloom	Plant Height	Test Weight	Oil Content	Grain Yield 2025	Grain Yield 2-Year	Grain Yield 3-Year
			DAP[2]	inches	lbs/bu	%	--------lbs/ac--------		
Advanta	ADV 5205CLHO	Trad. CL	76	78	29.3		1783	--	--
Advanta	ADV 5310CL	Trad. CL	75	68	30.2		1785	--	--
Advanta	ADV 5407CL	HO CL	75	69	27.0		1852	--	--
Advanta	ADV 5420CL	Trad. CL	76	74	30.5		2175	--	--
Advanta	Hysun 182IT	Trad. CL	74	64	28.7		2076	--	--
Advanta	Hysun 302IT	Trad. CL	76	75	31.5		2676	--	--
Croplan	CP4255E	HO EX	70	62	32.2		2413	1961	--
Croplan	CP4490E	HO CP	75	71	29.6		2189	--	--
Croplan	CP455E	HO CP	71	64	28.8		2254	1873	2307
Croplan	CP5249CL	HO CL	70	65	30.9		2063	1788	--
Croplan	CP7919CL	HO CP	74	66	30.3		2842	--	--
Dyna-Gro	H45HO10EX	HO EX	71	66	29.7		1873	1651	1913
Dyna-Gro	H47HO11EX	HO EX	70	69	29.5		2105	1821	2129
Dyna-Gro	H49HO19CL	HO EX	75	72	29.5		1969	1805	2223
Dyna-Gro	H50HO20CP	HO EX	72	70	30.3		1958	1708	--
Dyna-Gro	XH41H54CL	HO CL	72	74	29.9		1713	--	--
Dyna-Gro	XH41H56CL	HO EX	61	49	30.1		1346	1437	--
Dyna-Gro	XH41H90EX	HO EX	74	71	28.2		2140	1725	--
Limagrain	LG50459 SX	HO EX	72	72	31.1		2063	--	--
Limagrain	LG50487 CLP	HO EX	71	72	30.5		2209	--	--
Limagrain	LG50540 CLP	HO EX	69	58	29.1		2024	--	--
Nuseed	N4H205 E	HO CP	71	67	29.0		1965	1667	--
Nuseed	N4H337 E	MO CL	72	70	31.3		2292	1849	--
Nuseed	N4H422 CL	HO CP	73	72	30.7		2266	2030	2253
Nuseed	N4H462 E	HO EX	72	72	30.5		2552	2012	--
Nuseed	N4H470 CLP	HO EX	73	72	30.9		2027	1770	2183
Nuseed	N4H490 E	HO EX	74	70	30.4		1990	1655	--
Proseed	2534 E	NS EX	73	71	30.5		2048	1775	--
Proseed	2578 E	HO CP	71	70	30.3		1936	--	--
Proseed	50068 CL	HO EX	73	73	31.1		1861	1672	--
Proseed	E-2446 E	HO EX	73	66	31.0		2327	1824	--
Proseed	E-93 E	HO EX	73	74	30.6		1726	--	--
Proseed	EXP2609 E	HO CL	70	68	29.9		1997	--	--
Proseed	EXP2691 CP	HO CL	72	73	30.4		1841	--	--
Sunrich	4415 HO/CLP	HO CL	70	71	31.4		2302	--	--
Sunrich	4425 CL	HO CL	72	73	29.6		2187	1886	2194
Thunder	TCP1533H	HO CP	73	74	29.6		1834	--	--
Thunder	TSU1512H	HO EX	70	68	26.8		1718	--	--
Thunder	TSU1561H	HO EX	71	64	29.6		1971	--	--
Thunder	TSU1582H	HO EX	73	75	31.1		2104	--	--
Thunder	TSU1592N	HO CL	74	62	30.5		1932	--	--
USDA (Check)	894	TR	69	66	29.1		1619	1488	1738
CROPLAN (Check)	559CL	NS CL	73	76	30.3		2538	2038	2449
AAFC/USDA (Check)	Honeycomb	NS	67	60	30.0		1666	1396	1412
Trial Mean			72	69	30.0		2050	1785	2172
C.V. %			1.6	5.5	3.4		9.9	--	--
LSD 5%			1.4	4.5	1.2		239	--	--
LSD 10%			1.1	3.5	0.9		185	--	--

[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 4 Harvest Date: November 6 Previous Crop: Corn

Canola - Liberty Link - 2025 — Hettinger, ND

Brand	Cultivar	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Oil Content	Seed Yield 2025	Seed Yield 2-Yr. Avg.
		DAP[1]	days	DAP[1]	inches	%	---------lbs/a---------	
BASF Invigor	L340PC	48	23	89	32	42.4	1350	--
BASF Invigor	L343PC	48	18	85	34	43.2	1313	--
BrettYoung	BY 7204LL	48	19	85	34	46.1	1420	1282
CROPLAN	CP7130LL	48	21	87	35	44.7	1208	1158
CROPLAN	CP7250LL	49	22	88	34	42.9	1436	1271
DynaGro	DG 661 LCM	49	22	89	33	43.3	1234	--
Trial Mean		48	21	87	34	43.9	1325	1853
C.V. %		0.7	2.9	0.8	4.2	1.0	6.3	--
LSD 5%		0.4	0.7	0.8	1.7	0.5	102	--
LSD 10%		0.3	0.6	0.7	1.3	0.4	79	--

[1] Days after planting.

Planting Date: May 9

Harvest Date: August 20

Previous Crop: Oat Hay

Canola - Roundup Ready - 2025 — Hettinger, ND

Brand	Cultivar	Days to Bloom	Bloom Duration	Days to Mature	Plant Height	Oil Content	Seed Yield 2025	Seed Yield 2-Yr. Avg.
		DAP[1]	days	DAP[1]	inches	%	------------lbs/a------------	
CROPLAN	CP9221TF	46	20	84	31	42.2	1152	1093
CROPLAN	CP9551TF	46	20	84	30	44.8	1161	--
CROPLAN	CP9978TF	46	23	87	31	41.8	1124	1102
Dekalb	DK904TF	47	20	85	33	44.3	1120	--
DynaGro	DG 781 TCM	48	18	84	33	42.3	1045	--
Trial Mean		46	20	84	31	43.5	1149	1097
C.V. %		0.9	2.9	0.4	4.5	1.3	6.1	--
LSD 5%		0.5	0.7	0.4	1.7	0.7	86	--
LSD 10%		0.4	0.5	0.3	1.3	0.5	66	--

[1] Days after planting.

Planting Date: May 9

Harvest Date: August 20

Previous Crop: Oat Hay

NDSU Hettinger Research Extension Center

Flax - 2025 | **Hettinger, ND**

Variety	Days to Bloom	Plant Height	Test Weight	Oil Content	-------Grain Yield-------- 2023	2024	2025	Average Yield 2-Yr	3-Yr
	DAP [1]	inches	lbs/bu	%	---------------- bu per acre ----------------				
AAC Bright	53	22	49.8	37.2	31.9	16.8	24.8	20.8	24.5
AAC Marvelous	52	21	51.0	37.4	29.9	18.8	28.8	23.8	25.8
Carter [2]	52	22	51.3	36.0	27.9	15.1	25.5	20.3	22.8
CDC Dorado [2]	50	20	50.7	37.5	30.9	14.2	25.9	20.0	23.6
CDC Glas	52	22	50.8	37.2	31.1	16.9	28.2	22.5	25.4
CDC Kernen	51	22	51.1	37.5	31.9	18.4	28.6	23.5	26.3
CDC Neela	52	23	51.4	37.3	35.8	18.9	31.4	25.2	28.7
CDC Rowland	52	21	50.7	36.8	34.3	15.8	28.9	22.4	26.4
Gold ND [2]	53	23	51.6	35.2	30.0	17.6	26.7	22.1	24.7
ND Hammond	52	22	50.1	36.7	28.5	16.2	23.8	20.0	22.8
Omega [2]	53	23	51.4	35.7	29.3	14.7	26.2	20.4	23.4
Webster	52	24	51.3	36.8	30.1	16.7	30.1	23.4	25.6
York	51	23	51.5	37.0	32.2	17.2	31.8	24.5	27.1
Trial Mean	52	22	51.0	36.7	30.3	16.7	28.0	22.3	25.4
C.V. %	0.9	4.3	0.5	0.5	10.4	12.0	6.2	--	--
LSD 5%	0.5	1.1	0.3	0.2	3.7	2.4	2.1	--	--
LSD 10%	0.4	0.9	0.2	0.2	2.9	1.8	1.6	--	--

[1] Days after planting.

[2] Yellow seed type.

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

Planting Date: May 12

Harvest Date: September 12

Previous Crop: Canola

NDSU Dickinson Research Extension Center

2025 Flax - Recrop **Dickinson, ND**

Variety	Days to Flower	Days to Mature	Plant Height	Test Weight	Oil Content	-- Grain Yield-- 2023	2024	2025	Average Yield 2 Year	3 Year
			in	lbs/bu	%	------bu/ac------			----bu/ac----	
AAC Marvelous	59	103	24	54.7	38.0	28.4	22.7	38.2	30.5	29.8
CDC Glass	58	99	26	53.9	37.0	28.4	21.8	39.0	30.4	29.8
CDC Kernen	56	96	25	54.6	37.9	31.5	20.7	37.9	29.3	30.0
CDC Neela	57	100	26	54.6	37.4	29.0	21.3	37.9	29.6	29.4
CDC Rowland	58	99	25	54.7	36.8	28.5	21.5	34.9	28.2	28.3
ND Hammond	58	100	25	54.3	36.2	27.2	19.1	34.4	26.8	26.9
Webster	56	98	26	54.8	36.9	27.1	19.9	37.8	28.8	28.3
York	55	100	27	54.6	37.1	26.6	18.7	40.9	29.8	28.7
AAC Bright	57	98	25	53.2	36.9	24.2	22.1	36.8	29.4	27.7
CDC Dorado	54	99	24	54.1	37.9	25.8	20.6	27.2	23.9	24.5
Carter	56	99	24	55.0	36.3	27.6	20.2	30.3	25.2	26.0
Gold ND	56	101	26	54.8	35.6	29.1	19.7	34.6	27.2	27.8
Omega	55	98	25	55.0	35.5	25.2	20.5	33.5	27.0	26.4
Trial Mean	57	100	25	54.5	36.9	28.1	20.6	36.1	28.2	28.0
CV %	1.6	2.5	6.1	0.4	1.1	12.3	10.6	10.0	--	--
LSD 0.10	1	3	2	0.2	0.4	3.7	2.3	3.9	--	--

Planting Date: April 29, 2025
Harvest Date: August 27, 2025
Previous Crop: oat hay
No Lodging observed
Oil content reported on 9% moisture basis

Dry Bean - 2025											Hettinger, ND
		Days to	Plant	Plant	Test	Seed	-------- Grain Yield --------			Average Yield	
Variety	Type	Mature	Height	Lodge	Weight	Weight	2023	2024	2025	2 yr	3 yr
		DAP[1]	inches	1-9[2]	lbs/bu	g/100	------------------- lbs per acre -------------------				
Cowboy	Pinto	101	16	1	57.2	31.2	1788	1094	1886	1490	1589
Gleam	SD-Pinto	102	15	1	60.3	27.6	--	--	1680	--	--
LaPaz	Pinto	104	16	1	57.8	30.7	2044	984	1511	1247	1513
Monterrey	Pinto	103	17	1	57.4	29.3	2183	1132	1736	1434	1684
ND Falcon	Pinto	105	16	1	57.8	27.0	1979	1051	1073	1062	1368
ND Palomino	SD-Pinto	106	14	1	57.5	29.3	1579	815	1494	1154	1296
ND Rodeo	SD-Pinto	106	16	1	57.8	28.0	1839	1021	1563	1292	1474
Torreon	Pinto	101	14	1	57.8	30.8	1709	1231	1711	1471	1550
Vibrant	Pinto	100	16	1	58.7	29.7	2045	1098	1906	1502	1683
Windbreaker	Pinto	101	15	1	55.4	31.8	1652	827	1387	1107	1289
Blizzard	Navy	106	16	1	62.3	15.6	1583	656	1644	1150	1294
HMS Medalist	Navy	107	15	1	61.1	14.1	1819	500	1362	931	1227
ND Polar	Navy	107	18	1	61.2	14.5	1925	546	1350	948	1274
T9905	Navy	108	14	1	62.4	16.2	1720	857	1726	1292	1434
Merlot	Red	105	17	1	57.8	31.3	1292	826	1696	1261	1271
Viper	Red	107	16	1	59.5	19.9	--	1102	1808	1455	--
Coral	Pink	105	16	1	58.8	27.7	--	--	1636	--	--
Magnolia	Pink	104	14	1	57.6	32.9	--	--	1827	--	--
ND Rosalind	Pink	105	17	1	60.2	26.0	2132	1017	1686	1352	1612
Black Tails	Black	106	16	1	62.7	16.2	1826	857	1866	1362	1516
Eclipse	Black	103	15	1	61.7	18.1	2007	853	1677	1265	1512
ND Twilight	Black	105	15	1	61.5	19.4	1956	683	1597	1140	1412
ND Galaxy	Black	104	14	1	59.1	19.4	--	710	1549	1130	--
Eiger	Great Northern	106	15	1	61.3	26.4	--	--	2033	--	--
ND Pegasus	Great Northern	104	16	1	58.1	30.7	2049	1243	1995	1619	1762
Trial Mean		104	16	1	59.0	25.5	1804	929	1630	1245	1441
C.V. %		--	9.5	--	1.7	4.9	16.4	13.7	10.7	--	--
LSD 5%		--	1.7	--	1.2	1.5	348	149	205	--	--
LSD 10%		--	1.3	--	0.9	1.1	270	116	159	--	--

[1] Days after planting.

[2] 1 = no lodging, 9 = lying flat on ground.

Planting Date: June 4

Harvest Date: Spetember 29

Previous Crop: Spring Wheat

NDSU Dickinson Research Extension Center

2025 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	Average Yield 2 Year	Average Yield 3 Year
				gm		in	lbs/bu	%	bu/ac	----bu/ac----	
Yellow Types											
DS Admiral	Pulse USA	58	92	257	1,767	27	66.1	26.1	56.5	53.3	43.6
CDC Inca	Meridian Seeds	60	95	256	1,772	32	66.9	25.8	62.5	54.2	45.2
ND Dawn	NDSU	55	96	259	1,748	27	66.0	25.5	54.6	52.8	43.0
AAC Julius	NDSU	60	96	249	1,824	28	66.9	26.1	60.8	55.0	47.8
CP5222Y	Croplan	54	95	299	1,520	28	67.9	26.7	59.9	50.3	42.8
MS GrowPro	Meridian Seeds	55	96	324	1,398	28	67.0	27.1	59.3	53.7	45.4
MS Prostar	Meridian Seeds	58	95	274	1,658	27	67.6	25.6	59.6	56.8	48.3
AAC Beyond	Meridian Seeds	59	96	255	1,779	29	67.6	25.8	64.1	54.9	48.6
AAC Carver	Meridian Seeds	57	94	261	1,735	31	67.1	24.5	58.7	55.0	--
CDC Engage	Alliance Seeds	60	97	268	1,690	31	68.0	25.9	67.3	--	--
21162	Peterson Farms	61	97	273	1,663	30	67.2	28.4	57.2	--	--
21163	Peterson Farms	61	98	261	1,742	28	66.7	28.2	57.3	--	--
GTPR004	GeneTech	60	97	259	1,754	27	67.1	26.5	57.3	54.2	--
GTPR005	GeneTech	59	96	258	1,761	27	66.9	26.4	58.2	55.9	--
GTPR007	GeneTech	60	96	272	1,667	29	68.0	25.9	61.3	--	--
Orchestra	Premier Genetics	54	97	304	1,491	29	68.1	27.7	65.4	59.4	48.0
PG Bank	Premier Genetics	59	97	267	1,700	27	67.1	26.4	54.5	--	--
PG Cash	Premier Genetics	57	92	276	1,646	27	66.9	26.7	64.4	57.7	50.2
PG Prairie	Premier Genetics	59	97	281	1,613	31	68.4	25.7	57.4	48.1	--
Green Types											
PG Greenback	Premier Genetics	60	96	264	1,720	31	67.5	24.8	66.1	58.0	49.6
Aragorn	Pulse USA	54	92	238	1,904	25	65.1	27.1	48.0	42.6	35.6
Arcadia	Pulse USA	58	94	232	1,952	25	66.5	25.5	59.1	52.3	43.4
ND Victory	NDSU	58	100	228	1,990	33	66.3	26.0	54.7	38.9	34.1
Trial Mean		58	96	260	1,756	28	67.0	26.3	59.0	52.9	44.7
CV %		2.4	0.7	1.6	1.6	7.2	0.5	1.4	5.2	--	--
LSD 0.10		1	1	4	26	2	0.3	0.3	2.8	--	--

Planting Date: April 23, 2025
Harvest Date: August 6, 2025
Previous Crop: Oat hay
Seeding Rate: 325,000 live seeds/ac
Grain protein percentages reported on 0% moisture basis

NDSU Hettinger Research Extension Center

Soybean - Roundup Ready - 2025											Hettinger, ND
		Maturity	Mature	Plant	Test	Seed	Seed	Average Yield			
Company/Br	Variety		Date	Height	Weight	Oil	Protein	2025	2-Yr	3-Yr	
				inches	lbs/bu	%	%	--- Bushels per acre ---			
NDSU	ND17009GT	00.9	9/22	29	59.0	15.6	38.4	28.3	24.2	30.8	
Xitavo	XO 0094E	0.0	9/22	24	58.2	15.5	36.4	41.8	32.1	38.4	
Integra	XF0212	0.2	9/20	35	56.9	16.0	36.3	39.9	--	--	
Xitavo	XO 0234E	0.2	9/23	26	57.8	15.1	36.6	43.1	34.6	40.0	
Channel	0325RXF	0.3	9/23	30	56.3	15.9	35.7	44.4	--	--	
Thunder	TX8603N	0.3	9/23	28	56.4	16.1	35.4	42.3	--	--	
Fortus	XF0324E	0.4	9/24	27	57.3	15.0	36.2	43.9	--	--	
Thunder	TX8304N	0.4	9/23	32	56.8	14.6	37.0	42.6	34.0	--	
Xitavo	XO 0436E	0.4	9/23	28	58.0	15.4	37.0	44.4	--	--	
Channel	0525RXF	0.5	9/26	31	56.8	15.4	35.4	44.7	--	--	
Thunder	TE7405N	0.5	9/27	27	57.4	15.3	36.2	42.7	33.4	--	
Thunder	TX8605N	0.5	9/27	30	56.6	16.1	34.9	45.1	--	--	
Xitavo	XO 0554E	0.5	9/28	25	57.4	15.7	35.5	45.6	35.2	41.4	
Xitavo	XO 0602E	0.6	9/28	27	57.8	14.0	37.1	45.8	35.9	43.0	
Xitavo	XO 0731E	0.7	9/29	27	58.5	14.5	37.1	43.0	33.3	41.6	
Channel	0823RXF	0.8	9/28	29	57.2	14.8	37.2	44.7	--	--	
NDSU	ND2108GT73	0.8	9/29	27	58.6	15.7	35.5	42.5	34.9	42.6	
Xitavo	XO 0806E	0.8	9/30	27	58.1	15.4	36.1	42.8	--	--	
Channel	0924RXF	0.9	9/28	37	58.3	15.0	37.0	42.1	--	--	
Trial Mean			9/25	29	57.5	15.3	36.4	42.7	32.2	38.1	
C.V. %			0.5	5.8	0.6	2.1	1.2	4.8	--	--	
LSD 5%			1.6	2.0	0.4	0.4	0.5	2.4	--	--	
LSD 10%			1.2	1.5	0.3	0.3	0.4	1.9	--	--	

Planting Date: May 30
Harvest Date: October 9
Previous Crop: Barley

NDSU Hettinger Research Extension Center

Soybean - Roundup Ready - 2025	**Mandan, ND**

		Maturity	Plant	Test	Seed	Seed	Average Yield		
Company/Br	Variety		Height	Weight	Oil	Protein	2025	2-Yr	3-Yr
			inches	lbs/bu	%	%			
NDSU	ND17009GT	00.9	33	59.6	16.2	33.8	38.5	42.4	44.3
Xitavo	XO 0094E	0.0	27	57.5	16.3	34.1	47.5	50.1	49.8
Integra	XF0212	0.2	36	55.7	15.8	33.7	48.1	--	--
Xitavo	XO 0234E	0.2	32	57.7	16.0	33.7	49.1	52.1	53.0
Channel	0325RXF	0.3	34	56.2	16.2	33.7	48.5	--	--
Thunder	TX8603N	0.3	32	56.3	16.1	34.4	47.4	--	--
Fortus	XF0324E	0.4	28	56.7	15.9	33.8	50.5	--	--
Thunder	TX8304N	0.4	36	56.7	16.0	34.2	47.4	49.8	--
Xitavo	XO 0436E	0.4	31	56.8	15.7	35.4	48.4	--	--
Channel	0525RXF	0.5	35	56.0	16.1	35.0	50.6	--	--
Thunder	TE7405N	0.5	30	55.7	16.4	33.7	54.4	55.1	--
Thunder	TX8605N	0.5	37	56.6	15.7	34.8	51.6	--	--
Xitavo	XO 0554E	0.5	27	56.6	16.1	35.0	50.2	52.7	55.6
Xitavo	XO 0602E	0.6	30	57.0	15.9	34.3	56.3	56.4	58.9
Xitavo	XO 0731E	0.7	30	56.9	15.5	34.6	51.1	53.2	55.6
Channel	0823RXF	0.8	34	56.9	16.4	34.0	55.4	--	--
NDSU	ND2108GT73	0.8	30	58.1	16.0	33.8	46.9	49.3	53.3
Xitavo	XO 0806E	0.8	30	56.2	16.5	33.9	55.5	--	--
Channel	0924RXF	0.9	40	56.8	15.6	34.9	53.8	--	--
Trial Mean			32	56.8	16.0	34.3	49.9	52.1	54.2
C.V. %			5.4	1.5	3.1	3.2	6.0	--	--
LSD 5%			2.1	1.0	0.6	1.3	3.5	--	--
LSD 10%			1.6	0.8	0.5	1.0	2.7	--	--

Planting Date: June 10

Harvest Date: October 10

Previous Crop: Spring Wheat

2025 Soybean - Recrop — **Dickinson, ND**

Company /Brand	Variety	Maturity	Days to Mature	Plant Height	Seeds per Pound	KWT	Test Weight	Oil Content	Protein	Grain Yield
				inches		g/1000	lbs/bu	%	%	bu/ac
NDSU	ND Benson	0.4	136	28	5,190	88	56.6	18.4	29.3	30.3
NDSU	ND Dickey	0.7	140	31	4,114	111	56.8	16.4	32.4	38.8
NDSU	ND Rolette	00.9	127	28	4,811	94	57.8	18.7	29.6	41.1
NDSU	ND17009GT	00.9	127	31	3,735	122	59.1	18.4	31.1	31.1
Channel	0325RXF	0.3	134	30	3,943	115	56.5	18.2	30.2	41.3
Channel	0525RXF	0.5	138	31	4,376	104	56.5	17.9	28.6	39.1
Channel	0823RXF	0.8	141	28	4,912	93	56.8	17.1	31.0	43.4
Trial Mean			135	29	4,571	101	57.4	17.8	30.5	35.8
CV %			1.3	6.3	5.1	4.7	1.0	2.8	4.1	11.6
LSD 0.10			2	2	213	4	0.5	0.5	1.1	3.8

Planting Date: May 12, 2025
Harvest Date: October 3, 2025
Protein adjusted to 13% moisture
Oil adjusted to 13% moisture
Previous Crop: Oat

2025 New Salem Soybean - Recrop — **Dickinson, ND**

Company/Bra	Variety	Maturity	KWT	Seeds per Pound	Test Weight	Oil Content	Protein	Grain Yield
			g/1000		lbs/bu	%	%	bu/ac
NDSU	ND17009GT	00.9	121	3,753	61.8	16.3	36.0	38.0
Channel	0325RXF	0.3	111	4,127	59.6	16.1	34.5	43.2
Channel	0525RXF	0.5	98	4,660	58.8	15.8	33.8	41.3
Channel	0823RXF	0.8	96	4,762	59.9	14.9	35.3	44.9
Trial Mean			103	4,486	59.9	15.8	34.5	40.8
CV %			6.4	6.8	0.6	3.2	2.2	9.4
LSD 0.10			6	281	0.4	0.5	0.7	3.5

Planting Date: May 5, 2025
Harvest Date: October 7, 2025
Protein adjusted to 13% moisture
Oil adjusted to 13% moisture
Previous Crop: Corn

NDSU Dickinson Research Extension Center

2025 Lupin - Recrop	**Dickinson, ND**

Variety	Days to Flower	Plant Height	1000 seed weight	Seeds per Pound	Test Weight	Yield
		in	gm		lbs/bu	lbs/ac
LND0127	55	20	349	1,303	57.7	1,702
LND0229	56	20	293	1,551	59.0	1,715
LND0614	56	20	311	1,462	58.5	1,404
YELLOW	65	22	169	2,689	57.6	746
LND0002	56	22	365	1,243	57.7	1,832
NR55-Baer	54	21	365	1,246	55.6	1,977
Trial Mean	57	21	309	1,582	57.7	1,563
CV %	0.4	6.6	3.5	2.7	0.5	13.3
LSD 0.10	0	2	12	47	0.3	234

Planting Date: April 23, 2025
Harvest Date: August 28, 2025
Previous Crop: Oat hay

NDSU Hettinger Research Extension Center

HRSW Fungicide - 2025 | **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	62.1	31.8	1	59.9	57.0
Shelly	65.2	29.7	1	60.1	66.0
WB9590	61.1	26.9	1	59.4	65.4
LSD 5%	0.2	0.4	NS	0.3	1.2
Fungicide					
Untreated	63	30	1	59.7	62.3
Prosaro	63	29	1	59.8	62.5
Miravis Ace	63	29	1	60.1	62.8
Prosaro Pro	63	30	1	59.8	63.2
Sphaerex	63	29	1	59.6	63.3
LSD 5%	NS	NS	NS	NS	NS
Variety x Fungicide					
ND Vitpro					
Untreated	62	32	1	59.9	56.0
Prosaro	62	32	1	59.8	55.2
Miravis Ace	62	32	1	60.2	57.9
Prosaro Pro	62	32	1	59.8	56.9
Sphaerex	62	32	1	59.7	59.0
Shelly					
Untreated	65	31	1	60.0	65.8
Prosaro	65	29	1	60.0	66.4
Miravis Ace	65	29	1	60.8	66.2
Prosaro Pro	65	30	1	60.1	66.2
Sphaerex	65	29	1	59.7	65.5
WB9590					
Untreated	61	27	1	59.2	65.1
Prosaro	61	28	1	59.5	65.8
Miravis Ace	61	27	1	59.3	64.3
Prosaro Pro	61	27	1	59.7	66.5
Sphaerex	61	27	1	59.5	65.5
LSD 5%	NS	NS	NS	NS	NS
Average	63	29	1	59.8	62.8
CV	0.5	2.7	--	1.1	3.44

[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 21

Harvest Date: August 12

Feeks 10.51 Application: July 3

Durum Fungicide - 2025 **Hettinger, ND**

Treatment	Days to Head	Plant Height	Plant Lodge	Test Weight	Grain Yield
	DAP[1]	inches	1-9[2]	lbs/bu	
Untreated	66	36	1	58.9	59.5
Prosaro	66	36	1	60.0	61.3
Miravis Ace	66	36	1	60.1	61.2
Prosaro Pro	66	36	1	59.8	63.2
Sphaerex	66	36	1	59.1	60.5
Trial Mean	66	36	1	59.6	61.1
C.V. %	--	--	--	1.3	3.7
LSD 5%	NS	NS	NS	NS	NS
LSD 10%	NS	NS	NS	NS	NS

[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: April 21

Harvest Date: August 12

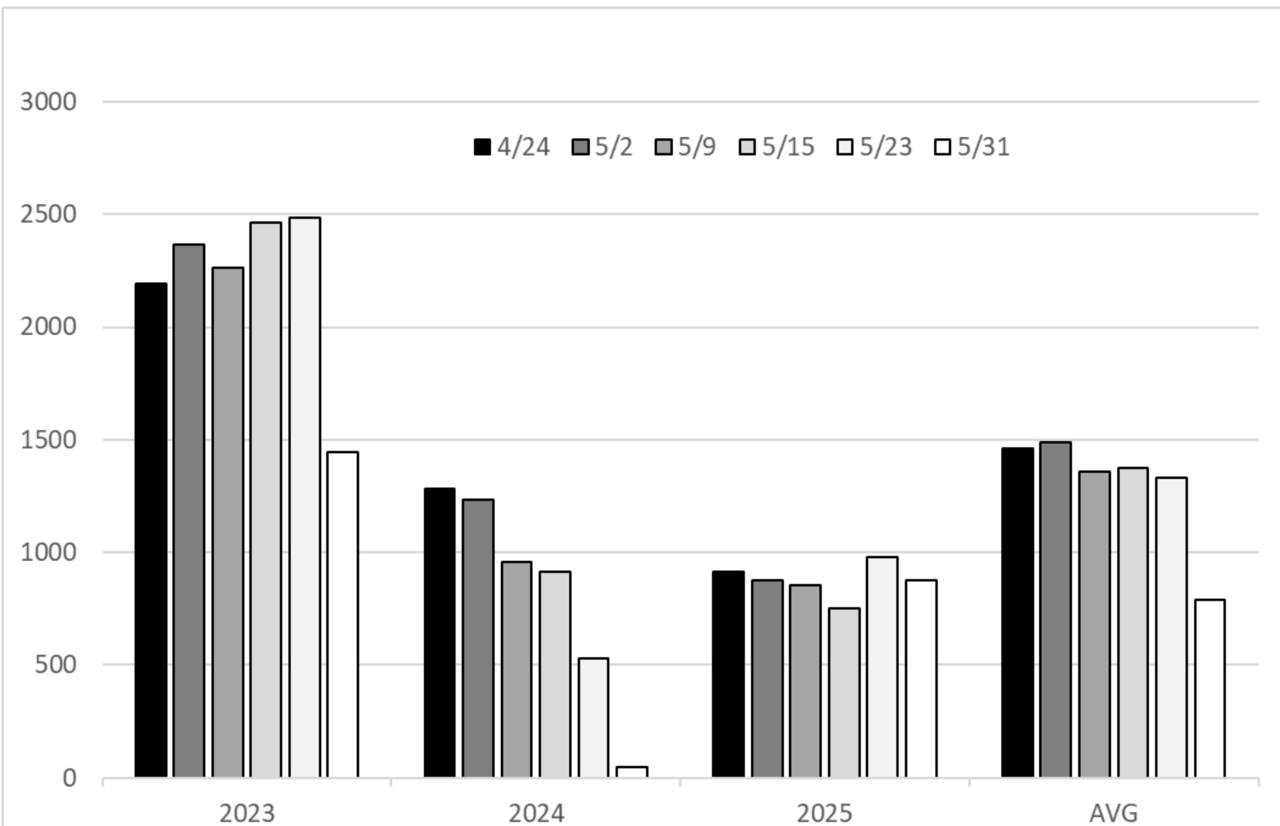
Feeks 10.51 Application: July 3

Canola Planting Date Study

John Rickertsen – Hettinger Research Extension Center

This study was initiated in 2023 to look at the impact of later May planting dates on canola yield and quality. Three canola hybrids were planted every week starting in late April until the end of May. Notes were observed on beginning and ending flowering, maturity and height. Trial was harvested for yield and samples taken for oil analysis. Results over the past three have varied due to environmental conditions, in 2023 with very favorable rainfall and temperatures, all but the late date performed well. 2024 was droughty and warmer with only the first two dates yielding well, middle dates suffering some yield loss, the fifth date having significant yield loss and the last date yielding close to zero. 2025 had good precipitation throughout the growing season and all dates performed similarly. This study will be continued in 2026.

Canola Planting Date Yields 2023 -2025, Hettinger, ND



Canola Planting Date - 2025								Hettinger, ND

Treatment	Start Flower	End Flower	Start Flower	End Flower	Bloom Duration	Plant Height	Seed Oil	Grain Yield
	date	date	DAP[1]	DAP[1]	days	inches	%	lb/ac
Planting Date								
4/23	6/16	7/7	55	76	21	33	42.3	914
5/2	6/21	7/10	51	70	19	33	42.3	874
5/9	6/24	7/13	47	66	18	32	43.0	856
5/14	6/28	7/17	46	65	19	31	41.2	750
5/23	7/3	7/21	42	60	19	33	40.9	980
5/29	7/7	7/25	40	58	19	29	39.2	874
LSD 5%	0.3	0.5	0.3	0.5	0.6	1.6	0.6	72
Date X Variety								
4/23 - L340PC	6/16	7/7	55	76	21	32	41.8	1028
4/23 - CP7250LL	6/18	7/9	57	78	21	36	43.2	795
4/23 - DK400TL	6/15	7/7	54	76	22	32	41.8	919
5/2 - L340PC	6/21	7/10	51	70	19	35	42.4	983
5/2 - CP7250LL	6/22	7/11	52	71	19	33	42.1	874
5/2 - DK400TL	6/19	7/9	49	69	20	32	42.3	765
5/9 - L340PC	6/25	7/12	48	65	18	33	41.9	794
5/9 - CP7250LL	6/26	7/14	49	67	19	32	42.6	888
5/9 - DK400TL	6/23	7/12	46	65	19	32	44.5	886
5/14 - L340PC	6/28	7/17	46	65	19	32	40.3	648
5/14 - CP7250LL	6/29	7/19	47	67	20	31	40.7	762
5/14 - DK400TL	6/28	7/16	46	64	18	30	42.5	840
5/23 - L340PC	7/3	7/20	42	59	18	33	40.1	895
5/23 - CP7250LL	7/4	7/24	43	63	20	33	40.1	985
5/23 - DK400TL	7/2	7/20	41	59	19	32	42.5	1059
5/29 - L340PC	7/7	7/25	40	58	19	30	38.4	835
5/29 - CP7250LL	7/8	7/26	41	59	18	30	39.0	917
5/29 - DK400TL	7/6	7/25	39	58	19	28	40.3	871
LSD 5%	1	1	1	1	1	NS	1.0	125
Trial Mean	6/27	7/16	47	66	19	32	41.5	875
C.V. %	0.1	0.1	0.1	0.1	3.6	5.3	1.4	8.4

[1] Days after planting

Harvest Dates: Dates 1,2,3 - August 20; Dates 4,5 - August 28

Previous Crop: Oats

Boron Fertilization to Boost Canola Production in Western North Dakota

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Introduction

In recent years, canola acreage has significantly expanded in western North Dakota due to market downturns for small grains and advancements in cultivar traits. However, canola production in North Dakota is significantly impaired by plant nutrient availability, including micronutrients. Boron (B) is a critical nutrient for canola, as the crop is a heavy user of B and is highly sensitive to its deficiency.

Boron deficiency, although rare, typically occurs in sandy areas of fields. This deficiency may be exacerbated by aluminum toxicity to roots, a condition commonly associated with acidic sandy soils—an issue that is becoming increasingly prevalent in western North Dakota. According to AGVISE Laboratories, Inc. (2024), soil samples with soil test boron below 0.4 ppm in 2024 in western North Dakota were between 16-44%.

The current recommendation for boron application in North Dakota is 2 lbs/acre for canola. However, this recommendation is based on data generated in northeast North Dakota, a region characterized by cooler and more humid conditions compared to the semi-arid climate of western North Dakota. While claims of boron fertilization benefits in canola production exist, scientific evidence supporting these claims remains inconclusive, with inconsistent effects observed on yield, protein content, and oil quality.

To address this knowledge gap, the objective of this study is to evaluate the effects of different rates, timings, and modes of boron application on the yield and seed quality of canola in western North Dakota. This research aims to provide region-specific recommendations that optimize canola production and address nutrient management challenges in the area.

Material and Methods

Field experiments were conducted at the Dickinson Research Extension Center and the North Central Research Extension Center (Minot, ND). A randomized complete block design, with four replications was used. Treatments consisted of either three rates of granular B fertilizer (2, 5 and 10 lbs B ac^{-1}) broadcasted after planting, or a foliar B application at 10-20% bloom stage at three different rates (0.25, 0.50 and 1 lbs B ac^{-1}), or the combination of a granular application at planting (1lbs ac^{-1}) and a foliar application at 10-20% bloom (0.25 and 0.50 lbs ac^{-1}) plus a zero B control treatment.

The canola hybrids were InVigor® L345PC in Dickinson and DK400TL in Minot. In both locations, plots were solid seeded with a no-till drill. The seeding rate in Dickinson was 600,000 plants $acre^{-1}$ and Minot it was 450,000 plants $acre^{-1}$. Prior to planting, soil samples were pulled from the experimental area for soil chemical and physical analysis. Preference was given for fields deficient in Boron (B < 0.5 ppm).

In Dickinson, all plots received a baseline fertilization with 120 lbs. ac^{-1} Nitrogen as Urea and 20 lbs. ac^{-1} Sulfur as ammonium sulfate. In Minot, the plots received 150 lbs. ac^{-1} N (urea plus Anvol™), 50 lbs. ac^{-1} Phosphorus (MAP), and 30 lbs. ac^{-1} Sulfur (ammonium sulfate).

In Dickinson, granular boron at the rate of 0, 1, 2, 5 or 10 lbs B ac^{-1} was broadcasted immediately after seeding in each corresponding experimental plot. In Minot, those same rates of granular boron were placed in furrow. At 10-20% bloom stage, the remainder of the treatments received a foliar spray of Boron (Solubor®, Sodium Borate 20.5%), at 0.25, 0.50 and 1 lbs B ac^{-1}, using a backpack sprayer.

Each experimental unit measured 10 ft x 30 ft (300 ft^2). Local air temperatures and precipitation were quantified using NDAWN weather stations.

At the end of the growing season (after physiological maturity), plants in the central rows of each plot were mechanically harvested and quantified for grain yield, harvest moisture content, test weight, and, seed composition analysis (i.e., seed oil content), due to the importance of seed quality for end users.

Data was analyzed through an analysis of variance using a mixed-model approach (PROC GLIMMIX) in SAS 9.4. Within each site, the fixed factors were be fertilizer rates, timing and modes of application. The random factor was replication.

Results

Soil pH was moderately acidic at Dickinson (5.5) and near neutral at Minot (6.5), which may influence boron availability and uptake (Table 1). Boron concentrations were low and similar between sites (0.35 ppm at Dickinson and 0.44 ppm at Minot). However, boron soil tests are known to be highly variable and often unreliable (Marupaka et al., 2022).

		OM	N (nitrate)	P (Olsen)	K	Ca	Mg	S	Soluble Salts	B	CEC
Site	pH	%	lbs. ac^{-1}	ppm	ppm	ppm	ppm	lbs. ac^{-1}	mmho/cm	ppm	meq
Dickinson (0-6”)	5.5	4.0	17	19	332	1685	435	10	0.2	0.35	23
Minot (0-6”)	6.5	3.3	10	11	356	2285	395	7	0.2	0.44	18

Source: Agvise

Both in Dickinson and Minot, a large precipitation (>2 inches) was recorded in the days following canola seeding, which resulted in poor plant establishment. In Dickinson, the plant population was 317,462 plants $acre^{-1}$, equivalent to 53% of the target plant population.

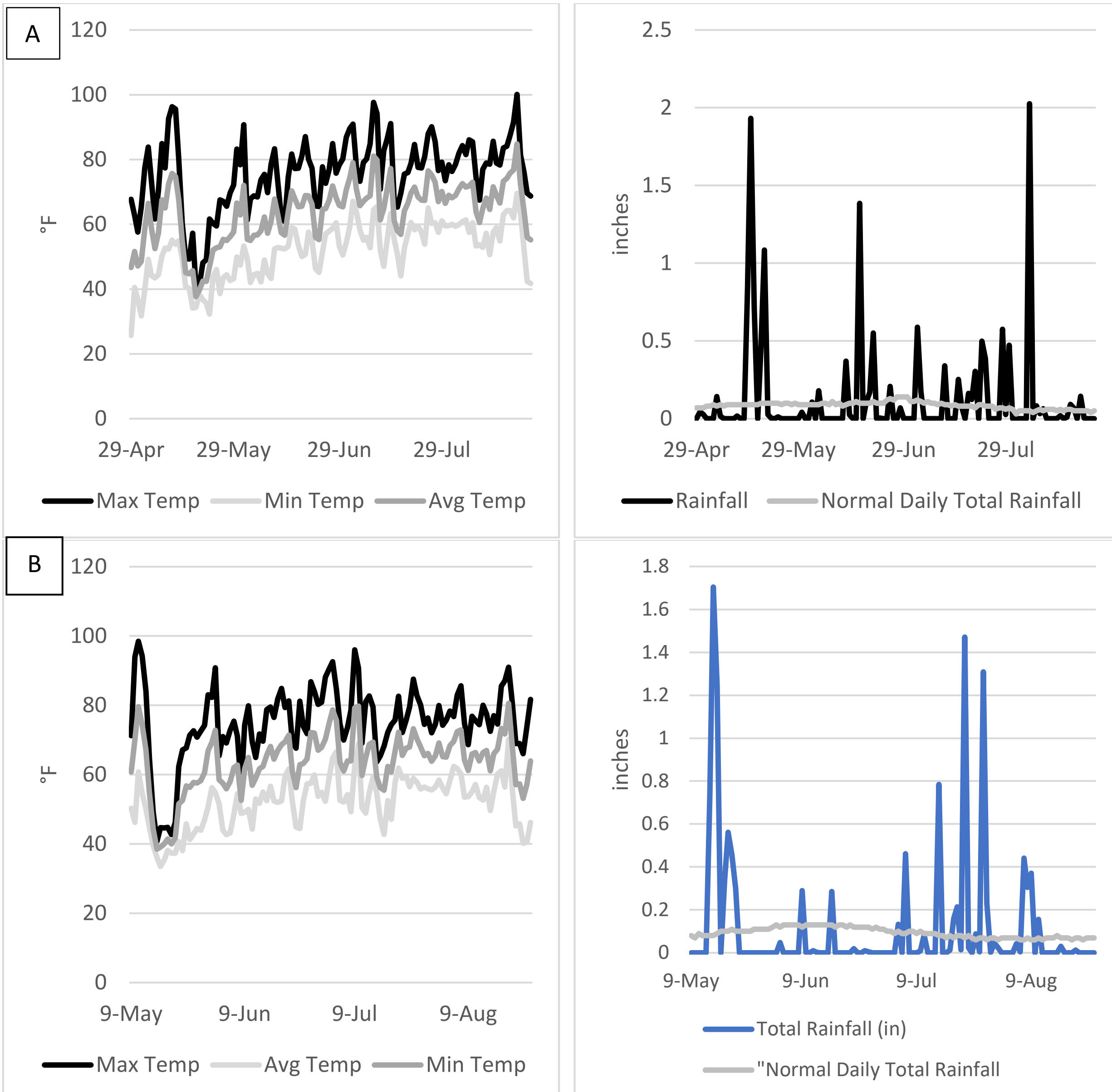

Figure 1. Maximum, minimum and average temperatures and total rainfall in Dickinson, ND (A) and Minot (B) for the duration of the trials. Source: NDAWN

Significant differences in grain yield ($p < 0.05$) were observed only at the Dickinson site (Table 1). Seed oil content was not significant ($p > 0.05$) in any of the locations.

Grain yield at Dickinson responded positively to boron fertilization, with treatments producing higher yields than the untreated check. The combination of granular and foliar boron (1 lb/ac granular + 0.25 lb/ac foliar) resulted in the highest yield (2,351 lbs/ac), significantly outperforming the check (25% yield increase). The lowest rate treatment (0.25 lbs/a foliar) still provided a 14% yield increase in Dickinson.

Treatments with either foliar or granular boron alone generally showed intermediate yield gains. This could be due to the fact that canola plants need a steady supply of boron throughout the growing season, and one single application at planting may not be sufficient to meet the crop needs during the reproductive stages, when the plant's boron demand increases (Ma et al., 2019).

In Minot, while the results were not statistically significant, we could still observe a yield gain trend with the different treatments compared to the control. The treatment consisting of 0.50 lbs B acre^{-1} had the greatest yield overall (2,448 lbs ac^{-1}), with a 14% increase compared to the control treatment.

Overall, the results suggest that low rates and combined application methods tended to be more effective than single-source applications in enhancing canola yield under the conditions at Dickinson.

Table 2. Grain yield (lbs ac^{-1}) and seed oil content (%) of canola as a function of different boron fertilizer sources, rates and application timings in Dickinson, ND and Minot, ND (2025).

	Dickinson		Minot	
Treatment	Yield (lbs/ac)	Oil (%)	Yield (lbs/ac)	Oil (%)
1 lb/ac Granular + 0.25 lb/ac Foliar	2,351 A	43.1	2,405	42.2
1 lb/ac Foliar	2,296 AB	43.0	2,307	42.0
1 lb/ac Granular + 0.50 lb/ac Foliar	2,269 AB	43.0	2,412	41.9
0.25 lb/a Foliar	2,127 ABC	43.5	2,344	42.6
10 lbs/ac Granular	2,088 BCD	43.0	2,328	42.4
2 lbs/ac Granular	2,082 BCD	42.8	2,399	42.7
5 lbs/ac Granular	2,014 CD	43.2	2,337	43.7
0.50 lbs/ac Foliar	1,957 CD	43.2	2,448	42.3
Untreated Check	1,874 D	43.2	2,153	42.7

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

Conclusions

- The effects of Boron fertilization in canola yield seem to be positive.
- The combination of a granular B application at planting plus a foliar B application at 10-20% bloom produced the best results.
- This correlation, however, seems to be location dependent.
- Boron sources, rates and timing of application do not affect seed oil content in canola.
- The study will be conducted again next year to confirm the results and to provide more sound recommendations to canola growers.

Acknowledgments

This study was sponsored by the Northern Canola Growers Association.

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Sulfur Fertilizer for Spring Canola Production in Western North Dakota

Krishna Katuwal – Dickinson Research Extension Center

Introduction

Sulfur is the fourth key macronutrient for crop growth after nitrogen, phosphorus, and potassium. It is a component of the amino acids cysteine and methionine which are fundamental building blocks of proteins and enzymes, and supports chlorophyll synthesis and enhances plant tolerance to both biotic and abiotic stressors. Sulfur also activates enzymes such as acetyl-CoA carboxylase, contributing to oil formation in oilseed crops like canola through its role in lipid metabolism. NDSU currently recommends applying 20 lb/ac of sulfur for canola production in areas south and west of the Missouri Coteau in North Dakota (Franzen, 2017; Franzen and Grant, 2008). However, these guidelines are derived from older studies conducted north and east of the Coteau, where conditions are cooler and wetter. As canola acreage expands in southwest North Dakota, updated region-specific sulfur recommendations are needed. This project aims to (1) evaluate the effects of various sulfur fertilizer sources and application rates on spring canola yield and quality in western North Dakota, and (2) assess how these sulfur sources and rates interact with different nitrogen management strategies to influence spring canola performance in the region.

Materials and Methods

This project represents the third year (2025) of a trial initiated in 2023. Research was carried out at three locations across southwest North Dakota: Dickinson, Minot and Hettinger. Canola was solid-seeded in May, and all treatments were broadcast immediately after planting. The study included three different treatments. The first was sulfur fertilizer source, consisting of ammonium sulfate, gypsum and elemental sulfur. The second treatment was sulfur application rate: 0, 10, 20 and 30 lb S/ac. The third was nitrogen application rate: 0, 100 and 150 lb N/ac. Nitrogen rate of 0 lb/ac received nitrogen equivalent to 30 lb/ac of ammonium sulfate supplemented with urea. All treatments were replicated four times, with individual plot dimensions of 30 × 10 ft in Dickinson and Minot, and 22 × 5.33 ft in Hettinger. Our experimental design was randomized complete block design with a split-split-plot arrangement. At physiological maturity, the center 5 ft strip of each plot was harvested with a plot combine to measure seed yield and oil content. Seed moisture and test weight were determined using a commercial grain tester, and yields were adjusted to the standard 8.5% moisture content.

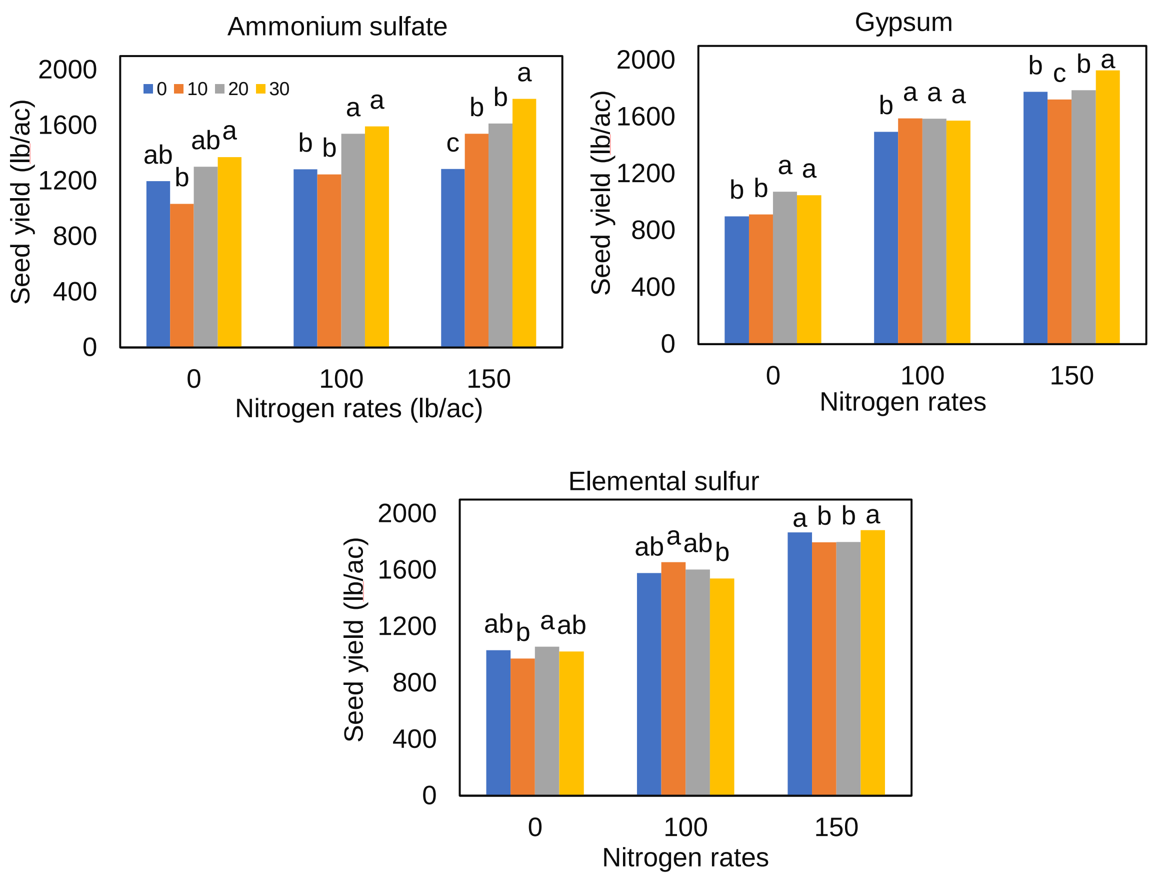
Results

This year's results revealed a significant three-way interaction among sulfur source, sulfur rate and nitrogen rate. For ammonium sulfate, applying 20 lb/ac of sulfur ranked the top for seed yields in two out of three nitrogen levels (Fig. 1). In gypsum and elemental sulfur treatments, the 20 lb/ac sulfur rate again ranked the highest in two of the three nitrogen rates tested. While being 10 lb lower than 30 lb/ac rate, 20 lb/ac sulfur still produced mostly similar to or even outyielded 30 lb/ac rate in some cases. When comparing different sources, ammonium sulfate either outyielded or produced similar yield to gypsum and elemental sulfur.

Conclusions and recommendations to producers

Across three years of continuous research on sulfur fertilizer management in canola, we found that applying 20 lb/ac of sulfur together with adequate nitrogen consistently maximized canola production in western North Dakota. Ammonium sulfate yielded higher seed production than gypsum or elemental sulfur. Based on these results, producers are encouraged to apply 20 lb/ac of sulfur as ammonium sulfate when broadcasting fertilizer in the spring prior to planting. Additional studies comparing spring versus fall application timings are still needed to develop stronger region-specific sulfur recommendations for canola in western 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) in 2025. Columns marked with same letter are not significantly different at P ≤ 0.05.



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Sulfur Fertilizer for Spring Wheat Production in Western North Dakota

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Introduction

Sulfur fertilization has gained increasing attention as sulfur deficiencies become more frequent across western North Dakota. Although plants require sulfur in relatively small amounts, it is essential for chlorophyll formation and overall growth. Historically, soils supplied most of the sulfur needed by crops, but sulfur availability is strongly influenced by environmental conditions that control mineralization. As a result, sulfur deficiencies have become more common, especially in sandy soils or soils with less than 2% organic matter, which often respond to sulfur fertilizer application (Franzen and Grant, 2008). Managing sulfur can be challenging. Sulfate-based fertilizers such as ammonium sulfate are generally the most dependable sources because they are immediately plant available. In contrast, elemental sulfur requires biological oxidation before becoming available, a process that may be too slow to meet the early-season demands of short-season crops like wheat. To address the limited information on sulfur requirements for hard red spring wheat in western North Dakota, this project aims to (1) evaluate the effects of various sulfur fertilizer sources and application rates on spring wheat yield and quality in western North Dakota, and (2) assess how these sulfur sources and rates interact with different nitrogen management strategies to influence spring wheat performance in the region.

Materials and Methods

This research has been conducted at three different locations in western North Dakota: Dickinson, Minot, and Hettinger since 2023. In 2025 trial, spring wheat was planted at 1.1 million pure live seeds/ac in early May, and all fertilizer treatments were broadcast immediately after planting. The study evaluated three fertilizer treatments: (1) sulfur sources (ammonium sulfate, gypsum and elemental sulfur); (2) sulfur application rates (0, 5, 10, 15 and 20 lb S/ac); and (3) nitrogen application rates (0 and 125 lb N/ac). The 0 lb N/ac treatment received nitrogen equivalent to 30 lb/ac of ammonium sulfate, supplemented with urea to balance N levels. Treatments were arranged in a randomized complete block design with a split-split-plot structure and four replications. Plot sizes were 30 × 10 ft in Dickinson and Minot, and 22 × 5.33 ft in Hettinger. At physiological maturity, the center 5 ft of each plot was harvested using a plot combine to measure seed yield and protein content. Seed moisture and test weight were determined with a commercial grain tester, and grain yield was adjusted to the standard 13.5% moisture.

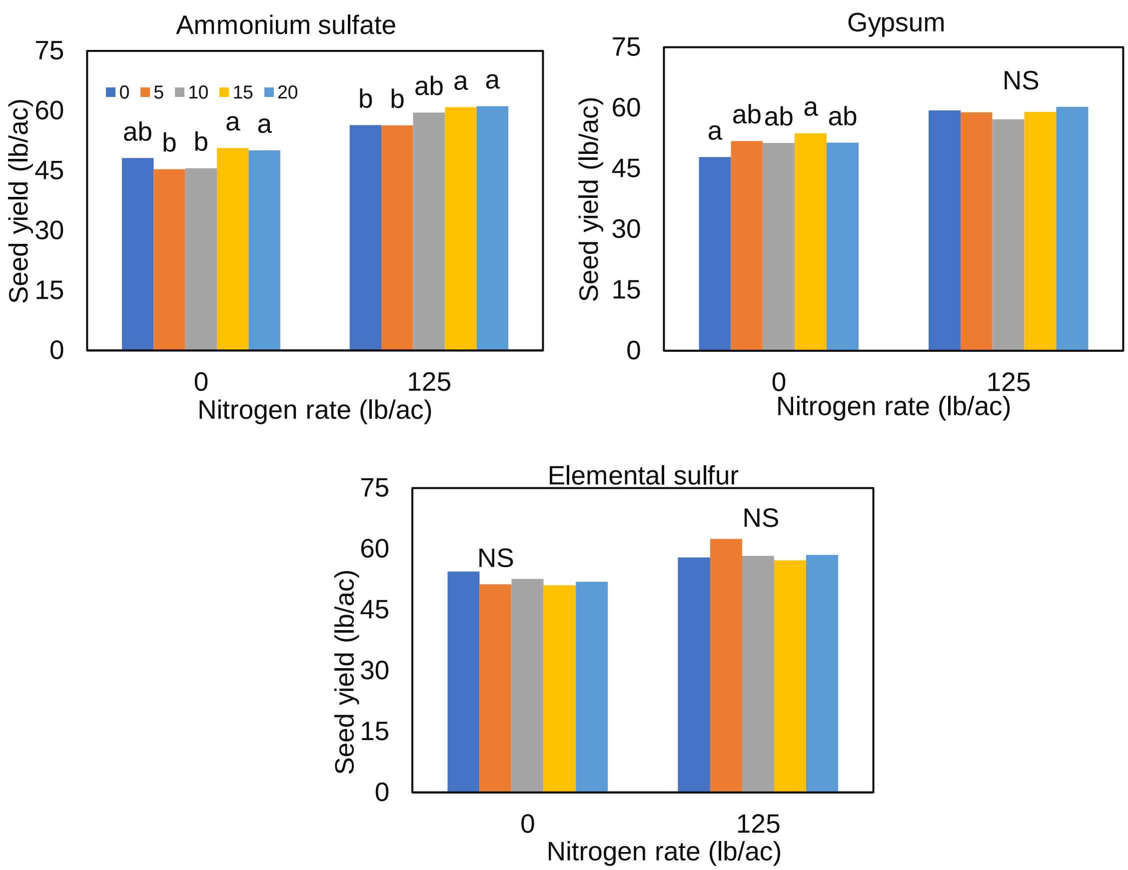
Results

Our results in 2025 trial showed that 15 and 20 lb/ac sulfur produced the top spring wheat seed yield when ammonium sulfate was used as sulfur source (Fig. 1). When gypsum was used, again 15 lb/ac was one of the top seed yield producing sulfur rate particularly when no nitrogen was applied. With 125 lb/ac nitrogen application, no difference was observed for seed yield among different sulfur rates when gypsum was used as a sulfur source. Similarly, no differences were observed among different sulfur rates when applying elemental sulfur as sulfur source in both 0 and 125 lb/ac nitrogen rates.

Conclusions and recommendations to producers

With continuous three years of research on sulfur fertilizer management in spring wheat, we found that 15 lb/ac sulfur with ammonium sulfate as a sulfur source improves spring wheat yield in western North Dakota. When broadcasting sulfur fertilizer in spring before planting, producers are encouraged to apply ammonium sulfate as sulfur source as no yield gains were consistently observed with other sources such as gypsum and elemental sulfur. Yield gains with ammonium sulfate sulfur fertilizer application may be limited when weather becomes severe like extreme drought and heat. Additional research comparing spring versus fall application timings are still needed to develop stronger region-specific sulfur recommendations for spring wheat in western North Dakota.

Fig. 1. Spring wheat seed yield affected by different sulfur rates (0, 5, 10, 15 and 20 lb/ac), sulfur fertilizer sources (Ammonium sulfate, gypsum and elemental sulfur) and nitrogen rates (0 and 125 lb/ac) in 2025. Columns marked with same letter are not significantly different at $P \leq 0.05$.



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Emergence and Early Growth of Hard Red Spring Wheat in Acid Soils of Western North Dakota

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Introduction

Acidic acres have been increasing in western North Dakota. Decades of nitrogen fertilizer usage paired with slightly acidic soil parent materials and poorly buffered soils has lowered soil pH below 5.5 on many farmable acres. These areas of strong acidity are adversely impacted by reduced nutrient availability, soil microbial activity, and stunted roots from aluminum (Al) toxicity, ultimately causing yield penalties.

While surface liming can improve these acidic areas, lime availability in western North Dakota remains limited. The Sidney (MT) sugar beet processing plant is one of the few local sources and supplies sugar beet waste lime to the region. However, considering the costs of hauling and application, lime remains a scarce and expensive resource, complicating efforts to address soil acidity effectively.

There is a critical need to help farmers identify alternatives to reduce yield losses on acid-affected soils. For wheat farmers, one potential alternative is variety selection. Yield is determined by three main components: plants per acre, seeds per plant, and seed size. Soil acidity can adversely affect all three components. Specifically, wheat seeds, being small, are typically planted at depths within the stratified acidic soil layer (0-3 inches), exposing them to stress early in their development. This stress can impair emergence, early growth, and overall plant stands.

Previous research conducted in Dickinson, Minot and Lefor looked at wheat variety selection in acidic soils (Buetow, 2022). However, these studies did not account the effects of soil pH on wheat plant stands. Additionally, the author of the study noted that drought conditions during the experimental period introduced high variability, preventing reliable recommendations from being drawn from the dataset (Buetow, 2022).

Because producers in North Dakota are not familiar with the need to lime and infrastructure of lime sources and application equipment in the region are in the early stages and considered costly, many are searching for alternative short-term solutions.

This project aims to assess the emergence and early growth of Hard Red Spring Wheat (HRSW) varieties in acidic soils of western North Dakota. By identifying wheat varieties better suited to low soil pH conditions, this research aims to provide short-term solutions for local farmers. The long-term goal is to use the collected data to select the best-performing varieties for future field trials that will also evaluate grain yield and quality.

Material and Methods

The study was conducted in a growth chamber (Conviron GEN1000), under controlled environmental conditions (12 hours of light at 25°C, 12 hours of dark at 20°C) using a completely randomized design with four replications. The assessed varieties were: AP Gunsmoke CL2, Ascend-SD, Brawn-SD, MN Rothsay, MT Carlson, MT Dutton, ND Heron, ND Stampede, ND Thresher, ND Horizon, ND Frohberg, ND Roughrider, and Dagmar. Additionally, the varieties Lanning and SY Soren were included as tolerant and susceptible checks, respectively.

In the spring, acidic soil (pH ≤ 5.5) was collected from a collaborating farmer's field near Lefor, ND. Soil pH characterization was conducted *in situ* using a Veris Cart (Veris Technologies, Inc., Salina, KS). Soil was collected from areas of the field with the lowest pH according to the map generated by the Veris Cart. Furthermore, soil samples were collected at the 0-3 inch depth and analyzed for chemical and physical attributes.

The acidic soil was then ground and placed in plastic trays and planted with ten seeds of each variety per cell. Due to in field variability, prior to experimental setup the batch of soil used in the study was tested again for soil pH using a portable handheld pH meter (MW802 PRO, Milwaukee Instruments, Rocky Mount, NC). The test indicated pH 4.8 for the batch of soil used in the study.

Daily emergence was assessed and the emergence rate index (ERI) was calculated using the formula:

$$ERI = \frac{\sum_{i=1}^{k} Ni}{k}$$

Where:

- k = Total number of time intervals (e.g., days)
- Ni = The number of seeds that emerged in the time interval.

At 10 days after planting, final emergence counts were taken.

Four weeks after planting, whole plants (including roots) were hand-harvested and measured for plant height, root length, culm diameter, phenological stage, and fresh weight. Subsequently, wheat was placed in paper bags and dried in a forced-air circulation oven until constant weight, for dry mass calculation.

Data analysis was performed using the software SAS 9.4 (The SAS Foundation, Cary, NC).

Results

Soil analysis results are shown on Table 1.

Soil Test

	N (Nitrate)	P (Olsen)	K	Cl	S	B	Zn	Fe
	lb/acre	ppm	ppm	lb/acre	lb/acre	ppm	ppm	ppm
0-3"	12	23	521	2	7	0.5	1.72	89.9

	Mg	Ca	Na	OM	CCE	Al (Exchangeable)	Soil pH	Buffer pH
	ppm	ppm	ppm	(%)	(%)	ppm		
0-3"	445	1456	13	6.3	0.6	2.9	5.5	6.3

Emergence

The emergence rate index (ERI) varied significantly ($p < 0.05$) among the evaluated HRSW varieties and the variety SD Ascend exhibited the greatest ERI (33.5), indicating the fastest emergence rate (Table 1). A higher ERI reflects a quicker and more uniform emergence, which favors rapid canopy development, improved early-season competition with weeds, and overall better stand establishment.

In contrast, SD Brawn and ND Roughrider recorded the lowest ERI values (17.70 and 13.44, respectively) and where statistically lower than all the other varieties. The lower ERI's observed for these varieties may suggest a greater susceptibility to acidic soil conditions and potential aluminum toxicity.

Despite Lanning's known genetic tolerance to aluminum toxicity and low soil pH, it did not outperform the other varieties in terms of ERI, including those that do not carry the *TaAlmt1* gene responsible for aluminum tolerance. Fordyce et al. (2020) similarly reported that regionally adapted *TaAlmt1* carriers did not outperform adapted noncarriers under field conditions. However, more positive results were observed for Lanning in terms of final emergence, where this variety outperformed the susceptible check and most other varieties.

Final emergence (%) did not differ significantly among varieties, ranging from 80% for ND Roughrider and 100% for SD Ascend. Despite the lack of statistical differences in total emergence, the variation in ERI underscores differences in early seedling vigor and tolerance to acidic soil conditions among the tested varieties.

Table 1. Emergence rate index (ERI) and final emergence rate (%) of 15 wheat varieties grown under acidic soil conditions (pH 4.8).

Variety	Emergence Rate Index		Emergence (%)
AP Gunsmoke	29.58	AB	87.5
Dagmar	28.97	AB	90.0
Lanning (tolerant check)	25.50	B	97.5
MN Rothsay	29.72	AB	97.5
MT Carlson	26.70	AB	87.5
MT Dutton	28.97	AB	95.0
ND Frohberg	24.42	BC	92.5
ND Heron	26.43	AB	97.5
ND Horizon	29.18	AB	97.5
ND Roughrider	13.44	D	80.0
ND Stampede	30.69	AB	97.5
NDThresher	25.88	B	92.5
SD Ascend	33.50	A	100.0
SD Brawn	17.70	CD	85.0
SY Soren (susceptible check)	31.01	AB	90.0

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

Early Growth

Among the evaluated hard red spring wheat (HRSW) varieties, only plant height, root length, and root fresh weight varied significantly ($p < 0.05$) (Table 2). Culm diameter averaged 1.7 mm, tops fresh weight 9.5 g, tops dry matter 1.6 g, root dry matter 2.5 g, and crop growth stage averaged Zadoks 17 across varieties.

Overall, SD Ascend outperformed all other varieties in terms of plant height, root length, and root fresh weight. The superior early growth performance of SD Ascend is consistent with its rapid emergence and likely reflects greater vigor and adaptation to acidic soil conditions.

Aluminum toxicity primarily targets the root apex, where Al exposure inhibits cell elongation and division, resulting in root stunting and impaired water and nutrient uptake (Panda et al., 2009). Consequently, root length is often used as an indicator of Al susceptibility or tolerance. In this study, varieties MT Dutton, ND Frohberg, ND Thresher, and SD Brawn exhibited the shortest roots, suggesting a higher sensitivity to aluminum toxicity. MT Dutton has been described as exhibiting partial/moderate tolerance to aluminum and acidic soils (Cook et al., 2023). However, we observed relatively short root length for MT Dutton under our experimental conditions (pH 4.8), suggesting that its tolerance may be limited under more severe acid stress or may be environment-dependent.

Root fresh weight also differed significantly among varieties ($p < 0.05$). SD Ascend had the greatest root fresh weight, confirming its superior vigor and ability to maintain active root growth under stress. In contrast, ND Frohberg, ND Thresher, and SD Brawn produced the lowest root fresh weights, consistent with their reduced root length.

Lanning also showed low root fresh weight despite showing intermediate root length. This discrepancy suggests that while Lanning was able to sustain primary root elongation under acidic conditions, its overall root biomass accumulation was limited. Such a response could indicate a reduced development of lateral roots or a lower root tissue density, both of which are common adaptive trade-offs observed in aluminum-tolerant genotypes (Kochian et al., 2015). Aluminum exclusion mechanisms, such as those mediated by the *TaALMT1* gene, may protect the root apex but do not necessarily promote biomass accumulation if carbon allocation to roots is constrained under stress. Consequently, Lanning's moderate elongation combined with lower root mass may reflect a tolerance mechanism centered on maintaining root function rather than vigorous root growth under low pH stress.

Root biomass accumulation represents an integrated response to both root elongation and lateral root proliferation. Varieties able to maintain greater root fresh weight under low pH likely possess more efficient carbon allocation to belowground tissues and enhanced physiological resilience against aluminum-induced growth inhibition. Conversely, reduced root biomass may limit nutrient and water uptake capacity, potentially constraining shoot development and yield potential under field conditions (Ofoe et al., 2023).

The variation observed in root fresh weight complements differences in emergence and early growth, highlighting genetic variability in tolerance to soil acidity and aluminum toxicity among the tested HRSW varieties.

Table 2. Plant height (cm), root length (cm), culm diameter (mm), tops fresh weight (g), root fresh weight (g), root dry matter (g), and crop stage (Zadoks) of 15 wheat varieties grown under acidic soil conditions (pH 4.8).

Variety	Plant Height (cm)	Root Length (cm)	Culm Diameter (mm)	Tops Fresh Weight (g)	Root Fresh Weight (g)	Tops Dry Matter (g)	Root Dry Matter (g)	Crop Stage (Zadoks)
AP Gunsmoke	7.5 EF	11.4 BC	1.6	9.0	9.2 BC	1.6	2.0	17
Dagmar	7.0 F	13.4 ABC	1.6	8.4	8.7 BC	1.8	1.9	18
Lanning (tolerant check)	8.0 BCDE	11.3 BC	1.8	11.2	7.8 C	1.7	1.9	15
MN Rothsay	7.5 EF	12.8 BC	1.7	8.7	11.2 BC	1.6	2.8	17
MT Carlson	8.1 BCDE	12.1 BC	1.7	9.8	9.4 BC	1.7	2.1	16
MT Dutton	8.5 BCD	10.3 C	1.8	10.4	10.1 BC	1.8	2.8	18
ND Frohberg	8.6 BCD	10.3 C	1.6	9.8	8.1 C	1.6	1.9	17
ND Heron	8.7 ABC	11.5 BC	1.5	8.7	8.9 BC	1.5	2.3	15
ND Horizon	8.3 BCDE	14.5 AB	1.8	10.1	13.8 BC	2.1	3.7	16
ND Roughrider	8.8 AB	11.3 BC	1.9	8.3	10.3 BC	1.3	3.1	18
ND Stampede	8.4 BCD	10.8 BC	1.6	9.1	9.8 BC	1.5	2.7	16
ND Thresher	7.8 DEF	9.6 C	1.7	9.5	7.0 C	1.5	1.6	15
SD Ascend	9.6 A	16.9 A	1.9	12.3	19.2 A	2.3	4.6	18
SD Brawn	7.8 CDEF	9.9 C	1.6	7.8	6.6 C	1.4	2.4	17
SY Soren (susceptible check)	8.1 BCDE	10.7 BC	2.0	9.0	8.5 BC	1.4	2.1	16

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

Conclusions

- SD Ascend consistently demonstrated superior performance in terms of emergence rate, plant height, root length, and root biomass, indicating strong adaptation and vigor under acidic soil conditions.
- Varieties such as ND Frohberg, ND Thresher, and SD Brawn showed sensitivity to acidic conditions, exhibiting both shorter roots and lower root biomass, implying reduced ability to cope with aluminum stress.
- Variety selection represents a viable short-term management strategy for producers facing acid soils in western North Dakota, offering an immediate alternative while long-term liming solutions remain limited.
- The trial will be repeated one more time to confirm the results, as only one run of the trial is not sufficient to draw impactful conclusions and recommendations.

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Lime Impacts on Spring Wheat Yield

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Introduction

Acidic soils (pH below 5.5) limit nutrient availability and can suppress biological activity. Soil acidity has increased in North Dakota largely due to fertilizer applications. During nitrification, hydrogen ions are released as nitrogen is converted to plant-available nitrate; these hydrogen ions drive acidity and add to the soil's acidity pool. Lime (calcium carbonate) is an amendment that neutralizes acidity by reacting with hydrogen ions to raise soil pH. The Dickinson Research Extension Center has been researching and developing lime recommendations for North Dakota soils (Augustin, 2023).

Materials and Methods

The initial soil pH at the research site was 5.3. Half of the site was limed on April 16–17, 2025, using 98G pelletized lime from Calcium Products (2025) at a rate of 6.8 tons calcium carbonate equivalent per acre. The lime rate was based on Augustin (2024), which reported a 0–3 inch soil buffer pH of 6.6. Lime was surface-applied with a pendulum spreader and not incorporated. The remaining half of the site received no lime.

Plots measured 540 ft^2, and each treatment had three replications. Roughrider spring wheat was planted on May 6, 2025, at 1.1 million live seeds per acre using a no-till drill. The crop was managed for weeds and other pests as needed. Initial soil tests showed 40 lbs N/ac, 18 ppm P, and 402 ppm K. Urea was applied at 50 lbs N/ac. Plots were harvested with a small-plot combine to determine yield.

Results

The untreated check spring wheat yielded 34.3 bu/ac. Whereas, the limed spring wheat yield was 39.8 bu/ac (figure 1). The lime treatment did increase the soil pH (figure 1). This area will be transitioned into a rotational study to see the impacts of different crop rotations and fertilizer practices on soil pH.

Table 1. Yield and soil pH impacts from lime treatments.

Treatment	Wheat Yield -bu/ac-	Soil pH -0-3in depth-
Lime	39.8	7.5
Check	34.3	5.5
p-value	0.05	0.04

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Aphanomyces and Sugarbeet Waste Lime Impacts on The Subsequent Spring Wheat Crop

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Introduction

A study was initiated in 2024 to observe impacts of sugarbeet waste lime treatments on field pea and Aphanomyces. Sugarbeet waste lime a by-product of sugar processing has been found to reduce Aphanomyces in sugarbeets (Bresnahan et al., 2003). Lime treatments in 2024 did not impact field pea yield or quality. Spring wheat was planted in these plots 2025 to determine if there was a yield improvement the subsequent year.

Materials and Methods

In the spring of 2024, lime was hand applied after field pea planting at rates of 0, 2.25, 4.5, and 9 tons calcium carbonate per acre. Additionally, soils were inoculated with Aphanomyces with treatments of 0 and 4.5 tons calcium carbonate per acre. The plots were 190 ft^2 with five replications. Roughrider spring wheat was planted at 1.1 million live seeds per acre using a no-till drill. Plots were harvested with a small plot combine to determine crop yield.

Results

Treatments did not impact spring wheat yield (p-value 0.11) or quality (0.93). The average yield was 21.5 bu/ac.

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Bresnahan, G.A., A.G. Dexter, C.E. Windels, J.R. Branter, and J.L. Luecke. 2003. The effect of spent lime on sugarbeet yield and *Aphanomyces cochlioides* suppression. Sugarbeet Res. Ext. Rept. 33:273-276.

Sugarbeet Waste Lime Impacts on Field Pea Aphanomyces

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Introduction

Aphanomyces root rot—caused by *Aphanomyces euteiches*—poses a major threat to field pea production. Effective management strategies are urgently needed. Sugarbeet waste lime a by-product of sugar processing has been found to reduce Aphanomyces in sugarbeets (Bresnahan et al., 2003).

Materials and Methods

Lime was hand applied after field pea planting at rates of 0, 2.25, 4.5, and 9 tons calcium carbonate per acre. Additionally, soils were inoculated with Aphanomyces with treatments of 0 and 4.5 tons calcium carbonate per acre. The plots were 265 ft^2 with five replications. Plots were harvested with a small plot combine to determine crop yield.

Results

Treatments did not impact field pea yield (p-value 0.41) or quality (0.33). The average yield was 29 bu/ac. A similar study conducted at the Williston Research Extension Center observed similar results. However, nodule counts appeared to be positively correlated with lime treatments at the previous year WREC trial.

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Bresnahan, G.A., A.G. Dexter, C.E. Windels, J.R. Branter, and J.L. Luecke. 2003. The effect of spent lime on sugarbeet yield and *Aphanomyces cochlioides* suppression. Sugarbeet Res. Ext. Rept. 33:273-276.

Determining Soybean Inoculation Strategies in Western North Dakota

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Introduction

Soybean (*Glycine max* L.) production in western North Dakota remains challenging because of the limiting environmental conditions and because the crop is relatively new to the region, and locally validated agronomic recommendations are limited. With soybean acreage in the region having more than doubled over the past decade (USDA-NASS, 2024), the need for region specific inoculation and nitrogen management recommendations become more crucial.

One of the most critical knowledge gaps in supporting soybean expansion into "soybean-virgin" soils is understanding how to effectively use *Bradyrhizobium* inoculants to maximize biological nitrogen fixation (BNF) and reduce dependence on costly nitrogen fertilizers. More than half of soybean nitrogen requirements are typically supplied through symbiosis with *Bradyrhizobium*, with the remainder obtained from soil mineralization or fertilizer inputs (Salvagiotti et al., 2008). For example, a 40 bu/ac soybean crop requires roughly 200 lb N/ac, illustrating the magnitude of nitrogen inputs required for sustainable production (Tamagno et al., 2018).

Farmers currently have access to several inoculation products and application methods, including peat, liquid, and granular formulations. However, limited data exist on which products and rates perform best under the distinct soil and climatic conditions of western North Dakota. Moreover, inoculation effectiveness is known to vary with initial soil nitrogen levels and with the presence—or absence—of native rhizobia populations. In newly cultivated soybean fields, these populations are often low or absent, making inoculation critical for establishing an effective symbiosis.

Therefore, research is needed to determine the most efficient inoculant sources and application rates under varying soil nitrogen conditions.

Material and Methods

To identify the most effective inoculation strategies for maximizing soybean production in western North Dakota, this study evaluated the performance of liquid and granular inoculants derived from different rhizobia strains—*Bradyrhizobium japonicum* (liquid) and *B. elkanii* (granular)—applied at varying rates and in combination with a starter nitrogen fertilizer treatment. This trial was conducted at the Dickinson REC, in a field with no soybean history.

The experiment included the following treatments:

• Three inoculation rates (1×, 2×, and 3× the label recommendation) for both liquid and granular formulations (six treatments total);

• Two treatments combining the 1× inoculation rate (liquid or granular) with 20 lb N/ac starter fertilizer to simulate field starting-nitrogen differences;

• One treatment combining 1× liquid and 1× granular inoculants to evaluate potential strain complementarity;

• Two controls: an untreated control and a control with 20 lb N/ac starter fertilizer.

In total, 11 treatments were evaluated using a randomized complete block design with four replications at each site.

The soybean variety was ND170009GT, treated with a fungicide (Allegiance®). The inoculation treatments were mixed in the seed envelopes prior to planting. All other agronomic management followed the NDSU's soybean production field guide (Kandel & Endres, 2023). Soybean was solid seeded at 145,000 seeds acre^{-1} on May 12 and was harvested on Oct. 3.

Grain yield, oil, and protein content data were determined.

Results

Soybean yield, protein, and oil content were influenced by inoculant type, rate, and the use of starter fertilizer (Table 1). In general, inoculated treatments outperformed the non-inoculated check, confirming the importance of rhizobial inoculation in recently introduced soybean-growing areas such as western North Dakota.

Grain yield ranged from 31.0 to 40.8 bu/ac. The greatest yields were obtained by the 1× Liquid, 3× Liquid, 2x Granular, 3x Granular, and 1× Granular + 20 lbs N/ac treatments, which were statistically similar and significantly greater than the untreated check. These results suggest that both liquid and granular inoculants are effective at improving yield under the study conditions.

Protein content varied from 31.30 to 35.63%, while oil ranged from 16.69 to 17.94%. The 3× Granular treatment had the greatest protein concentration (35.63%). Greater protein levels were often associated with lower oil concentrations, consistent with the typical inverse relationship between these two seed components.

The check and nitrogen-only treatments showed lower protein and moderate-to-high oil content, reinforcing that biological nitrogen fixation contributes more effectively to protein accumulation than small additions of inorganic N.

Table 1. Grain yield, protein content and oil content of soybean treated with different inoculants at varying rates, and the use of a starter fertilizer. Dickinson, ND, 2025.

Treatment	Yield (bu/acre)		Protein (%)		Oil (%)	
1x Liquid	40.6	A	33.44	BCD	17.01	CD
2x Liquid	37.1	AB	32.97	CD	17.59	AB
3x Liquid	40.8	A	33.27	BCD	17.12	BCD
1x Granular	37.3	AB	32.56	DE	17.56	ABC
2x Granular	40.4	A	34.61	AB	16.82	D
3x Granular	40.4	A	35.63	A	16.69	D
1xLq+1xG	39.2	AB	34.15	ABC	16.91	D
1x Liquid + 20 lbs/ac N	36.0	ABC	32.41	DE	17.51	ABC
1x Granular + 20 lbs/ac N	40.7	A	34.13	ABC	16.80	D
20 lbs/ac N	34.5	BC	31.30	E	17.94	A
Check	31.0	C	32.34	DE	17.69	AB

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test.

Conclusions

- Inoculation significantly improved soybean yield compared to the untreated check, confirming the necessity of *Bradyrhizobium* inoculation in western North Dakota soils lacking native rhizobia populations.
- Liquid and granular inoculants performed similarly in yield, though higher granular inoculant rates (3×) tended to enhance protein content, likely offsetting the inhibitory effect of elevated soil nitrate (45 lbs N/ac) on nodulation.
- The study will be replicated at least for one more year to confirm the results, as only one year of the trial is not sufficient to draw impactful conclusions and recommendations.

Acknowledgements

This study was sponsored by the North Dakota Soybean Council.

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Managing Soybean Inoculation in Western North Dakota Acidic Soils

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Summary:
Soybean production in western North Dakota is challenged by the lack of native Rhizobium populations and increasing soil acidity caused by long term no-till associated with ammonia-based fertilizers. Acidic soils reduce Rhizobium survival, limiting nodulation and nitrogen fixation. This study examines the interaction between soil pH and inoculant type to improve soybean establishment and symbiotic performance under low pH soil conditions.

Objective:
Evaluate the performance of three commercial soybean inoculants under varying soil pH conditions to identify Rhizobium strains most tolerant to acidity and suitable for western North Dakota soils.

Methods:
Soybean variety *ND17009GT* was grown in 1-gallon pots under controlled conditions in a growth chamber simulating early-season weather in Stark County. Seeds received one of three inoculant treatments:

- **Granular:** LAL FIX Start (*B. elkanii*)
- **Liquid:** BYSI-N (*B. japonicum*)
- **Peat:** N-Charge Soybean (*B. japonicum*)
  A non-inoculated control was included.

In the spring, soil from a collaborating farmer field was collected. Soil pH was 5.1. The soil was placed in 1-gallon pots and adjusted to four pH levels (4.7, 5.1, 5.5, 6.0) using either aluminum sulfate to acidify the soil or pelletized lime to increase the soil pH. Emergence, nodulation, and early growth traits were evaluated.

Results

Emergence rate and final emergence were influenced by both inoculant and pH, though not their interaction (Table 1). Inoculated treatments had higher emergence (>85%) than the control (77%). Slightly acidic soils (pH 5.1–5.5) favored faster and more uniform emergence compared to strongly acidic (pH 4.7) or neutral (pH 6.0) soils.

Table 1. Emergence rate index and final emergence of soybean as a function of inoculant products and soil pH.

Inoculant	Emergence Rate Index	pH	Emergence Rate Index	Inoculant	Final Emergence (%)	pH	Final Emergence (%)
Granular	52.71 A	5.1	51.87 A	Granular	93 A	5.1	93 A
Liquid	48.54 A	5.5	51.79 A	Peat	90 A	5.5	90 AB
Peat	48.43 A	6.0	45.86 B	Liquid	87 A	6.0	83 BC
UTC	43.12 B	4.7	43.29 B	UTC	77 B	4.7	81 C

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

Soybean early growth was influenced by soil acidity only (Table 2). Plants at pH 4.7 were elongated (etiolated) and had thinner stems, indicating stress and possible aluminum toxicity.

Table 2. Plant height and stem diameter of soybean as a function of soil pH.

pH	Plant Height (cm)	Stem Diameter (mm)
4.7	24.85 A	2.81 B
5.5	21.94 AB	3.15 A
5.1	21.83 AB	3.12 A
6.0	19.05 C	3.24 A

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

The number of nodules per plant and the weight of nodules per plant varied significantly as a function of the interaction between inoculants and pH levels ($p < 0.05$) (Table 4). Overall, it was observed that the granular inoculant produced the greatest number of nodules per plant, followed by the liquid inoculant. Statistically, the peat inoculant was similar to the untreated check in terms of number of nodules.

One possible reason for the superior performance of the granular inoculant is the presence of *Bacillus velezensis* in its formulation. *B. velezensis* is known to promote phosphorus (P) solubilization, increasing the amount of plant-available P in the soil solution. In acidic soils, aluminum (Al^{3+}) readily reacts with phosphate ions, forming insoluble aluminum phosphates and thereby reducing P availability to plants. By solubilizing P, *B. velezensis* may indirectly mitigate Al toxicity's suppression of root growth and nodule formation. This mechanism may help explain the greater nodule numbers observed with the granular inoculant.

Support for this mechanism is found in the work of Buetow (2022), who reported that in furrow-applied phosphorus trials on acid-affected soils (pH < 5.5) in western North Dakota, adding P improved yield responses in a susceptible hard red spring wheat variety, suggesting P availability can alleviate some of the constraints imposed by low pH and Al toxicity. Similarly, a report from Oklahoma State University showed that in acid Oklahoma soils (pH < 5.5) banding P fertilizer significantly reduced Al toxicity and improved root performance in winter wheat.

In terms of weight of nodules, it was observed a linear growth for the granular inoculant that followed the pH increase. For the liquid inoculant, the weight of nodules at pH 5.1 was the greatest across all treatments. The peat inoculant had low nodule weight, being for the most part similar to the untreated check.

Table 3. Number and weight of nodules per plant as a function of inoculant and soil pH.

Inoculant	pH	Number of nodules per plant		Weight of nodules per plant (g)	
Granular	4.7	3.87	D	0.0344	CDE
	5.1	19.47	A	0.0825	BCD
	5.5	15.20	B	0.0964	BC
	6.0	19.33	A	0.1030	B
Liquid	4.7	0.20	DE	0.0023	E
	5.1	10.00	C	0.1711	A
	5.5	8.67	C	0.0788	BCD
	6.0	2.93	DE	0.0302	DE
Peat	4.7	0.00	E	0.0000	E
	5.1	2.07	DE	0.0361	CDE
	5.5	1.40	DE	0.0058	E
	6.0	0.73	DE	0.0125	DE
UTC	4.7	0.07	E	0.0005	E
	5.1	0.47	DE	0.0063	E
	5.5	0.47	DE	0.0038	E
	6.0	0.52	DE	0.0094	DE

Means followed by the same letter within a column are not significantly different according to the least significant difference (LSD) test at 5%.

Conclusions

- Inoculant type and soil pH significantly affect soybean emergence and nodulation.
- The granular inoculant (*B. elkanii*) performed best in acidic soils, producing more nodules.
- Extremely acidic conditions (pH 4.7) impaired plant growth, suggesting aluminum toxicity.
- Slightly acidic soils (pH 5.1–5.5) supported better establishment and nitrogen fixation.
- A second experimental run is underway to confirm these results before developing grower recommendations.

Acknowledgements

This study was sponsored by the North Dakota Soybean Council.

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Corn seed inoculation with *Azospirillum brasilense* and *Stutzerimonas stutzerias* a tool to improve corn establishment and partially replace nitrogen

John Rickertsen – Hettinger Research Extension Center

The biological products or additives promising to reduce N use or to improve N use efficiency are gaining attention and interest. *Azospirillum brasilense* is a plant growth-promoting bacteria that has been used successfully in corn, wheat, and grass pastures, especially in Brazil. This trial was carried out in four no-till locations: Minot (NCREC), Carrington (CREC), Dickinson (DREC), and Hettinger (HREC). Initial soil testing (0-6; 6-24 inches) was done to evaluate soil physical-chemical properties to determine the N rates to be applied. Phosphorus, potassium, and other nutrients will be applied based on soil test results. Plot dimensions were 10 ft wide by 22 ft long. The fertilizer was applied 4" in the ground using a no-till plot drill just prior to planting. The bacterial treatments were applied to the corn seed according to manufactures directions just prior to planting. The center two rows were harvested with a small plot combine with an on-board weigh system. The results in 2025 at Hettinger showed increased yield with nitrogen treatments over the untreated check, but neither of the bacterial treatments increased yields over the treatments without bacteria.

Corn Bacterial Inoculant - 2025				**Hettinger, ND**
Treatment	Stalk Lodge	Moisture Content	Test Weight	Grain Yield
	%	%	lbs/bu	bu/ac
Check - 0 % N	0	14.6	62.1	87
Check - 75% N	0	14.7	62.5	101
Check - 100% N	0	15.0	63.4	106
Azospirillum - 0 % N	0	14.0	60.8	84
Azospirillum - 75% N	0	15.4	62.9	97
Azospirillum - 100% N	0	15.7	62.8	106
Stutzerimonas - 0 % N	0	14.2	60.1	84
Stutzerimonas - 75% N	0	14.4	61.3	93
Stutzerimonas - 100% N	0	16.5	62.8	107
Trial Mean	0.0	14.9	62.0	96
C.V. %	--	6.2	1.2	8.0
LSD 5%	--	1.3	1.0	11.7

Planting Date: May 29
Harvest Date: October 22
Previous Crop: Corn
Corn Hybrid: Dekalb DKC081-18RIB

Corn response to sulfur application in Central and Western North Dakota

John Rickertsen – Hettinger Research Extension Center

This study aims to evaluate corn grain yield response to sulfur application in no-till systems in different soils across Central and Western North Dakota. This trial was carried out in four no-till locations: Minot (NCREC), Carrington (CREC), Dickinson (DREC), and Hettinger (HREC). Five sulfur rates were applied in a randomized complete block design with four replications. Rates of 0, 10, 20, 30, and 40 lbs S/ac using ammonium sulfate (AMS) as a sulfur source were applied 4" in the ground using a no-till plot drill just prior to planting. Plot dimensions were 10 ft wide by 22 ft long. The center two rows were harvested with a small plot combine with an on-board weigh system. The results in 2025 at Hettinger showed no statistical difference in yield among any of the sulfur treatments and the untreated check.

Corn Sulfur Fertilizer - 2025 **Hettinger, ND**

Treatment	Stalk Lodge	Moisture Content	Test Weight	Grain Yield
	%	%	lbs/bu	bu/ac
0 lbs S	0	14.5	62.2	94
10 lbs S	0	15.3	62.7	99
20 lbs S	0	14.5	62.7	99
30 lbs S	0	15.4	61.6	94
40 lbs S	0	15.1	62.4	100
Trial Mean	0.0	15.0	62.3	97
C.V. %	--	4.1	1.2	7.4
LSD 5%	--	NS	NS	NS
LSD 10%	--	NS	NS	NS

Planting Date: May 29
Harvest Date: October 22
Previous Crop: Corn
Corn Hybrid: Dekalb DKC081-18RIB

Timing of Fall Application of Pyroxasulfone for Weed Control in Field Pea at Hettinger, ND, 2025.

Timing and rate of fall application of pyroxasulfone was evaluated for both crop response and weed control in 2025 at Hettinger, ND (see Table 1 for treatments; Table 3 for description of applications). A fall application of glyphosate alone provided poor control of cheatgrass (30%). Application of glyphosate plus pyroxasulfone (Zidua SC) resulted in 92-97% control of cheatgrass and there was no difference between rate or timing. At 23 days after planting (DAP) Wild oat control with pyroxasulfone increased from 74 to 85% for 3 to 5 oz/A of Zidua SC at the September application and similarly from 74 to 86% for 3 to 5 oz/A of Zidua SC at the October application timing. After this evaluation, clethodim (Section 3) was applied over the entire trial to control grasses so there were no further evaluations. At 23 DAP, increasing Zidua rate increased kochia control and timing of application resulted in similar control in most cases. At 50 DAP, kochia control was also higher for the 5 oz/A rate of Zidua compared with 3 oz/A, with similar response in most cases for application timing. Wild buckwheat control was poor to fair regardless of Zidua application rate or timing. It is generally recommended to apply herbicides for residual weed control in the fall after soil temperatures have fallen to 40 to 50 F. While average soil temperature was greater at the September application timing, the lack of rainfall after this earlier application was likely responsible for results being similar to the later application timing. In years with greater fall rainfall, weed control would likely be reduced at the earlier application timing due to increased degradation of the herbicide in the fall.

Table 1. Evaluation of timing and rate for fall application of pyroxasulfone for weed control in field peas.

Treatment[a]	Rate	Timing[b]	Cheatgrass 23 DAP	Wild oat 23 DAP	Kochia 23 DAP	Kochia 50 DAP	Wild buckwheat 23 DAP	Wild buckwheat 50 DAP
	oz/A		% control					
1 Untreated			0c	0d	0d	0d	0d	0e
2 Roundup PowerMax 3	22	Sept	30b	0d	0d	0d	0d	0e
3 Roundup PowerMax 3 Zidua SC	22 3	Sept Sept	92a	78bc	86ab	72b	62bc	41d
4 Roundup PowerMax 3 Zidua SC	22 4	Sept Sept	97a	82ab	90ab	70b	66abc	50bc
5 Roundup PowerMax 3 Zidua SC	22 5	Sept Sept	96a	85a	92a	81a	72ab	56ab
6 Roundup PowerMax 3	22	Oct	30b	0d	0d	0d	0d	0e
7 Roundup PowerMax 3 Zidua SC	22 3	Oct Oct	94a	74c	77c	61c	61c	44cd
8 Roundup PowerMax 3 Zidua SC	22 4	Oct Oct	93a	83ab	83bc	75b	74a	58a
9 Roundup PowerMax 3 Zidua SC	22 5	Oct Oct	96a	86a	87ab	82a	65abc	63a
LSD P=.05			12.2	6.9	6.9	6.2	10.6	6.3
Standard Deviation			10.1	5.7	5.7	5.1	8.8	5.2
CV			14.48	10.57	10.01	10.47	19.73	15.16
Treatment F			57.903	202.837	226.636	211.052	58.700	104.192
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal. All treatments included AMS at 8.5 lb/100gal.

[b]Timings of application were September 24, 2024 and October 28, 2024.

[c]Abbreviations: DAP, days after planting; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

Fall herbicide treatments did not cause visible injury to peas (data not shown). Pea stand count was the least when no herbicide was pplied (untreated) and when only glyphosate was applied. In most cases, pea stand count was similar for the rates and timings of pyroxasulfone application. Pea height was reduced in treatments with poor weed control (especially with poor control of wild oat and cheatgrass). Pea yield was lowest in the untreated control and with a fall application of glyphosate alone. Pea yield was similar for all fall Zidua application rates and timings and was always greater than the untreated control and when only glyphosate was applied in the fall.

Table 2. Evaluation of fall application of metribuzin and pyroxasulfone for crop response in peas.

Treatment[a]	Rate	Stand count 35 DAP	Pea height 51 DAP	Pea yield
	oz/A	plants/A	inches	lb/A
1 Untreated		266081d	10.6c	1443c
2 Roundup PowerMax 3	22	261022d	11.2bc	1601c
3 Roundup PowerMax 3 Zidua SC	22 3	278222bcd	12.2a	2335a
4 Roundup PowerMax 3 Zidua SC	22 4	273163cd	12.2a	2426a
5 Roundup PowerMax 3 Zidua SC	22 5	283280bcd	12.2a	2451a
6 Roundup PowerMax 3	22	261022d	10.9c	1674bc
7 Roundup PowerMax 3 Zidua SC	22 3	321725a	11.7ab	2126a
8 Roundup PowerMax 3 Zidua SC	22 4	301491abc	12.2a	2393a
9 Roundup PowerMax 3 Zidua SC	22 5	309585ab	11.6ab	2089ab
LSD P=.05		12.1	2.0	377.6
Standard Deviation		10.0	1.6	311.6
CV		15.06	5.58	17.37
Treatment F		0.679	6.250	12.940
Treatment Prob(F)		0.7051	0.0002	0.0001

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal. All treatments included AMS at 8.5 lb/100gal.

[b]Timings of application were September 24, 2024 and October 28, 2024.

[c]Abbreviations: DAP, days after planting; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

Table 3. Application environment and equipment for preemergence application of herbicide treatments for weed control in peas.

Application Description			Application equipment	
Date	Sep-24-2024	Oct-28-2024	Equipment Type	Tractor mounted
Start Time	9:21 AM	4:58 PM	Operation Pressure	42 PSI
Stop Time	9:27 AM	5:08 PM	Nozzle Model	11002DG
Air Temperature Start, Stop	65.3, 67.5 F	57.6, 56.9 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	41.7, 45.1	29.6, 31.6	Boom Length	100 IN
Wind Velocity+Dir. Start	6.9 MPH, WNW	5.7 MPH, NW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	7.3 MPH, WNW	5.7 MPH, NW	Ground Speed	4 MPH
Wet Leaves (Y/N)	N, no	N, no	Carrier	WATER
Soil Temperature	43 F	41 F	Application Amount	10 GAL/AC
% Cloud Cover	0	10	Propellant	CO2

Field pea response and weed control with fall application of metribuzin and pyroxasulfone at Hettinger, ND, 2025.

Fall application of the herbicides metribuzin and pyroxasulfone were evaluated for both crop response and weed control in 2025 at Hettinger, ND (see Table 1 for treatments; Table 3 for description of applications). A fall application of glyphosate alone provided poor control of cheatgrass (26%) and addition of metribuzin did not improve cheatgrass control (28 to 32%). Application of glyphosate plus pyroxasulfone (Zidua SC) resulted in 86% control of cheatgrass and the addition of metribuzin only improved cheatgrass control when added at 8 oz/A. Kochia control with pyroxasulfone was 86 and 82% at 23 and 50 days after planting (DAP). Fall application of metribuzin provided similar control of kochia. The combination of pyroxasulfone and metribuzin improved kochia control to 95 and 91% (23 and 50 DAP) when applied at 8 oz/A. Wild buckwheat control with pyroxasulfone was 74 and 50% (23 and 50 DAP). Metribuzin at 4, 6, and 8 oz/A also resulted in poor wild buckwheat control (61 to 69%). Combination of pyroxasulfone and 8 oz/A of metribuzin improved wild buckwheat control to 81%. Wild oat was controlled 86% with pyroxasulfone. Metribuzin did not control wild oat. An application of clethodim (Section 3) was applied to the entire trial after the 23 DAP evaluation to control wild oat and cheatgrass. Prickly lettuce control with pyroxasulfone was poor (45%). Metribuzin improved control to 81 to 85%. Best control was with a combination of pyroxasulfone and 8 oz/A of metribuzin.

Table 1. Evaluation of fall application of metribuzin and pyroxasulfone for weed control in peas.

		Cheatgrass	Kochia		Wild buckwheat		Wild oat	Prickly lettuce
Treatment[a]	Rate	23 DAP	23 DAP	50 DAP	23 DAP	50 DAP	23 DAP	50 DAP
	oz/A	% control						
1 Untreated Control	-	0d	0d	0d	0d	0f	0d	0e
2 Roundup PowerMax3	22	26c	0d	0d	0d	0f	0d	0e
3 Zidua SC Roundup PowerMax3	4 22	86b	86bc	82c	74ab	50e	86a	45d
4 Metribuzin Roundup PowerMax3	4 22	28c	85c	85bc	63c	61d	23c	81c
5 Metribuzin Roundup PowerMax3	6 22	32c	88bc	84c	62c	63d	31bc	84bc
6 Metribuzin Roundup PowerMax3	8 22	29c	89bc	86bc	66bc	69c	33b	85bc
7 Zidua SC Metribuzin Roundup PowerMax3	4 4 22	94ab	91ab	85bc	79a	76ab	89a	83bc
8 Zidua SC Metribuzin Roundup PowerMax3	4 6 22	88ab	90abc	89ab	69bc	73bc	82a	88ab
9 Zidua SC Metribuzin Roundup PowerMax3	4 8 22	95a	95a	91a	81a	80a	88a	95a
LSD P=.05		7.7	5.7	4.7	9.4	6.1	9.8	6.8
Standard Deviation		6.3	4.7	3.9	7.8	5.0	8.1	5.7
CV		11.83	6.85	5.88	14.22	9.64	16.85	9.09
Treatment F		135.968	275.360	374.080	66.401	150.741	89.289	179.924
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal; metribuzin 75%DF. All treatments included AMS at 8.5 lb/100gal.

[b]Abbreviations: DAP, days after planting; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

Fall herbicide treatments did not cause visible injury to peas (data not shown). Pea stand count was not affected by herbicide treatment. Pea height was reduced in treatments with poor weed control (especially with poor control of wild oat and cheatgrass). Pea yield was lowest in the untreated control and with a fall application of glyphosate alone. Pea yield was highest when a combination of pyroxasulfone and metribuzin was applied in the fall.

Table 2. Evaluation of fall application of metribuzin and pyroxasulfone for crop response in peas.

Treatment[a]		Rate	Stand count 37 DAP	Pea height 51 DAP	Pea yield
		oz/A	plants/A	inches	lb/A
1	Untreated Control	-	255000-	10.2e	996d
2	Roundup PowerMax3	22	251000-	10.2de	983d
3	Zidua SC	4	251000-	11.8abc	1925b
	Roundup PowerMax3	22			
4	Metribuzin	4	259000-	11.0cd	1425c
	Roundup PowerMax3	22			
5	Metribuzin	6	275000-	11.4bc	1869b
	Roundup PowerMax3	22			
6	Metribuzin	8	279000-	11.8abc	1842b
	Roundup PowerMax3	22			
7	Zidua SC	4	279000-	12.2ab	2352a
	Metribuzin	4			
	Roundup PowerMax3	22			
8	Zidua SC	4	279000-	12.2a	2380a
	Metribuzin	6			
	Roundup PowerMax3	22			
9	Zidua SC	4	299000-	12.2a	2433a
	Metribuzin	8			
	Roundup PowerMax3	22			
LSD P=.05			12.1	2.0	377.6
Standard Deviation			10.0	1.6	311.6
CV			15.06	5.58	17.37
Treatment F			0.679	6.250	12.940
Treatment Prob(F)			0.7051	0.0002	0.0001

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal; metribuzin 75%DF. All treatments included AMS at 8.5 lb/100gal.

Table 3. Application environment and equipment for preemergence application of herbicide treatments for weed control in peas.

Application Description		Application equipment	
Date	Nov-4-2024	Equipment Type	Tractor mounted
Start Time	2:39 PM	Operation Pressure	42 PSI
Stop Time	3:02 PM	Nozzle Model	11002DG
Air Temperature Start, Stop	50, 50 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	37, 37	Boom Length	100 IN
Wind Velocity+Dir. Start	6 MPH, WSW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	15 MPH, SW	Ground Speed	4 MPH
Soil Temperature	40 F	Carrier	WATER
% Cloud Cover	10	Application Amount	10 GAL/AC

Metribuzin and Sulfentrazone for Preemergence Weed Control in Field Pea at Hettinger, ND, 2025.

A trial was conducted to evaluated the use of metribuzin and sulfentrazone for weed control and for tolerance in field pea. Field pea were planted on May 7, 2025 and herbicide treatments were applied on May 9. Field pea emerged on May 19. Rainfall measuring 4.17 inches fell during the time between planting and pea emergence. Kochia, wild buckwheat, and common mallow were evaluated for weed control 32 and 49 days after treatment (DAT). Kochia control was above 90% with all herbicide treatments 32 DAT, but tended to increase with herbicide rate, especially for combinations of metribuzin and sulfentrazone. At 49 DAT, 4oz/A of metribuzin resulted in 87% control of kochia, which was the lowest level of control observed. The highest level of control was with the combination of metribuzin (8 oz/A) and sulfentrazone (6.75 lb/A). This combination also resulted in the best control of wild buckwheat and common mallow.

Table 1. Evaluation of weed control from preemergence application of metribuzin and sulfentrazone in field pea.

Treatment[a]	Rate	Kochia		Wild buckwheat		Common mallow	
		32 DAT	49 DAT	32 DAT	49 DAT	32 DAT	49 DAT
	oz/A	% control					
1 Untreated		0d	0e	0i	0e	0h	0g
2 Metribuzin	4	93bc	87d	83h	68d	79g	65f
3 Metribuzin	6	96abc	88d	89fg	73d	87ef	75e
4 Metribuzin	8	97abc	90bcd	92de	84c	91cde	84d
5 Spartan	3.75	93abc	90cd	86gh	71d	85f	72e
6 Spartan	5.25	91c	88d	91ef	81c	88def	76e
7 Spartan	6.75	96abc	90cd	98abc	83c	87f	83d
8 Metribuzin Spartan	4 3.75	99a	94a-d	95bcd	83c	87ef	82d
9 Metribuzin Spartan	4 5.25	95abc	90cd	94cde	86bc	92bcd	85cd
10 Metribuzin Spartan	4 6.75	97abc	97abc	96abc	92ab	96ab	90bc
11 Metribuzin Spartan	6 3.75	98ab	94a-d	95bcd	83c	96abc	85cd
12 Metribuzin Spartan	6 5.25	94abc	96abc	99a	93ab	96ab	91b
13 Metribuzin Spartan	6 6.75	96abc	92a-d	97abc	92ab	99a	94ab
14 Metribuzin Spartan	8 3.75	97ab	98ab	96abc	86bc	96ab	91b
15 Metribuzin Spartan	8 5.25	95abc	98ab	97abc	93a	96ab	93ab
16 Metribuzin Spartan	8 6.75	99a	99a	98ab	96a	99a	98a
LSD P=.05		5.8	8.2	3.4	6.6	4.5	4.8
Standard Deviation		4.9	6.9	2.8	5.5	3.8	4.0
CV		14.48	5.49	7.97	7.02	4.42	5.13
Treatment F		20.413	95.227	46.089	66.549	154.570	126.843
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[a]Metribuzin, 75% DF; Spartan, sulfentrazone 4lbai/gal. All treatments included AMS at 8.5 lb/100gal.

[c]Abbreviations: DAT, days after treatment; lbai/gal, pounds active ingredient per gallon.

Field pea injury was less than 10% for all herbicide treatments. Pea stand count was the least in the untreated control (likely due to weed interference. There was no consistent response of field pea stand to the herbicides applied. There was no difference in field pea height when measured 48 DAT. There was no difference in field pea yield with yields ranging from 2594 to 3067 lb/A.

Table 2. Evaluation of field pea tolerance to preemergence application of metribuzin and sulfentrazone.

Treatment[a]	Rate	Injury 32 DAT	Stand count 33 DAT	Pea height 48 DAT	Pea yield
	oz/A	%	plants/A	inches	lb/A
1 Untreated		0c	278,000g	11.9-	2594-
2 Metribuzin	4	0c	338,000abc	11.9-	2693-
3 Metribuzin	6	0c	340,000abc	12.1-	2784-
4 Metribuzin	8	0c	317,000a-f	12.2-	2900-
5 Spartan	3.75	0c	289,000efg	11.8-	2760-
6 Spartan	5.25	0c	352,000a	11.8-	2866-
7 Spartan	6.75	0c	331,000a-d	11.6-	2885-
8 Metribuzin Spartan	4 3.75	0c	305,000c-g	11.6-	2735-
9 Metribuzin Spartan	4 5.25	0c	280,000fg	11.9-	2737-
10 Metribuzin Spartan	4 6.75	0c	318,000a-f	11.8-	2899-
11 Metribuzin Spartan	6 3.75	0c			
12 Metribuzin Spartan	6 5.25	0c	334,000a-d	12.1-	3067-
13 Metribuzin Spartan	6 6.75	1c	351,000ab	11.6-	2986-
14 Metribuzin Spartan	8 3.75	4b			
15 Metribuzin Spartan	8 5.25	3b	298,000d-g	12.1-	2985-
16 Metribuzin Spartan	8 6.75	9a	314,000b-g	11.5-	2803-
LSD P=.05		1.3	37433.9	0.53	283.9
Standard Deviation		1.1	31522.4	0.44	239.1
CV		99.78	9.92	3.75	8.45
Treatment F		20.413	2.138	1.178	1.051
Treatment Prob(F)		0.0001	0.0252	0.3228	0.4252

[a]Metribuzin, 75% DF; Spartan, sulfentrazone 4lbai/gal. All treatments included AMS at 8.5 lb/100gal.

[c]Abbreviations: DAT, days after treatment; lbai/gal, pounds active ingredient per gallon.

Table 3. Application environment and equipment for preemergence application in peas.

Application Description		Application equipment	
Date	May-9-2025	Equipment Type	Tractor mounted
Start, Stop Time	2:48, 3:30 PM	Operation Pressure	42 PSI
Air Temperature Start, Stop	82.2, 77.4 F	Nozzle Model	11002DG
% Relative Humidity Start, Stop	24.9, 24.1	Nozzle Spacing	20 IN
Wind Velocity+Dir.	5.1 MPH, WNW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	13.0 MPH, WNW	Ground Speed	4 MPH
Soil Temperature	43 F	Application Amount	10 GAL/AC

Weed control and soybean response to preemergence application of metribuzin and sulfentrazone at Hettinger, ND, 2025.

Two trials were conducted to evaluate weed control and soybean tolerance soybean following preemergence application of metribuzin and sulfentrazone (Spartan). Soybean were planted on June 3. Prior to planting the field was treated with paraquat (Gramoxone) to control weeds that were present prior to planting. In one trial, weeds were allowed to grow following herbicide application to determine levels of weed control. In order to determine yield, an application of glufosinate (Liberty) was applied following the final weed control evaluation (57 days after treatment). In the other trial, soybean were maintained weed free through postemergence application of glyphosate and glufosinate and the objectives were to determine soybean tolerance. Two soybean varieties were evaluated. Preemergence herbicide treatments were applied on June 4 (see Table 1 for herbicide treatments and Table 3 for a description of application). In the week following application there was 0.2 inches of rainfall. Weed control was evaluated 37 and 57 days after treatment (DAT). Control of kochia, wild buckwheat, common lambsquarters, and common mallow were greatest (87 to 90%, 57 DAT, with the tank mix of metribuzin at 10.7 oz/A and sulfentrazone at 8 oz/A. Metribuzin alone resulted in 72 to 82% control of these weeds at 57 DAT. Sulfentrazone alone resulted in 72 to 92% control of these weeds. Kochia control was similar (81 to 92%) for all combinations of metribuzin and sulfentrazone as well as the 8oz/A rate of sulfentrazone (83%). Kochia control with metribuzin alone (73 to 75%) and sulfentrazone at the 4 oz/A rate (75%) was less than the tank-mixes of these herbicides.

Table 1. Evaluation of fall application of metribuzin and pyroxasulfone for weed control in peas.

			Kochia		Wild buckwheat		Common lambsquarters		Common Mallow	
	Treatment[a]	Rate	37 DAT	57 DAT	37 DAT	57 DAT	37 DAT	57 DAT	37 DAT	57 DAT
		oz/A	% control							
1	Untreated		0e	0c	0e	0e	0d	0e	0f	0d
2	Metribuzin	5.3	85bc	73b	78d	70d	75c	70d	75e	67c
3	Metribuzin	10.7	75cd	75b	76d	76c	84b	82c	81cd	80b
4	Spartan	4	69d	75b	82c	82b	98a	86bc	79d	72c
5	Spartan	8	93ab	83ab	85bc	88a	96a	92a	84c	80b
6	Metribuzin Spartan	5.3 4	90ab	81ab	83bc	84b	92a	86bc	83c	77b
7	Metribuzin Spartan	10.7 4	98ab	92a	86b	84b	97a	89ab	87b	81b
8	Metribuzin Spartan	5.3 8	94ab	91a	87ab	89a	98a	94a	87b	82ab
9	Metribuzin Spartan	10.7 8	99a	92a	90a	92a	95a	92a	90a	87a
LSD P=.05			8.9	9.4	3.9	3.9	6.8	5.3	2.5	4.8
Standard Deviation			6.7	6.9	3.2	3.2	5.6	4.4	2.1	4.0
CV			9.61	10.97	4.38	4.34	6.88	5.76	2.83	5.72
Treatment F			72.121	55.169	300.992	316.772	125.942	180.136	719.954	180.457
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal; metribuzin 75%DF. All treatments included AMS at 8.5 lb/100gal.

[b]Abbreviations: DAT, days after treatment; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

There were no differences in stand count (19 DAT) or soybean height (51 DAT) in either soybean variety. Soybean yield in the weedy trial was greatest in treatments where weed control was highest (combinations of metribuzin and sulfentrazone). Soybean yield in the untreated control was reduced by more than 50%. In the weed free trial, soybean yield following herbicide treatments was equal to or greater than yield in the weed free control. This trial showed that soybean were tolerant to metribuzin and sulfentrazone rates that were applied. The soil at this location is a silty clay loam with greater than 3% organic matter and a pH of around 5.6. Soybean tolerance to metribuzin can be influenced by soil conditions, with higher injury potential to soybean in sandy soils, or soils with high pH and low organic matter.

Table 2. Evaluation of fall application of metribuzin and pyroxasulfone for crop response in peas.

						Soybean yield			
		Stand count		Soybean height		Weedy		Weed free	
Treatment[a]	Rate	AG07XF2	AG07XF4	AG07XF2	AG07XF4	AG07XF2	AG07XF4	AG07XF2	AG07XF4
	oz/A	Plants/A		IN		BU/A			
1 Weed Free		100264-	108232-	12-	11-	13.8f	12.9f	27.2-	24.8cd
2 Metribuzin	5.3	101592-	108232-	12-	11-	18.1e	17.6e	27.8-	28.6ab
3 Metribuzin	10.7	101592-	114872-	12-	11-	21.1cde	21.9cd	31.6-	27.0bc
4 Spartan	4	105576-	112216-	13-	12-	19.4de	20.5de	28.0-	27.3abc
5 Spartan	8	108896-	110224-	13-	11-	22.8c	22.0cd	27.1-	30.6a
6 Metribuzin Spartan	5.3 4	100928-	107568-	12-	11-	21.7cd	25.3bc	27.4-	21.6d
7 Metribuzin Spartan	10.7 4	106240-	110224-	12-	12-	23.7bc	22.2cd	33.0-	24.4cd
8 Metribuzin Spartan	5.3 8	95616-	103584-	12-	11-	26.5ab	30.4a	26.7-	24.7cd
9 Metribuzin Spartan	10.7 8	97608-	109560-	13-	12-	27.4a	29.2ab	30.4-	24.6cd
LSD P=.05		9978.2	9879.5	0.9	0.8	3.14	4.12	4.95	3.55
Standard Deviation		8247.9	8166.4	0.8	0.7	2.60	3.41	4.09	2.94
CV		8.08	7.46	6.17	5.69	12.0	15.2	14.22	11.32
Treatment F		1.050	0.594	1.186	0.973	10.522	10.161	1.252	3.339
Treatment Prob(F)		0.4284	0.7736	0.3479	0.4797	0.0001	0.0001	0.3132	0.0104

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal; metribuzin 75%DF. All treatments included AMS at 8.5 lb/100gal.

[b]Abbreviations: DAT, days after treatment; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

Table 3. Application environment and equipment for preemergence herbicide application in soybean.

Application Description		Application equipment	
Date	Jun-4-2025	Equipment Type	Tractor mounted
Start, Stop Time	2:39, 3:05 PM	Operation Pressure	42 PSI
Air Temperature Start, Stop	71.1, 66.4 F	Nozzle Model	11002DG
% Relative Humidity Start, Stop	32.2, 40.2	Nozzle Spacing	20 IN
Wind Velocity+Dir. Start	1.7 MPH, SSW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	12.7 MPH, WNW	Ground Speed	4 MPH
Soil Temperature	57 F	Carrier	WATER
% Cloud Cover	10	Application Amount	10 GAL/AC

Timing of Fall Application of Pyroxasulfone for Weed Control in Spring Wheat at Hettinger, ND, 2025.

Timing and rate of fall application of pyroxasulfone was evaluated for weed control in spring wheat at Hettinger, ND (see Table 1 for treatments; Table 2 for description of applications). A fall application of glyphosate alone provided poor to fair control of cheatgrass (68-78%). Application of glyphosate plus pyroxasulfone (Zidua SC) resulted in 93-99% control of cheatgrass and there was no difference between rate or timing. At 35 days after planting (DAP) Wild oat control with pyroxasulfone ranged from 87 to 96% and was generally similar when comparing rates and timing of application. Prior to harvest, at 102 DAP, wild oat control ranged from 76 to 88%. At 35 DAP, kochia control ranged from 71 to 84%, and control was similar in most cases when comparing rates and timings. At 102 DAP, kochia control was higher in most cases when applications were made in September than in October. Wheat yield was reduced only when no herbicide was applied or when glyphosate was applied alone in the fall. Application of Zidua in the fall improved spring wheat yield by nearly two times. It is generally recommended to apply herbicides for residual weed control in the fall after soil temperatures have fallen to 40 to 50 F. While average soil temperature was greater at the September application timing, the lack of rainfall after this earlier application was likely responsible for results being similar to the later application timing. In years with greater fall rainfall, weed control would likely be reduced at the earlier application timing due to increased degradation of the herbicide in the fall.

Table 1. Evaluation of timing and rate for fall application of pyroxasulfone for weed control in field peas.

Treatment[a]	Rate	Timing[b]	Cheatgrass 35 DAP	Wild oat 35 DAP	Wild oat 102 DAP	Kochia 35 DAP	Kochia 102 DAP	Wheat yield
	oz/A		% control					BU/A
1 Untreated			0d	0c	0c	0c	0e	22.2 b
2 Roundup PowerMax 3	22	Sept	78b	0c	0c	0c	0e	27.7 b
3 Roundup PowerMax 3 Zidua SC	22 3	Sept Sept	93a	89ab	87ab	77ab	71ab	50.4 a
4 Roundup PowerMax 3 Zidua SC	22 4	Sept Sept	96a	87b	84ab	77ab	79a	44.4 a
5 Roundup PowerMax 3 Zidua SC	22 5	Sept Sept	96a	96a	88a	84a	78a	46.8 a
6 Roundup PowerMax 3	22	Oct	68c	0c	0c	0c	0e	21.2 b
7 Roundup PowerMax 3 Zidua SC	22 3	Oct Oct	98a	89ab	76b	71b	62c	44.2 a
8 Roundup PowerMax 3 Zidua SC	22 4	Oct Oct	97a	93ab	82ab	71b	50d	42.7 a
9 Roundup PowerMax 3 Zidua SC	22 5	Oct Oct	99a	95ab	80ab	78ab	67bc	44.8 a
LSD P=.05			7.8	7.3	8.7	8.1	8.1	10.70
Standard Deviation			6.4	6.0	7.1	6.7	6.7	8.83
CV			8.0	9.97	13.35	13.46	15.14	23.27
Treatment F			99.134	230.648	130.718	127.266	106.132	6.302
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0002

[a]Roundup PowerMax3, glyphosate 4.8 lbae/gal; Zidua SC, pyroxasulfone 4.17 lbai/gal. All treatments included AMS at 8.5 lb/100gal.

[b]Timings of application were September 24, 2024 and October 28, 2024.

[c]Abbreviations: DAP, days after planting; lbae/gal, pounds acid equivalent per gallon; lbai/gal, pounds active ingredient per gallon.

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

Application Description			Application equipment	
Date	Sep-24-2024	Oct-28-2024	Equipment Type	Tractor mounted
Start Time	9:21 AM	5:12 PM	Operation Pressure	42 PSI
Stop Time	9:27 AM	5:21 PM	Nozzle Model	11002DG
Air Temperature Start, Stop	65.3, 67.5 F	56.9, 55.1 F	Nozzle Spacing	20 IN
% Relative Humidity Start, Stop	41.7, 45.1	31.7, 33.5	Boom Length	100 IN
Wind Velocity+Dir. Start	6.9 MPH, WNW	5.3 MPH, NW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	7.3 MPH, WNW	5.7 MPH, NW	Ground Speed	4 MPH
Wet Leaves (Y/N)	No	No	Carrier	WATER
Soil Temperature	43 F	40 F	Application Amount	10 GAL/AC
% Cloud Cover	0	10	Propellant	CO2

Kochia Control in Spring Wheat with Postemergence Herbicides at Hettinger, ND, 2025.

A trial was conducted to evaluate postemergence herbicides for control of kochia and other weeds in spring wheat. Spring wheat was planted on May 5. Herbicide treatments were applied on June 18 when wheat was 14 inches in height (see Table 1 for treatments and Table 2 for description of application). At time of application, kochia averaged 4 inches in height and was found at a density averaging 15 kochia per square foot. Other weeds present included common lambsquarters (2.1 in) and green foxtail (3.1 in). Kochia control was 65% 30 days after treatment (DAT) with fluroxypyr alone (Starane Ultra), the addition of bromoxynil increased kochia control to 73, 80, and 85% with increasing rates of bromoxynil (Maestro 2 EC). Kochia control was 87 to 93% with premixes Huskie FX, Huskie Complete, Talinor, and Tolvera. The premix Carnivore and Bison resulted in the lowest kochia control (76 to 82%). The addition of fluroxypyr to Bison increased kochia control to 88 to 90%. Fluroxypyr alone provided poor control of common lambsquarters. All other treatments resulted in 89 to 100% control. Foxtail control was 89% with Tolvera. Huskie FX, Huskie Complete, and Talinor provided some control of green foxtail. Wheat yield was similar for all herbicide treatments. While there was no yield increase, uncontrolled weeds increase soil seed bank levels and could be more troublesome in rotational crops.

Table 1. Evaluation of postemergence herbicides for weed control in spring wheat.

Treatment[a]	Rate	Kochia		Common lambsquarters	Green foxtail	Wheat yield
		15 DAT	30 DAT	15 DAT	15 DAT	69 DAT
	oz/A	% control				Bu/A
1 Untreated		0h	0i	0f	0e	69.7-
2 Starane Ultra	5.6	62g	65h	31e	0e	61.9-
3 Starane Ultra	5.6	73f	79fg	89c	0e	63.4-
Maestro 2EC	16					
4 Starane Ultra	5.6	80d	84c-f	97ab	0e	59.9-
Maestro 2EC	24					
5 Starane Ultra	5.6	85abc	91ab	99a	0e	63.5-
Maestro 2EC	32					
6 Huskie FX	13.5	90a	93a	98ab	54d	64.0-
7 Huskie Complete	13.7	88a	91ab	99a	78b	68.2-
8 Talinor	13.7	81cd	87bcd	94b	65c	64.0-
9 Tolvera	11	87ab	87bcd	100a	89a	63.2-
10 Carnivore	16	74ef	76g	96ab	0e	58.5-
11 Carnivore	24	79d	82d-g	98a	0e	62.0-
12 Bison	24	78de	79efg	97ab	0e	64.9-
13 Bison	24	83bcd	88abc	98ab	0e	62.5-
Starane Ultra	2.8					
14 Bison	24	82bcd	90abc	98ab	0e	57.4-
Starane Ultra	5.6					
LSD P=.05		5.2	5.8	4.6	5.4	8.38
Standard Deviation		4.4	4.9	3.9	4.5	7.04
CV		5.84	6.21	4.63	22.28	11.18
Treatment F		99.848	88.194	229.265	227.492	0.814
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.6502

[a]Starane Ultra, fluroxypyr (2.8 lbae/gal), Maestro 2 EC, bromoxynil (2 lbai/gal); Huskie FX, bromoxynil + pyrasulfotole + fluroxypyr (2.3 lbai/gal); Huskie Complete, bromoxynil + pyrasulfotole + thiencarbazone), Talinor, bicyclopyrone + bromoxynil (1.77 lbai/gal); Tolvera, tolpyralate + bromoxynil (1.71 lbai/gal); Carnivor, MCPA + fluroxypyr + bromoxynil (4.01 lbae/gal); Bison, MCPA + bromoxynil (4 lbae/gal).
[b]Abbreviations: DAT, days after treatment; lbai/gal, pounds active ingredient per gallon.

Table 2. Application environment and equipment for postemergence weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-18-2025	Equipment Type	Tractor mounted
Start, Stop Time	11:02, 11:48 AM	Operation Pressure	40 PSI
Air Temperature Start, Stop	76.6, 77.2 F	Nozzle Model	11002DG
% Relative Humidity Start, Stop	46.8, 46.4	Nozzle Spacing	20 IN
Wind Velocity+Dir.	4 MPH, WSW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	8.5 MPH, SSW	Ground Speed	4.1 MPH
Soil Temperature	53 F	Application Amount	10 GAL/AC

Postemergence Weed Control in Spring Wheat with Vios FX Herbicide tank-mixes at Hettinger, ND, 2025.

A trial was conducted to evaluate Vios FX Herbicide tank-mixes for postemergence for weed control in spring wheat. Spring wheat was planted on May 5, 2025. Herbicide treatments were applied on June 18 when wheat was in early tillering stage and 14 inches in height (see Table 1 for treatments and Table 2 for description of application). At time of application, kochia averaged 3.8 inches in height. Other weeds present included green foxtail (3.4 in), and wild oat (6.6 in). Kochia control with Vios FX alone was 75% at 15 days after treatment (DAT) and 87% 30 DAT. Addition of other herbicides as tank-mixes did not improve kochia control 30 DAT. Green foxtail control with Vios FX was 89% 30 DAT. Addition of other herbicides did not improve green foxtail control and in some cases, foxtail control was reduced when other herbicides were tank-mixed. Wild oat control with Vios FX was 86% 30 DAT. Similar to other weeds, there was no improvement in wild oat control when other herbicides were tank-mixed. Wheat yield was similar for all herbicide treatments. While there was no yield increase, uncontrolled weeds increase soil seed bank levels and could be more troublesome in rotational crops.

Table 1. Evaluation of postemergence herbicides for weed control in spring wheat.

Treatment[a]	Rate	Kochia 15 DAT	Kochia 30 DAT	Green foxtail 15 DAT	Green foxtail 30 DAT	Wild oat 30 DAT	Wheat yield 69 DAT
	oz/A	% control					Bu/A
1 Non-Treated		0d	0d	0d	0d	0c	61.8-
2 Vios FX Herbicide	13.7	75c	87a	79bc	89a	86a	55.5-
3 Vios FX Herbicide Huskie	13.7 12.8	85a	87a	82ab	84b	82ab	55.7-
4 Vios FX Herbicide Bison	13.7 16	85a	87a	82a	84b	82ab	54.4-
5 Vios FX Herbicide 2,4-D Ester	13.7 8	79b	80c	81abc	83bc	79b	59.3-
6 Vios FX Herbicide Quelex Affinity Broadspec	13.7 0.75 0.4	80b	85ab	80abc	84b	83ab	61.0-
7 Vios FX Herbicide Affinity Broadspec MCPA Ester	13.7 0.4 8	79b	79c	80abc	83bc	80b	56.0 -
8 Vios FX Herbicide Affinity Broadspec 2,4-D Ester	13.7 0.4 8	80b	82bc	78c	79c	82ab	55.6 -
LSD P=.05		3.9	4.3	2.8	4.2	4.6	4.95
Standard Deviation		3.2	3.5	2.3	3.4	3.8	4.07
CV		4.61	4.8	3.28	4.66	5.28	7.09
Treatment F		311.667	286.452	607.414	303.776	235.488	1.987
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.1056

[a] Vios FX, thiencarbazone + fluroxypyr (1.02 lbai/gal); Huskie, bromoxynil + pyrasulfotole (2.06 lbai/gal); Bison, MCPA + bromoxynil (4 lbae/gal); 2,4-D ester (4 lbae/gal); Quelex, halauxifen + florasulam (0.2% WDG); Affinity Broadspec (50% WDG); MCPA (4 lbae/gal)

[b]Abbreviations: DAT, days after treatment; lbai/gal, pounds active ingredient per gallon; lbae/gal, pounds acid equivalent per acre.

Table 2. Application environment and equipment for postemergence weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-18-2025	Equipment Type	Tractor mounted
Start, Stop Time	2:05, 2:22 PM	Operation Pressure	40 PSI
Air Temperature Start, Stop	81, 81.6 F	Nozzle Model	11002DG
% Relative Humidity Start, Stop	35.9, 38.4	Nozzle Spacing	20 IN
Wind Velocity+Dir.	5.2 MPH, WSW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	8.2 MPH, WSW	Ground Speed	4.1 MPH
Soil Temperature	60 F	Application Amount	10 GAL/AC

Postemergence Weed Control in Spring Wheat at Hettinger, ND, 2025.

A trial was conducted to evaluate postemergence herbicides for weed control in spring wheat. Spring wheat was planted on May 5, 2025. Herbicide treatments were applied on June 18 when wheat was in early tillering stage and 14 inches in height (see Table 1 for treatments and Table 2 for description of application). At time of application, kochia averaged 2.2 inches in height and was found at a density averaging 53 kochia per square foot. Other weeds present included green foxtail (2.2 in), and tame buckwheat (3.4 in). Kochia control with Huskie FX at 15.5 and 18 oz/A was 82 and 87%, respectively, 30 days after treatment (DAT). Kochia control with Tolvera (85% at 30 DAT) was similar to Huskie FX. Green foxtail control was poor in all treatments except Tolvera (94% at 30 DAT). Tame buckwheat control was 85 to 90% with all treatments except Talinor (68%) and Tolvera (79%). Wheat yield was similar for all herbicide treatments. While there was no yield increase, uncontrolled weeds increase soil seed bank levels and could be more troublesome in rotational crops.

Table 1. Evaluation of postemergence herbicides for weed control in spring wheat.

Treatment[a]	Rate	Kochia		Green foxtail		Tame buckwheat	Wheat yield
		15 DAT	30 DAT	15 DAT	30 DAT	15 DAT	69 DAT
	oz/A	% control					Bu/A
1 Non-Treated		0e	0e	0d	0e	0d	32.6-
2 Huskie FX	15.5	82b	82bc	44b	39c	90a	37.1-
3 Huskie FX	18	87a	87a	44b	39c	90a	39.0-
4 WideARmatch	14	79c	75d	49b	43bc	86a	40.8-
MCPA Ester	8						
5 Talinor	13.7	70d	75d	51b	51b	68c	34.4-
6 Bison	16	82b	81c	24c	21d	85a	38.1-
Starane Ultra	4.8						
7 Tolvera	11	86a	85ab	89a	94a	79b	35.7-
LSD P=.05		2.3	3.7	8.4	9.2	5.9	6.27
Standard Deviation		1.9	3.0	6.8	7.5	4.9	5.11
CV		2.71	4.36	15.95	18.37	6.84	13.9
Treatment F		1093.261	419.197	63.187	58.708	176.628	1.195
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.3530

[a] Huskie FX, bromoxynil + pyrasulfotole + fluroxypyr (2.3 lbai/gal); WideARmatch, clopyralid + haulauxifen + fluroxypyr (1.88 lbai/gal); MCPA (4 lbae/gal); Talinor, bicyclopyrone + bromoxynil (1.77 lbai/gal); Bison, MCPA + bromoxynil (4 lbae/gal); Starane Ultra, fluroxypyr (2.8 lbae/gal), Tolvera, tolpyralate + bromoxynil (1.71 lbai/gal).
[b]Abbreviations: DAT, days after treatment; lbai/gal, pounds active ingredient per gallon.

Table 2. Application environment and equipment for postemergence weed control in spring wheat.

Application Description		Application equipment	
Date	Jun-18-2025	Equipment Type	Tractor mounted
Start, Stop Time	2:27, 2:36 PM	Operation Pressure	40 PSI
Air Temperature Start, Stop	79.8, 83 F	Nozzle Model	11002DG
% Relative Humidity Start, Stop	35.2, 40	Nozzle Spacing	20 IN
Wind Velocity+Dir.	5.9 MPH, WSW	Boom Height	22.0 IN
Wind Velocity+Dir. Max	6.9 MPH, WSW	Ground Speed	4.1 MPH
Soil Temperature	60 F	Application Amount	10 GAL/AC

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