Carrington Research Extension Center

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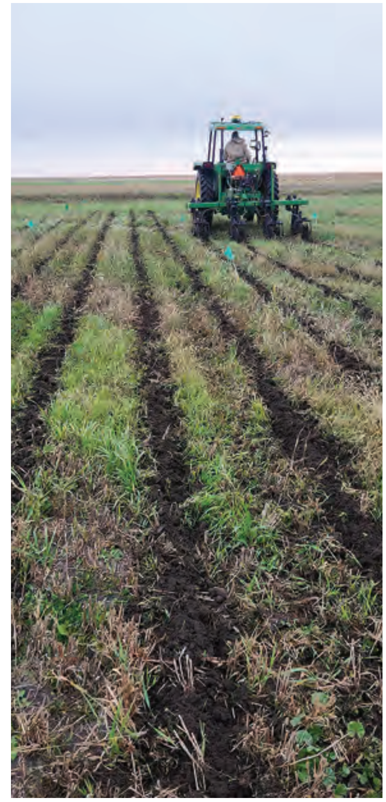

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Carrington Research Extension Center Mission

- **Research programs** in Agronomy, Livestock, Organic Agriculture, Plant Pathology, Precision Agriculture, Soil Science, and Horticulture serving needs of local communities with priorities identified by our 13-county Advisory Board.
- **Extension programs** in Agronomy, Livestock, Precision Agriculture, and Livestock Environmental Management serving statewide to promote unbiased best management practices.
- **Locations** near Carrington, Oakes, Dazey, Wishek, and Fingal so that testing occurs in a wider region.
- **Experiments** are conducted in dryland, irrigated, and/or organic environments to represent growing conditions relevant to producer operations.
- **Foundation Seed** production for spring wheat, barley, durum, field pea, soybean, flax, and winter rye to increase seed availability of the best varieties.
- **Providing local data** and best management practices since 1960.

Carrington Research Extension Center Impacts and Engagements

Feeding Cattle to Finish in North Dakota

- A demonstration feedout project showed that feeding cattle to finish averaged $905 per head additional profit. The 112 head of cattle fed in this project created $101,450 additional revenue. Feeding only 25% of North Dakota calves born each year could have resulted in $142 million additional return above expenses in 2025.
- Cattle feeding returns can be quite variable and are addressed at the annual NDSU Feedlot School and Backgrounding Seminars. Pre- and post-evaluations showed producers' knowledge of cattle feeding was increased by 60% from attending Feedlot School. The backgrounding cattle seminars reached over 3,400 viewers.
- The Dakota Feeder Calf Show is a feedout project to help North Dakota producers identify cattle with superior growth and carcass characteristics. The average difference in profitability between consignments from the top five herds and the bottom five herds was $376.95 per head for the 2024-2025 feeding period. The carcass-value variability among producers' herds is substantial.

Research Near You

- Analytics from a QR code implemented for site and trial layout at two off-station research sites in Tri County (Wishek) and Dazey demonstrate that stakeholders are actively seeking site information. Thirteen new users loaded the Tri County site during the plot tour, with seven new users added after the tour. The site was loaded 218 times during the season. Eleven new users loaded the Dazey site during the plot tour and season total traffic was 90 visits.
- Partnership with producers in the Tri County region (Logan, McIntosh, and Emmons counties) focused the research effort at the site. By producer request, an intercropping trial, a durum variety trial, a flax variety trial, and additional dry bean market classes were added to the site in 2025. For the past two years producers filled out a survey to indicate which wheat varieties they wanted included in the hard red spring wheat variety trial, increasing the number of varieties from 37 in 2023 to 46 in 2025, the maximum number. The NDSU team presented to about 30 local stakeholders in July.

- Partnered with Agassiz Seed to showcase prevent plant options targeting forage producers. Twelve different mixes were planted for demonstration at our Fingal plot research site. The plot tour was attended by 25 stakeholders, and the advantages and disadvantages of each mix were discussed.

Disaster Training Workshops were a Success in 2025

- NDSU Extension trained 65 professionals in 2024 to safely respond to an animal disease outbreak or mass livestock mortality. Six-month follow-up evaluation data collected in 2025 indicated that 92% of respondents (25) felt their community was better prepared for and able to respond to an animal disease or mass livestock mortality. Since the training, 12% of participants have responded to an animal mortality, 100% of whom felt they were better equipped to respond due to the training.
- In September 2025, the North Dakota Extension Disaster Education Network (ND EDEN) hosted a table-top training for NDSU Extension, county emergency managers, and other disaster responders with 35 participants. The post-event evaluations indicated that 97% of respondents increased their confidence and ability to provide support to the communities they serve during a disaster. Additionally, 82% of respondents formed relationships with other professionals involved in disaster response within their communities. Respondents (94%) intended to make changes following the training to be better prepared to respond to disasters.

Producers in northeast Montana and northwest North Dakota have shifted from planting spring wheat first to planting peas and lentils first. This shift was made in response to multi-year, multi-location research led by the NDSU Carrington REC and conducted in collaboration with the NDSU Williston REC that demonstrated that yield losses to Aphanomyces root rot are reduced when field peas and lentils are seeded when soil temperatures average approximately 42 to 50° F in the first seven days after planting.

Split nitrogen applications were explored with three urea-based enhanced efficiency fertilizers (EEF). Split application did not result in any yield increase for any product, but a 60:40 split was associated with significantly higher grain protein compared to when all the nitrogen was applied at-planting. In the case of urea alone, protein increased by 1.2%. In comparison, when enhanced efficiency products were used, this difference was only 0.5%. EEFs outperformed plain urea when all the nitrogen was applied as starter, indicating that nitrogen from fertilizer was available for longer during the season. If the current wet weather pattern continues, mid-season applications could be profitable in locations where it was not feasible in the past.

From the inception of the long-term Cropping Systems Study in 1987 through the end of the 2022 growing season (cycle 9), the no-till treatment soil organic matter has increased half a percentage point from 3.3% to 3.9%. Concurrently, in the no-till treatment with composted beef feedlot manure (200 lbs of N applied once every four years), soil organic matter has increased a full percentage point from 3.3% to 4.3%. This demonstrates how changes to production practices can improve soil health over time.

The Organic Cropping Systems Program held an organic tour during the CREC Field Day engaging 38 farmers in hands-on learning about soil health, compost and manure use, and regenerative practices, supported by the mobile soil health lab and partnerships with organic nonprofit organizations. Through applied research, innovative system design, and direct collaboration with producers, the program helps organic farms adopt practices that enhance soil health, improve crop performance, and advance the long-term success of organic agriculture in the region.

Inexpensive fungicide tank-mixes with chlorothalonil have been widely adopted in North Dakota and Montana in response to multi-year, multi-location research led by the NDSU Carrington REC and conducted in collaboration with the Williston REC. Research demonstrated that Ascochyta management in chickpeas is sharply improved when locally systemic fungicides are tank-mixed with the contact fungicide chlorothalonil.

Two commercially available biological products were tested in spring wheat for the second year in Carrington and Minot, in an effort to provide farmers with independent product testing. Significant yield increase was observed in one of the four site-years. Grain proteins were not affected. This provides further evidence of the environmental influence on efficacy of biological products.

The CREC manages the annual Crop Management Field School and assists with the Junior Crop Scout School for youth. Forty people participated in this year's Crop Management Field School. The topics covered this year included soybean disease management, soil health management, herbicide site of action, and weed identification. Of the 32 participants completing the meeting survey, greater than 89% of participants reported all topics were good to excellent. Based on a before and after survey, youth's overall knowledge improved 31% after the Junior Crop Scout School.

A spray droplet size trial was conducted at CREC in 2025 using TeeJet and Wilger nozzles and a sprayer travel speed trial applying Liberty Ultra and tank-mixes to soybean. A medium spray droplet size provided 87% Powell amaranth control, and the ultra-coarse spray droplet size only provided 55% Powell amaranth control. When Enlist One was mixed with Liberty Ultra, Powell amaranth control was always greater than 84% across nozzle type and regardless of spray droplet size. In the sprayer travel speed trial, Powell amaranth control was reduced 13% when traveling greater than nine miles per hour.

New initiatives are expanding options for winter crops in North Dakota to aid crop diversity and provide economic alternatives. Efforts include breeding nurseries for hairy vetch, winter pea, and pennycress, as well as research on winter canola, winter pea, and camelina to determine optimal fall planting windows and identify cold-tolerant or high yielding varieties.

The new Oakes Irrigation Research Site building was the host for the 2025 North Dakota Water Management Tour, organized by North Dakota Water Users Association on July 15. The theme was "Innovative Irrigation in Oakes." Approximately 70 producers, researchers and stakeholders participated.

Crop disease management sessions reached a total direct audience of approximately 1,380 farmers, crop advisors, commercial agronomists and other stakeholders across three states/provinces (Montana, Manitoba, North Dakota) at 21 events. The Pathology Program responded to approximately 300 one-on-one inquiries from stakeholders across the Northern Plains and western Minnesota seeking in-season advice for disease management decisions in chickpea, dry bean, field pea, lentil, and soybean production.

Preliminary results suggest that management of white mold in pinto beans and kidney beans can be sharply improved by increasing the number of fungicide applications from 2 to 3 and making the applications approximately 10 days apart in pinto beans and approximately seven days apart in kidney beans. In soybeans preliminary results indicate that optimal fungicide application timing for white mold in soybeans differs for one- versus two-application programs, that the response to fungicide droplet size differs in soybeans seeded to wide versus narrow or intermediate rows, and that low soybean seeding rates (100,000 viable seeds/ac) may improve white mold management.

The NDSU Extension Horse Management Webinar Series was held in spring 2025. Three webinars were co-hosted and presented, with 104 individuals joining live and 501 views of the recordings as of November 1, 2025. Find the recording playlist here: https://tinyurl.com/NDSUHorseWebinars. Webinar topics included breeding management, foaling management, and small acreage management. Of the 46 webinar poll respondents, 78% found the information shared to be either very or extremely useful for their daily management tasks.

At the Oakes Irrigation Research Site, the team addressed critical emerging issues facing soybean producers in southeastern North Dakota by collaborating to successfully execute some of the first North Dakota field research on the management of sudden death syndrome and frog-eye leaf spot.

Collaboration continues with main station researchers targeting variety development, intercropping, microbial community identification, soil health, and rhizobium optimization. In 2025 some rhizobium strains isolated from North Dakota soils had either a negative or positive effect on lentil yield at Carrington. One strain increased the lentil yield 5% and a second strain decreased the lentil yield 40% compared to the uninoculated control on a field with high pulse history. With low pulse history all rhizobia strains had either no effect or a positive lentil yield effect. In peas, a similar trend was observed with up to a 9% positive or negative effect on pea yields. These research results guide which isolates will proceed into commercial development and producer availability.

Two area Family and Consumer Science high school classes toured the CREC orchard and used North Dakota-grown apple varieties for baked goods in their classrooms. The partnerships with the CREC Fruit Program help educate the next generation about opportunities for using regional high value crops.

Over the last 100 years, wheat breeding has successfully increased yields by almost 50% while creating shorter, more resilient plants. The NDSU wheat variety release from 1926, “Ceres,” was showcased in the drill strips and in the dryland wheat variety trial. Ceres was out yielded by several new releases from NDSU by 20.9 and 27.1 bushels per acre (ND Thresher and ND Stampede, respectively). The Ceres variety stood almost a foot taller than both ND Stampede and ND Thresher. Ceres had the highest protein in the trial at 16.2%.

The Carrington Research Extension Center Field Day was held on a rainy July 22. Over 200 people attended the concurrent tours to learn about research, production decisions, new machinery, economics, emerging issues, and specialty crops. In August, the Oakes Irrigation Research Site Field Day (70 participants) and CREC Row Crop tours (50 participants) were held which focused on pest management and other input decisions for central and southern North Dakota.

Mitigating Salinity Impact: Spring-Planted Cover Crops to Boost Soybean Yields in North Dakota

Sergio Cabello Leiva and Szilvia Yuja

Soil salinity represents a formidable agronomic challenge in North Dakota, afflicting over 1.9 million acres. Soybeans, in particular, are highly sensitive to this stressor, with yields capable of dropping by 20-25% when soil electrical conductivity (EC) exceeds 1.1 mS/cm, leading to yield losses of 50% or more at 2.2 mS/cm. Mitigating salinity primarily relies on effective water management, including reducing evaporation and improving drainage. The vast majority of salt-affected cropland is characterized by dynamic, yield-limiting EC levels - those falling between the agronomically acceptable threshold and the threshold for complete crop failure. This acreage significantly outweighs the smaller extent of land suffering from the most severe, near-total-wipeout salinity. It is postulated that spring-planted winter cover crops could improve soybean production in these marginally salt-affected areas by reducing soil evaporation, while their root channels enhance drainage and water infiltration. Furthermore, integrating these cover crops increases system diversity, which fosters beneficial microbial communities known to alleviate the adverse effects of salinity on soybeans.

A two-year research project (2024–2025) was initiated in Carrington, ND, to test the hypothesis that planting winter cover crops, specifically winter rye, winter barley, and winter camelina, early in the spring could act as a green mulch to alleviate salinity problems, thereby significantly increasing soybean yields. The research objectives centered on determining the optimal cover crop seeding rate and termination date to achieve the greatest soybean yield under saline conditions.

Site selection and treatments

Prior to planting each year, the research area was mapped using an electromagnetic induction device (EM38) to provide apparent electrical conductivity, which guided the selection of sites with a salinity gradient (Figure 1). Soil samples were taken from multiple depths for comprehensive salinity analysis.

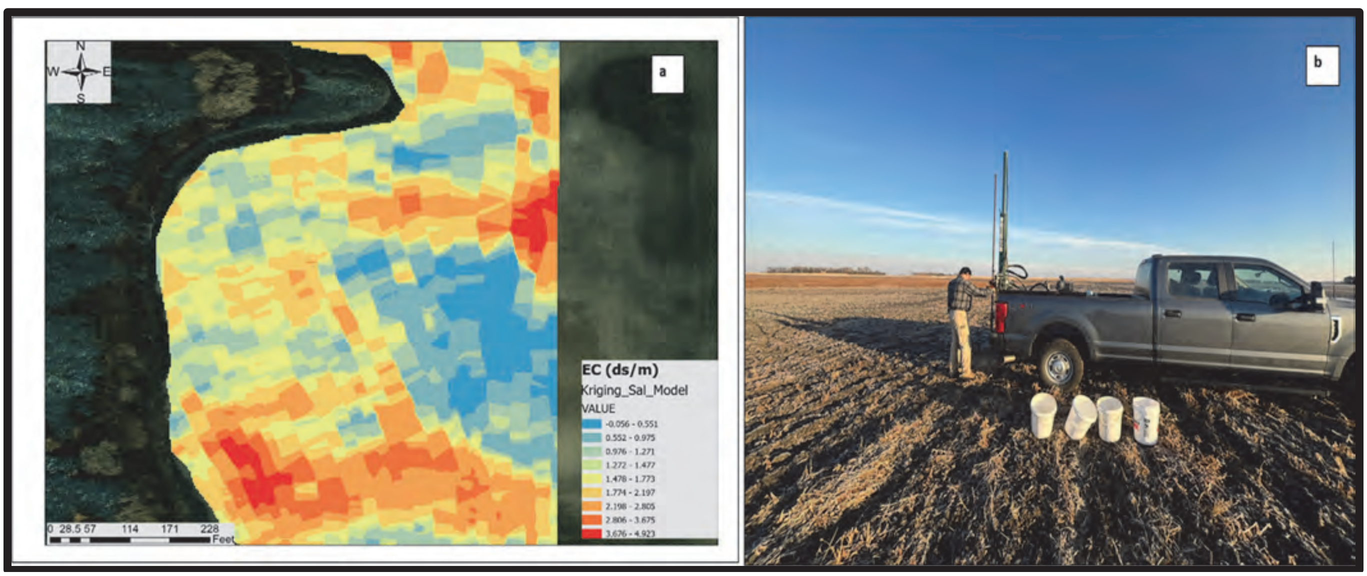


Figure 1. Soil electrical conductivity map from EM38, Carrington, ND 2024 (a). Soil sampling from soil electrical conductivity. Carrington, ND, 2024 (b).

The treatments involved three factors (Table 1): 1) cover crop type, 2) cover crop seeding rate and 3) cover crop termination. The cover crop types were winter rye, winter barley, winter camelina, plus a mix of those three cover crops. Seeding rates were at 66 or 33% of a full rate. Cover crop termination treatments consisted of terminating at the R2 stage of soybean with glyphosate or letting the cover crops grow to maturity. Treatments had a full factorial arrangement with randomized complete block design. Cover crops were planted early in the spring (May 5, 2024, and May 7, 2025), approximately one month before soybean planting.

Table 1. Treatment structure.

Trt #	Cover Crop	Cover crop seeding rate (% full rate)	Cover crop termination	Treatment abbreviation
1	NO	NO	NA	Check
2	Winter rye	66	R2	WR-66-R2
3	Winter rye	66	No	WR-66-No
4	Winter rye	33	R2	WR-33-R2
5	Winter rye	33	No	WR-33-No
6	Winter barley	66	R2	WB-66-R2
7	Winter barley	66	No	WB-66-No
8	Winter barley	33	R2	WB-33-R2
9	Winter barley	33	No	WB-33-No
10	Winter Camelina	66	R2	Cm-66-R2
11	Winter Camelina	66	No	Cm-66-No
12	Winter Camelina	33	R2	Cm-33-R2
13	Winter Camelina	33	No	Cm-33-No
14	Mix Cover crop	66	R2	Mix-66-R2
15	Mix Cover crop	66	No	Mix-66-No
16	Mix Cover crop	33	R2	Mix-33-R2
17	Mix Cover crop	33	No	Mix-33-No

Results

The two site-years presented significantly different growing conditions, primarily in terms of soil salinity levels. The 2024 site had an EC range of 0.63 to 2.89 mS/cm measured during the growing season. In contrast, the 2025 site had an EC range of 0.24 to 1.4 mS/cm. The site used in 2025 initially had higher EC levels which ranged from 1.3 to 3.8 mS/cm in the early spring but decreased sharply as time went on due to frequent heavy rains. This discrepancy between the salinity levels of the two sites directly influenced the observed results, particularly the overall soybean yields and the effect of the cover crop treatments.

Benefits of cover crop treatments contingent upon salinity level

The most significant finding across both years was that the beneficial effect of cover crops was contingent upon the presence of elevated soil salinity. Soybean yields were only affected by soil salinity above an EC of 0.5 mS/cm (Figure 2). In the 2024 season, EC levels were consistently above that level causing more than a 50% yield loss in some plots. Under these conditions, cover crop treatments, specifically winter barley, winter rye, and winter camelina, boosted yields by 5-8% compared to the check plots (no cover crop). Although these differences were not statistically significant, they provided a useful starting point (Figure 3).

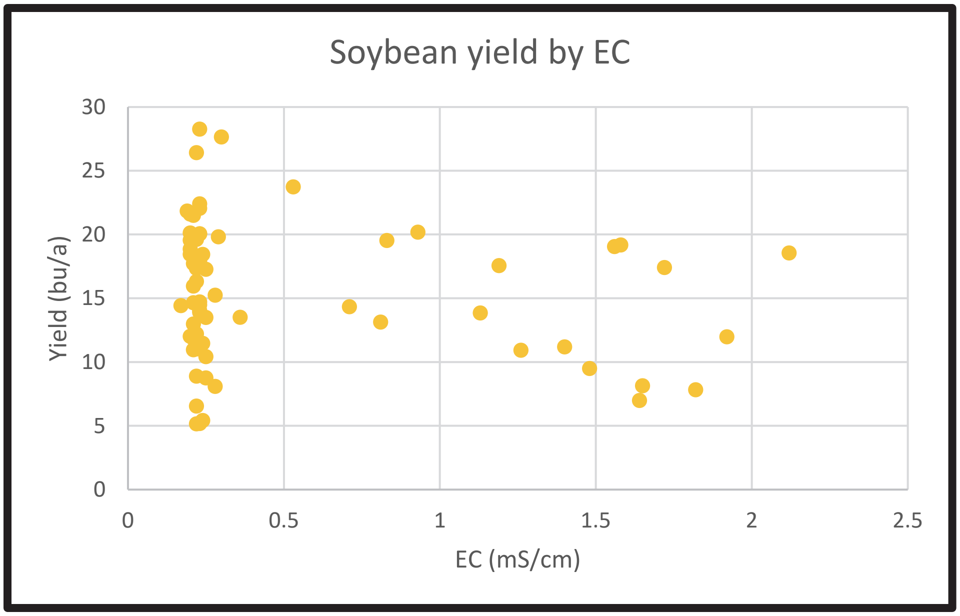


Figure 2. Soybean grain yield by soil EC levels measured in the top 6 inches of each plot on 8/26/2025.

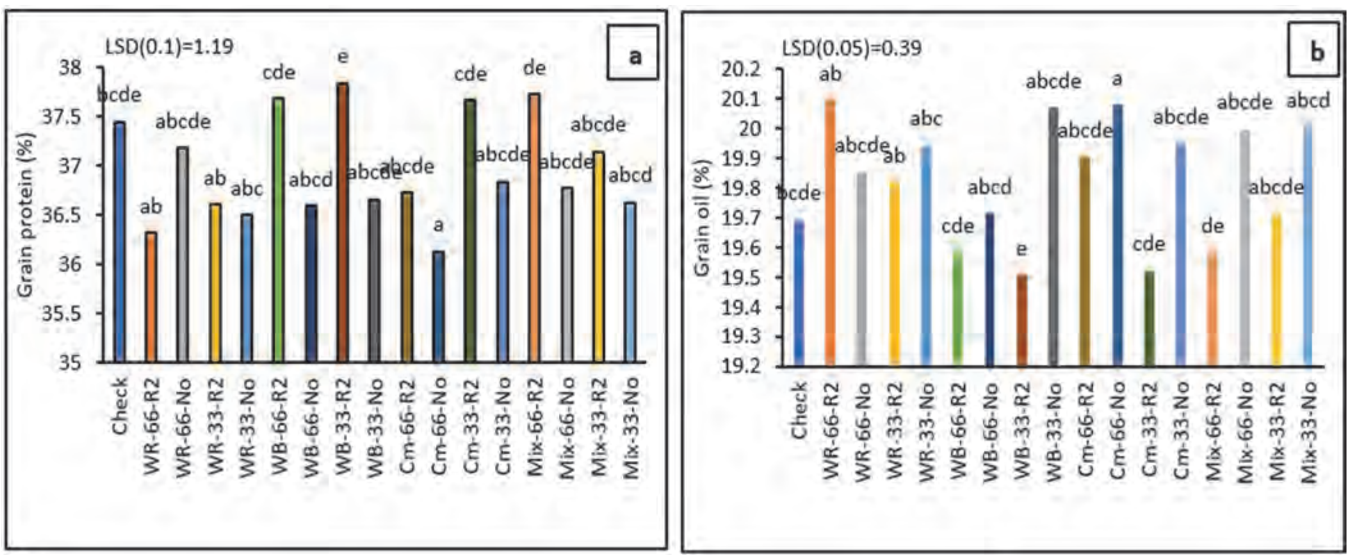


Figure 3. Soybean grain protein (a) and grain oil content (b), Carrington, ND, 2024. **Bars with different letters are significantly different at (a) P = 0.01 and (b) P = 0.05.**

In contrast, the 2025 season experienced frequent large rain events, drastically reducing top-soil EC levels, thus minimizing the salinity effect in most trial blocks. The overall results for 2025 showed that the presence of cover crops generally decreased yields when averaged across all treatments (Figure 4). However, in the one block that maintained higher EC levels (above 0.5 mS/cm), the plots with a terminated cover crop yielded similar to or slightly higher than the check plot (Figure 5). This consistency confirms that the advantage of using cover crops is primarily realized in the marginal-to-highly saline areas, where the mitigation benefits outweigh the competitive impact of the cover crop.

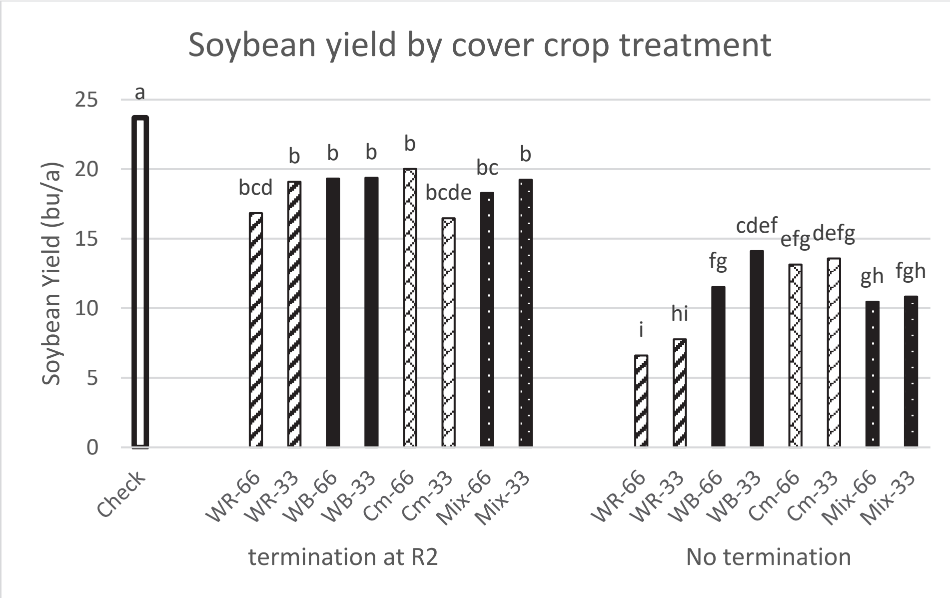


Figure 4. Soybean grain yield by all treatment combinations in 2025.
Treatments with different letters are significantly different from each other at the alpha=0.1 level.

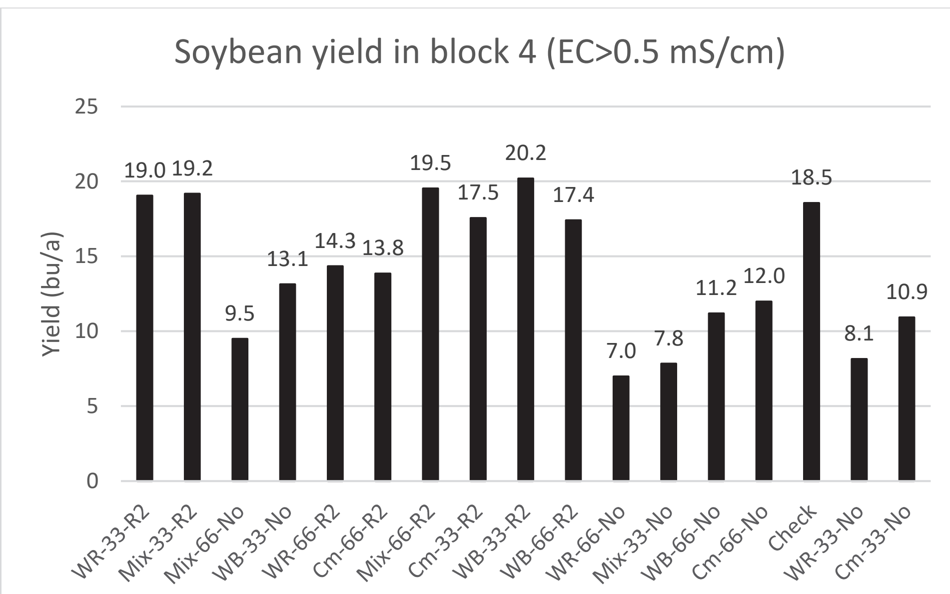


Figure 5. Soybean grain yield in block 4 (EC>0.5 mS/cm) by treatments in 2025. No statistical analysis was done due to lack of repetition in this EC range.

The Necessity of Timely Termination

In both years, allowing the cover crop to grow past the R2 growth stage of soybean resulted in a detrimental effect to soybean yields. This highlights the need to balance the benefits of green mulch and root drainage with the negative effects of competition for water and nutrients.

The 2024 season indicated that termination no later than the soybean R2 stage was acceptable and that early termination using winter barley and winter rye was associated with an 8% yield increase compared to the check plots (Figure 3). Furthermore, termination at R2 appeared to be linked to higher soybean grain protein levels, suggesting less late-season competition. Conversely, treatments with no termination and higher seeding rates were associated with higher oil content, likely due to increased stress and competition (Figure 3). The 2025 results reinforced this, showing that not terminating the cover crop had a universal detrimental effect on yield.

Seeding Rate Observations

Initial findings from the 2024 season suggested that a seeding rate of 33% of the recommended rate or less was sufficient to provide a benefit. It was concluded that if seeding rates exceeded 33%, along with late termination, the soybean yield would likely decrease significantly.

Conclusions

One of the challenges of conducting a trial on saline soil is the unpredictability of the electrical conductivity levels that crops will be exposed to in any given year. Soybean productivity can greatly fluctuate from season to season in marginally salt affected areas for which this research is targeted. However, this fluctuation in EC levels provided valuable insight into the viability of the applied treatments.

This trial provided evidence that spring-planted winter cover crops are a potential tool for managing marginally saline soils of EC levels greater than 0.5 mS/cm but should be used with caution on soils that are likely to be under this salinity level. In both cases, terminating the cover crop is a crucial step to avoid yield losses and it is recommended to use the lower planting rate (33%) because there was no overall benefit to using the higher rate.

This research was partially funded by the North Dakota Soybean Council.

Beyond Herbicides: Smart Strategies for Sustainable, Weed-Free Soybeans

Qasim Khan and Mike Ostlie

Weed management continues to be one of the most persistent challenges in soybean production across North Dakota, driven by expanding herbicide-resistant weed populations and increasing constraints on herbicide use due to regulatory and resistance pressures. This project evaluates integrated, non-chemical weed management strategies by examining how soybean planting time, row spacing, and cultivar canopy architecture influence weed suppression and soybean productivity. The overarching goal is to develop practical agronomic strategies that reduce reliance on chemical weed control while supporting competitive, resilient soybean production systems across North Dakota.

Methodology

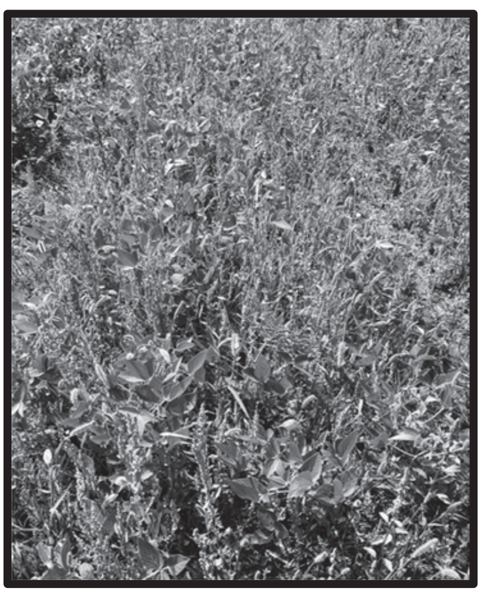
A field experiment was established at the Carrington Research Extension Center under rainfed conditions during the 2025 growing season. Treatments included early and late planting, 7-inch and 14-inch row spacing, and two soybean cultivars differing in growth habit: the bushy XF30-42 and the more erect XF30-52N. Weed-free check plots were included to provide a benchmark for yield potential and quantify soybean yield losses due to weed competition (Table 1). The experiment followed a randomized complete block design with four replications and a split-plot structure to allow robust comparisons among management factors. Soybeans were planted on May 30 (early) and June 19 (late) and harvested on November 5.

Table 1. Treatments for evaluating cultural weed management strategies in soybean.

Treatment	Planting Date	Row Spacing	Variety
		inches	
T1	Early	7	XF30-42
T2	Early	7	XF30-52N
T3	Early	14	XF30-42
T4	Early	14	XF30-52N
T5	Late	7	XF30-42
T6	Late	7	XF30-52N
T7	Late	14	XF30-42
T8	Late	14	XF30-52N
T9	Early	14	XF30-42 (Check)
T10	Early	14	XF30-52N (Check)
T11	Late	14	XF30-42 (Check)
T12	Late	14	XF30-52N (Check)

Results

Early-season precipitation created pockets of soil compaction at the experiment site and slowed emergence, resulting in stand densities well below the target seeding rate of 220,000 plants/a. Across treatments, stands ranged from approximately 133,000 to 146,000 plants/a, while weed-free plots achieved higher densities (~159,000 plants/a) (Table 2). Canopy closure was significantly affected by planting time and row spacing (Table 1). Early planting reached 68% closure compared with 60% for late planting, and 14-inch rows exhibited greater canopy closure (70%) than 7-inch rows (58%). Although narrow rows typically close canopy sooner, the 7-inch spacing in this trial experienced greater weed competition, resulting in higher weed biomass that reduced soybean vigor and slowed canopy closure compared with the 14-inch rows. Weed-free plots produced the highest canopy closure at 77%.



Dominant weed species in the trial included redroot pigweed and green foxtail, with additional presence of kochia and common lambsquarters.

Table 2. Soybean plant population and canopy closure across management treatments, Carrington, ND, 2025.

Treatment		Soybean	
		Stand	Canopy Cover
		plant per acre	%
Planting	Early	143,667	68
	Late	135,704	60
Variety	XF3042	133,293	63
	XF3052N	146,079	64
Row Spacing	7"	142,753	58
	14"	136,619	70
	Check	159,045	77
	Target	220,000	100
	Early vs Late	ns	*
	XF3042 vs XF305	ns	ns
	7" vs 14"	ns	*

Significant at P ≤0.10

A weed seedbank assessment conducted at planting revealed high weed pressure at the site, ranging from 81 to 138 seeds/sq. ft. Dominant weed species included redroot pigweed and green foxtail, with additional presence of kochia and common lambsquarters, reflecting conditions commonly encountered by North Dakota soybean growers.

Weed density and biomass at the vegetative (V4) and flowering (R1) growth stages showed distinct responses to cultural management treatments (Figure 1). Weed density at V4 was significantly lower in early-planted soybean compared with late planting (P ≤ 0.10), although no significant differences were observed at the R1 stage. Row spacing and cultivar did not affect weed density at either timing (Figure 1a). The increase in density from V4 to R1 reflects continued weed emergence throughout the season, consistent with the high seedbank and recurring rainfall events. Weed biomass responded more strongly to management practices than weed density (Figure 1b). At the V4 stage, weed biomass was significantly higher in early-planted soybean than in late planting, indicating reduced early-season weed suppression under the early planting scenario. Weed biomass was also higher in the 7-inch row spacing than in the 14-inch spacing, showing that weed suppression was lower in the narrower rows at this stage. By the R1 stage, early planting still showed numerically higher weed biomass, although the difference was no longer significant. Row spacing continued to influence weed biomass at R1, with weed biomass consistently higher in the 7-inch rows, reflecting lower weed suppression under narrow row spacing as the crop matured. Plant architecture has a significant influence on weed growth. Compared with erect cultivars, the bushy growth habit of XF30-42 provided greater weed suppression during the reproductive stage. Weed-free check plots maintained very low biomass across both timings.

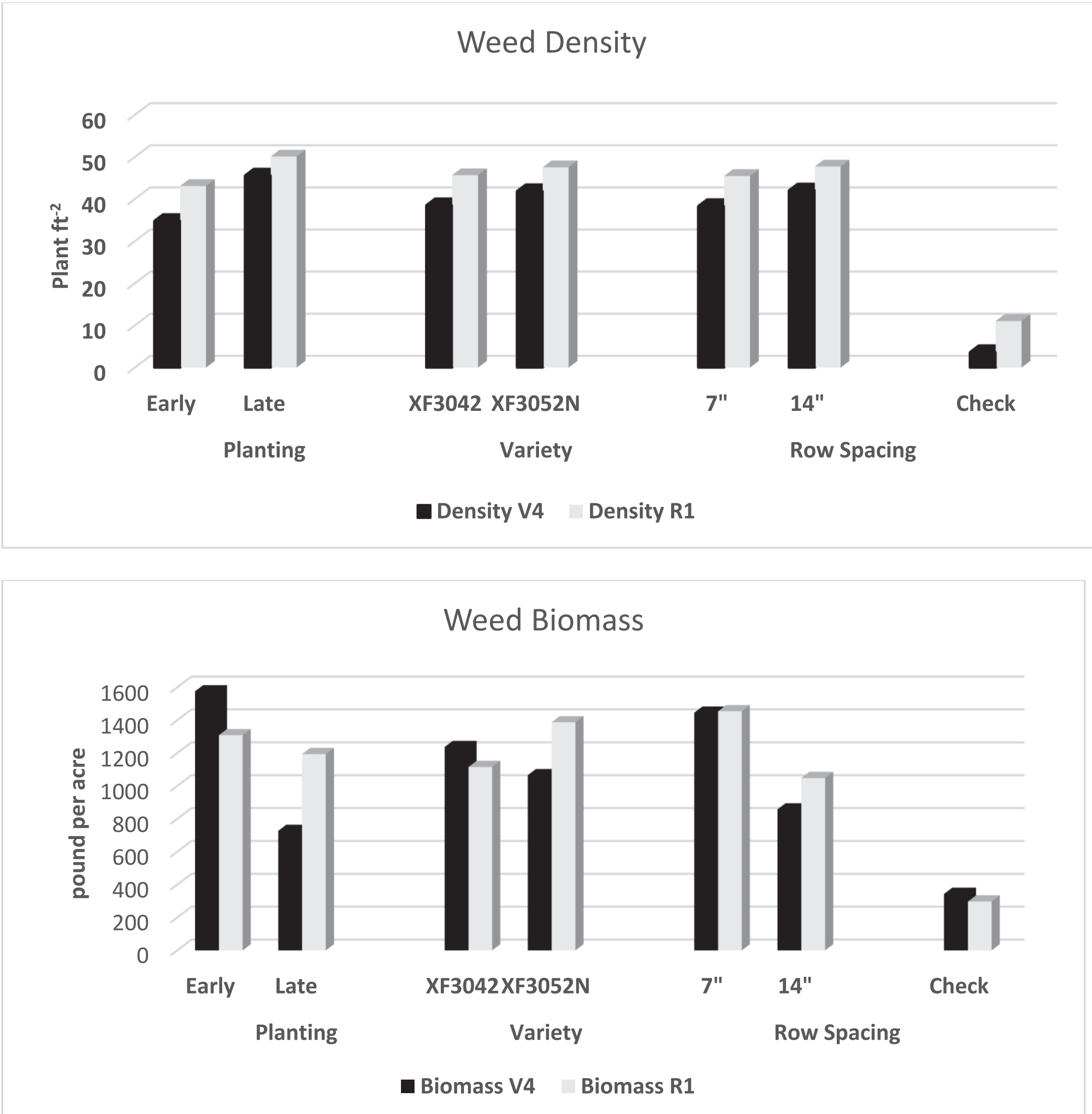


Figure 1. Treatment effect on weed density (a, top) and biomass (b, bottom) in soybean at Carrington, ND, 2025.

Soybean grain yield was influenced by planting time and row spacing (Figure 2). Early planting yielded 21 bu/a, while late planting averaged 24 bu/a and was significantly higher ($P \leq 0.10$). Row spacing also affected yield, with 14-inch rows producing 25 bu/a compared with 20 bu/a in 7-inch rows. Cultivar differences were small and not statistically significant, with XF30-42 and XF30-52N yielding 23 and 22 bu/a, respectively. Weed-free check plots yielded 32 bu/a, illustrating the substantial yield reductions caused by weed competition under non-chemical management conditions.

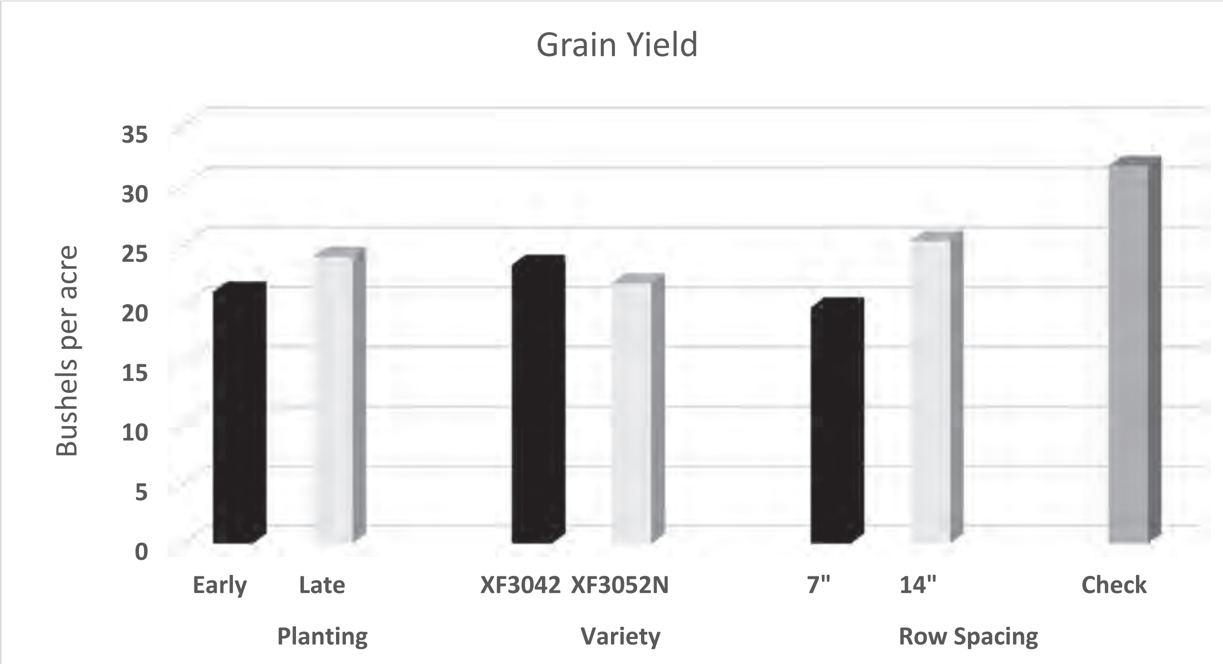


Figure 2. Soybean grain yield responses to cultural weed management practices, Carrington, ND, 2025.

Although treatment differences were evident, overall yields were well below the typical yield potential of these cultivars under favorable conditions. The reduced yield levels observed in 2025 were largely attributable to poor stand establishment and early-season soil moisture challenges, which limited early vigor and canopy development across treatments. These establishment issues, combined with sustained weed pressure, substantially constrained yield expression in this first year of evaluation.

This research was partially funded by the North Dakota Soybean Council

Planting Date and Hybrid Effects on Spring Canola at the Carrington REC (2023–2025)

Kristin Simons and Burton Johnson

Spring canola (*Brassica napus* L.) yield and quality in North Dakota are strongly influenced by planting date and hybrid. Because the region experiences variable early-season temperatures, intermittent spring moisture challenges, and occasional mid-summer heat episodes, determining the optimal planting window is essential for stabilizing yields from year to year.

This three-year summary selectively focuses on Carrington data from 2023, 2024, and 2025. Carrington provides a representative central-eastern ND environment where canola is frequently planted into well-managed rotation systems and typically experiences moderate rainfall and heat stress. The objective was to:

- Determine how planting date affects yield, development, and seed quality.
- Compare hybrid performance across shifting planting windows.
- Assess year-to-year stability of the response curve and identify actionable recommendations for North Dakota growers.

Methods

A six-date planting sequence was established beginning in late April or early May and continuing at 7–10-day intervals into early June each year. Hybrids included combinations of DK401TF, CP7250LL, L340PC, and other commercial lines depending on the year. Agronomic management followed local recommendations for fertility, weed control, and pest management. Each trial was designed as a split plot (Figure 1) and harvested at various dates after plots reached a suitable moisture after physiological maturity.

Data collected each year at Carrington included:
- Days to beginning bloom
- Flowering duration
- Days to maturity
- Seed yield (lb/ac)
- Seed oil (%)
- Test weight
- 1000-kernel weight

Environmental conditions differed over the years. 2023 featured cool July temperatures and good moisture. 2024 had relatively normal temperatures and moderate moisture but lower overall yields. 2025 provided favorable rain patterns and mild summer heat, supporting strong plant development and seed fill.

The canola planting date by hybrid trial was planted as a split plot design with planting date as the main plot and hybrid as the split plot.

Results

The 2023 season produced some of the strongest yields in the study (data not shown). Yields peaked at Date 4 (late May) at just over 4,000 lb/ac. Dates 3–5 all performed well, while the final planting (Date 6) dropped to near 2,000 lb/ac. The yield response curve followed a classic “bell shape,” with optimal yields centered around a mid-May planting date. Hybrid differences existed but were less important than planting date. The 2023 season demonstrated that Carrington’s environment can support exceptional yields when temperatures remain moderate during flowering and seed fill.

The 2024 season produced lower yields than in 2023 but maintained the same general planting-date pattern. The earliest planting date yielded around 2,020 lb/ac. Dates 2 - 4 produced similar yields with modest differences. Yields dropped sharply by Date 5 and Date 6. Hybrid × date interactions did not have a significant impact on yield at Carrington in 2024. Although 2024 yields were reduced compared to 2023, likely due to moderate moisture limitations and inconsistent early-season conditions, the relative response to planting date was extremely consistent: planting in early to mid-May still outperformed later planting.

The 2025 data are the most recent study results in the three-year series and closely aligns with the historical trends at Carrington (Table 1). Peak yield occurred around Date 2, typical for a mid-May planting (Figure 1). Yield declines after Date 2 were moderate but consistent. The later dates (5 and 6) still produced acceptable yields due to favorable mid-season conditions but never surpassed early dates. DK401TF performed strongly across all dates and appears well-adapted to Carrington's environment. L340PC yielded competitively in several planting windows. CP7250LL provided high test weight but lagged in overall yield.

Table 1. Detailed results from 2025 which follow similar trends as 2023 and 2024.

Planting Date	Days to Flower		Flower Duration		Days to Maturity		Seeds / Pound		Oil Content		Yield	
	DAP		days		DAP				%		lb/bu	
Date 1	50.4	e	26.9	c	105.2	d	123,753	a	45.5	d	3248	b
Date 2	48.1	d	23.3	b	99.9	c	131,174	ab	45.6	d	3403	b
Date 3	44.6	c	22.5	b	96.4	bc	136,515	b	44.7	c	3191	ab
Date 4	44.2	c	18.8	a	93.7	b	126,752	a	44.7	c	2903	a
Date 5	38.7	b	19.2	a	88.2	a	125,034	a	44.0	b	2991	ab
Date 6	37.0	a	20.3	ab	89.4	ab	126,488	a	42.9	a	2880	a
Trial Mean	**43.8**		**21.8**		**95.5**		**128,286**		**44.6**		**3103**	

Values followed by different letters are significantly different at P = 0.1.

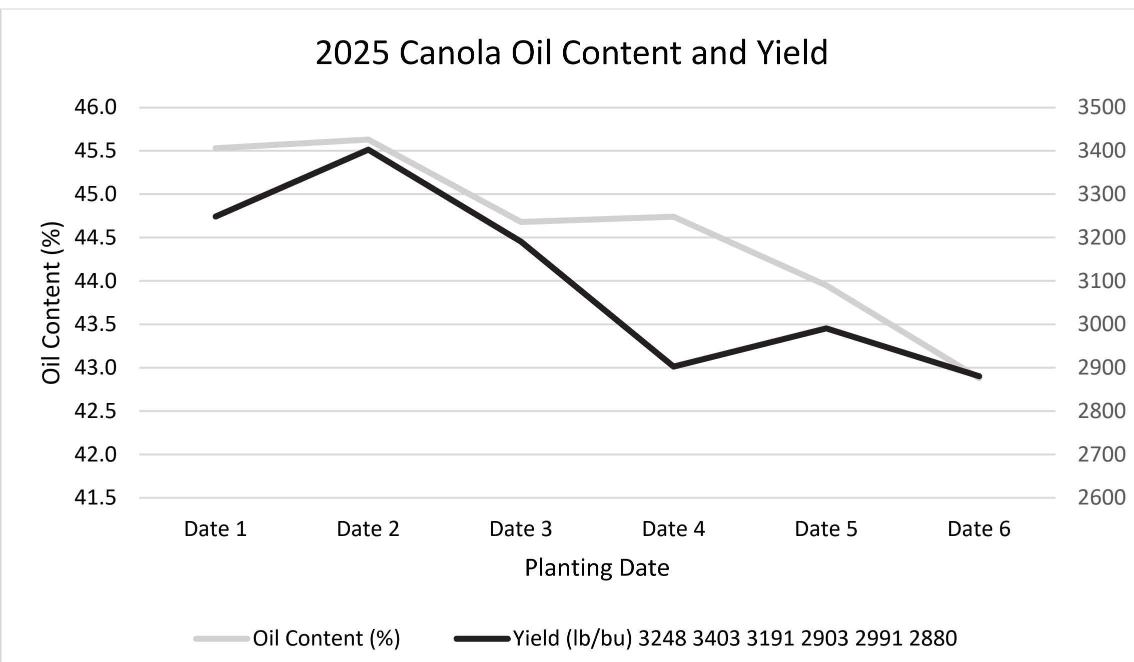


Figure 1. In 2025, planting Date 2 provided the best yield and oil content compared to the other planting dates.

Discussion

Across three years at Carrington, the planting date response curve remained remarkably stable despite varying environmental conditions. The data strongly support the following conclusions:

1. Early to mid-May is the optimal planting window. Dates 1–2 consistently produced the highest yields across all three years. In high-yield seasons like 2023, the peak shifted slightly later (Date 4), but Dates 2 through 4 all performed well. In moderate years like 2024 and 2025, the earliest plantings (Dates 1–2) reliably outperformed later ones. Thus, central ND growers should aim for planting between May 1 and May 15, depending on field conditions.
2. Yield penalties increased steadily with delayed planting. Date 4 and later saw gradual but consistent yield declines. Dates 5 and 6 were always lower yielding, regardless of weather. Even in favorable 2025 conditions, Dates 5 and 6 could not match earlier planting. Late planting consistently shortened vegetative development, reduced flowering duration, and limited seed fill, all mechanisms that explain the year-over-year yield decline.
3. Hybrid selection matters, but less than planting date. While hybrid ranking varied some years, planting date effects were universally stronger. Hybrid DK401TF showed excellent stability at Carrington in 2025. Hybrid L340PC performed well at intermediate planting dates. Hybrid CP7250LL showed strong test weight and acceptable oil content but lower yield. When growers select hybrids, they should determine which traits, in addition to yield, are important for crop value.
4. Weather patterns modify the ideal planting window where later planting dates shift reproductive phases to warmer and lower rainfall periods which stress cool-season canola. When growing seasons are cooler, such as in 2023, canola performs well even at later May planting dates. Moderate-yield years (2024, 2025) still favored early planting, with mid-May remaining the best balance for stand establishment, frost risk, and heat moisture stress avoidance. The consistent stability of the curve across three contrasting seasons strengthens confidence in recommending early-to-mid May as the optimum window.

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Optimizing Fungicide Application Timing, Fungicide Droplet Size and Soybean Seeding Rate for Improved White Mold Management in Soybeans in Oakes

Thomas Miorini, Spencer Eslinger, Heidi Eslinger, Jesse Hafner, Suanne Kallis, and Michael Wunsch

Sclerotinia stem rot (SSR), which is caused by *Sclerotinia sclerotiorum* (Lib.) de Bary, is a destructive disease of many crops worldwide (Boland and Hall 1994). Senescing soybean flower petals are considered the primary infection source, so fungicide application timing should be coordinated with growth stage to achieve appropriate SSR management in soybeans (Mueller et. 2004). Cooler temperatures within fuller canopies, which facilitate moist conditions, are favorable for disease development (Willbur et al. 2018, 2019).

Previous research from the CREC Plant Pathology team demonstrated that small adjustments to fungicide application timing, spray droplet size and seeding rate can improve white mold management in soybeans at little or no additional cost.

Four field experiments were conducted in Oakes in 2024 and 2025 under fields with a history of white mold and with supplemental overhead irrigation. The overhead irrigation was applied via a linear irrigation system as needed to optimize soybean yield potential. Objectives of the study are:

I. Identify optimal fungicide application timing for one versus two fungicide applications and fungicide droplet size calibrated relative to canopy characteristics (% closure and growth stage (R1-R3)).

II. Optimize fungicide droplet size for Sclerotinia stem rot management relative to canopy characteristics in soybeans seeded at different seeding rates in intermediate (21-inch) versus wide (28-inch) rows.

III. Evaluate the performance of Hypro's '3D' drift-reducing flat-spray nozzles versus TeeJet extended range flat-spray nozzles applied for white mold management with fine, medium and coarse droplet sizes.
IV. Evaluate the impact of seeding rate on white mold management and soybean agronomic performance under white mold pressure.

The impact of fungicide application timing was evaluated on irrigated soybeans seeded to narrow (14-inch) and wide (28-inch) rows at 140,000 viable seeds/ac. Five application timings, each 2 to 4 days apart, were tested beginning at early bloom (target 50% of plant with an open blossom). Testing was conducted for a single fungicide application versus a two-application program, with the second application made 11-12 days after the first. Evaluations were made on the Xtend-type varieties Peterson Farms '22XF12' (2024, planted May 28 and harvested Oct. 23-26) and Peterson Farms '22XF10' (2025, planted June 3-4 and harvested October 9-10). Experimental design was a randomized complete block with a split-plot arrangement, with the number of fungicide applications (one versus two) as the main factor and fungicide application factor as the sub-factor. Every fungicide application timing treatment was applied to a pair of plots, one seeded to four 14-inch rows, and one seeded to two 28-inch rows. The fungicide Endura (5.5 oz/ac) was applied with a tractor-mounted sprayer equipped with Wilger Combo-Jet flat-fan nozzles. Each fungicide application timing was evaluated three times, once with each of the three droplet sizes previously shown to optimize white mold management with Wilger nozzles across the range of canopy characteristics typically observed during soybean bloom. Applications were made with Wilger 11003SR, 11003MR, and 11003DR at 40 psi (medium, coarse and very coarse droplets, respectively). In 2024, applications were made at 6.0 mph with 16 gal/ac spray volume. In 2025, applications were made at 6.5 mph (11003SR nozzles) and 6.4 mph (11003MR and 11003DR nozzles), with driving speed calibrated to maintain a constant 15.0 gal/ac spray volume.

The fungicide droplet size studies were established as a randomized complete block design with six droplet size treatments (fine, medium and coarse droplets with TeeJet XR flat-fan nozzles and with Hypro 3D angled flat-spray nozzles) compared to a non-treated control. Each fungicide droplet size treatment was applied to a block of six plots concurrently, three plots seeded to 21-inch rows (seeded at 100,000; 140,000; or 180,000 viable seeds/ac) and three plots seeded to 28-inch rows (seeded to 100,000; 140,000; or 180,000 viable seeds/ac). The Enlist-type variety Peterson Farms '23EN10' was planted in 2024 (planted May 29, harvested Oct. 26-27); the Xtend-type variety Peterson Farms 'PFS 22XF10' was planted in 2025 (planted June 3-4; harvested October 10). The fungicide Endura (8.0 oz/ac) was applied at 6.0 mph in 15 gal/ac with a tractor-mounted sprayer equipped with a pulse-width modulation system. Pulse width was modified as needed to maintain constant driving speed and constant spray volume across nozzles differing in output.

Soybean growth stage, canopy height and canopy closure were assessed concurrent with each fungicide application, with canopy closure quantified with a visual estimate and with the cell-phone app 'Canopeo'. White mold was assessed at R8 growth stage using a 0 to 5 scale representing the percentage of the plant impacted by Sclerotinia stem rot: 0 = 0%, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-99%, 5 = 100%. Disease and yield data were evaluated with analysis of variance using SAS (version 9.4; SAS Institute, Cary, NC). To control the Type I error rate at the level of the experiment, the Tukey multiple comparison procedure was employed. Analyses were conducted with replicate and treatment as main factor effects.

Results

White mold disease pressure was sufficient to permit rigorous assessment of the impact of fungicide application timing and fungicide droplet size on disease management in 2024 but not in 2025. The percent of the canopy exhibiting white mold in the non-treated control at the end of the season averaged 2-4% in the fungicide timing studies and 3-9% in the fungicide droplet size studies in 2025, levels of disease pressure that are insufficient for rigorously differentiating small, incremental treatment effects in small-plot soybean white mold research.

In the fungicide timing study conducted in 2024, white mold management was optimized with a single fungicide application made when 90-96% of plants had reached the R2 growth stage or with the first of two sequential fungicide applications made 2-5 days earlier when 16-41% of plants were at the R2 growth stage (Table 1; analysis conducted on the average of all three fungicide droplet size treatments). Results were similar irrespective of soybean row spacing.

Table 1. Impact of application timing of the fungicide Endura (average response across medium, coarse and very coarse droplets) and droplet size calibrated relative to canopy closure for a single fungicide application versus two sequential applications in narrow rows. Impact of application timing of the fungicide Endura (average response across medium, coarse and very coarse droplets) for a single fungicide application versus two sequential applications in wide rows. Oakes, 2024.

Location: **Oakes** Year: **2024**

Narrow (14-inch) row spacing
average response across medium, coarse and very coarse droplets

Application date applic. #1	applic. #2	Application #1 Growth stage		Canopy closure	Single White mold (%)	Single Yield (bu/ac)	Two applications White mold (%)	Two applications Yield (bu/ac)
Non-treated control					**24** c*	**65** b*	**23** b*	**66** b*
July 17	July 29	**54%** bloom	**5%** R2	**59%**	**12** b	**71** a	**4** a	**72** a
July 20	Aug. 1	**75%** bloom	**16%** R2	**78%**	**11** b	**70** ab	**4** a	**72** a
July 23	Aug. 3	**93%** bloom	**87%** R2	**91%**	**8** ab	**70** ab	**5** a	**72** a
July 25	Aug. 6	**100%** bloom	**96%** R2	**99%**	**6** a	**72** a	**8** a	**71** a
July 28	Aug. 9	**81%** R2	**19%** R3	**100%**	**7** ab	**71** a	**6** a	**70** ab
					CV: 16.9	CV: 4.9	CV: 26.4	CV: 4.6

Narrow (14-inch) row spacing: droplet size calibrated vs. canopy
coarse droplets when canopy closure <95%; very coarse, canopy closure >95%

Application date applic. #1	applic. #2	Application #1 Growth stage		Canopy closure	Single White mold (%)	Single Yield (bu/ac)	Two applications White mold (%)	Two applications Yield (bu/ac)
Non-treated control					**24** b*	**65** a*	**23** b*	**66** a*
July 17	July 29	**54%** bloom	**5%** R2	**59%**	**12** ab	**71** a	**3** a	**72** a
July 20	Aug. 1	**75%** bloom	**16%** R2	**78%**	**13** ab	**70** a	**4** a	**72** a
July 23	Aug. 3	**93%** bloom	**87%** R2	**91%**	**9** a	**71** a	**3** a	**72** a
July 25	Aug. 6	**100%** bloom	**96%** R2	**99%**	**7** a	**73** a	**6** a	**72** a
July 28	Aug. 9	**81%** R2	**19%** R3	**100%**	**6** a	**73** a	**6** a	**69** a
					CV: 28.4	CV: 9.0	CV: 46.6	CV: 7.8

Wide (28-inch) row spacing
average response across medium, coarse and very coarse droplets

Application date applic. #1	applic. #2	Application #1 Growth stage		Canopy closure	Single White mold (%)	Single Yield (bu/ac)	Two applications White mold (%)	Two applications Yield (bu/ac)
Non-treated (**Non-treated** control					**29** b*	**53** b*	**28** b*	**53** b*
July 17	July 29	**54%** bloom	**5%** R2	**14%**	**18** ab	**56** ab	**12** a	**59** a
July 20	Aug. 1	**81%** bloom	**41%** R2	**24%**	**21** b	**56** ab	**8** a	**60** a
July 23	Aug. 3	**95%** bloom	**90%** R2	**69%**	**11** a	**58** a	**9** a	**59** a
July 25	Aug. 6	**100%** bloom	**100%** R2	**86%**	**13** ab	**58** ab	**12** a	**59** a
July 28	Aug. 9	**80%** R2	**20%** R3	**98%**	**15** ab	**58** ab	**11** a	**58** a
					CV: 16.1	CV: 5.7	CV: 23.2	CV: 5.4

*Within-column means followed by different letters are significantly different (P < 0.05; Tukey procedure)

Calibrating fungicide droplet size relative to canopy closure improved white mold management and facilitated slightly later applications. In soybeans seeded to narrow (14-inch) and intermediate (21-inch) rows, previous research found that white mold management is optimized with Wilger nozzles emitting very coarse droplets when the canopy is at or near closure (> 95% closure) and with coarse droplets when the canopy is open. Calibrating fungicide droplet size on the basis of this research, white mold management was optimized with a single application made when 96-100% of plants were at the R2 growth stage and with the first of two applications made when 5-87% of plants were at the R2 growth stage (Table 1). A similar analysis optimizing fungicide droplet size was not possible for soybeans seeded to wide (28-inch) rows; previous droplet size research was not conducted on soybeans seeded to wide rows, and the limited droplet size testing conducted on soybeans seeded to wide rows in this project was insufficient to reach rigorous conclusions on optimizing droplet size relative to canopy characteristics.

In soybeans under white mold pressure seeded to intermediate (21-inch) rows, applying fungicides with medium droplets optimized the yield gain conferred by the fungicide when canopy closure averaged 82-88% and Hypro nozzles were utilized (Table 2). On average, medium droplets also maximized the yield gain conferred by the fungicide when TeeJet nozzles were utilized, but variability in droplet size response was higher for TeeJet nozzles and statistical separation was not observed.

Table 2. Impact of fungicide droplet size and nozzle manufacturer on white mold management in soybeans relative to seeding rate, canopy closure, and row spacing in Oakes, 2024.

Oakes (2024) **Applications made at 100% bloom and 60% R2**

Soybean row spacing:	**Wide** (28-inch) **rows**					**Intermediate** (21-in.) **rows**				
soybean seeding rate:	100,000	140,000	180,000			100,000	140,000	180,000		
% canopy cover:	50	53	60	**Average** across three seeding rates:		82	88	85	**Average** across three seeding rates:	
plant height (inches):	24.8	25.8	25.9			25	25.3	26.5		
Hypro 3D angled flat-spray nozzles										
	WHITE MOLD (% of canopy)				**Yield gain** conferred by the fungicide (bu/ac)	**WHITE MOLD** (% of canopy)				**Yield gain** conferred by the fungicide (bu/ac)
Non-treated	12 b*	20 b*	23 b*	**18** b*		19 b*	32 b*	46 b*	**32** b*	
3D100025, 60 psi (fine)	2 a	2 a	5 a	**3** a		3 a	7 a	9 a	**6** a	
3D10004, 50 psi (medium)	6 ab	7 a	7 a	**7** a		8 ab	9 a	10 a	**9** a	
3D10006, 30 psi (coarse)	2 a	7 ab	7 a	**5** a		8 ab	9 a	11 a	**9** a	
CV:	48.1	42.1	32.9	29.4		48.2	78.8	33.6	43.3	
	YIELD (bu/ac)					**YIELD** (bu/ac)				
Non-treated	**60** a*	**60** a*	**58** b*	**59** b*		**66** a*	**66** b*	**60** b*	**64** b*	
3D100025, 60 psi (fine)	**64** a	**64** a	**63** a	**64** a	**4.9** a*	**70** a	**72** ab	**70** a	**71** a	**6.6** b*
3D10004, 50 psi (medium)	**64** a	**66** a	**65** a	**65** a	**5.9** a	**72** a	**76** a	**74** a	**74** a	**9.8** a
3D10006, 30 psi (coarse)	**61** a	**65** a	**64** a	**64** a	**4.5** a	**69** a	**74** a	**72** a	**72** a	**7.5** ab
CV:	6.6	7.1	3.5	1.7	19.1	7.9	7.3	6.4	2.8	11.4
TeeJet extended-range flat-spray nozzles										
	WHITE MOLD (% of canopy)				**Yield gain** conferred by the fungicide (bu/ac)	**WHITE MOLD** (% of canopy)				**Yield gain** conferred by the fungicide (bu/ac)
Non-treated	12 a*	20 b*	23 b*	**18** b*		19 b*‡	32 b*	46 b*‡	**32** b*	
XR11003, 60 psi (fine)	4 a	8 ab	5 a	**5** a		3 a	7 a	5 a	**5** a	
XR11006, 35 psi (medium)	4 a	4 a	4 a	**4** a		4 a	4 a	10 a	**6** a	
XR11010, 30 psi (coarse)	4 a	5 ab	6 a	**5** a		5 a	7 ab	9 a	**7** a	
CV:	53.2	47.6	39.1	32.2		50.5	78.7	42.8	49.1	
	YIELD (bu/ac)					**YIELD** (bu/ac)				
Non-treated	**60** a*	**60** c*	**58** b*	**59** c*		**66** a*	**66** b*	**60** b*	**64** b*	
XR11003, 60 psi (fine)	**64** a	**65** a	**65** a	**65** a	**5.6** a*	**69** a	**75** a	**74** a	**73** a	**8.5** a*
XR11006, 35 psi (medium)	**62** ab	**61** b	**62** a	**62** b	**2.6** b	**71** a	**75** a	**74** a	**73** a	**9.4** a
XR11010, 30 psi (coarse)	**63** ab	**65** ab	**63** a	**64** ab	**4.4** ab	**72** a	**74** a	**73** a	**73** a	**8.9** a
CV:	4.3	4.7	4.4	1.4	19.9	6.5	7.3	5.7	3.5	15.0

*Within-column means followed by different letters are significantly different ($P < 0.05$; Tukey procedure)

‡ To meet model assumptions of normality and/or homoskedasticity, analysis of variance was conducted on data subjected to a systematic LN transformation.

In soybeans under white mold pressure seeded to wide (28-inch) rows, applying fungicides with fine droplets optimized the yield gain conferred by the fungicide when canopy closure averaged 50-60% and TeeJet nozzles were utilized (Table 2). Medium droplets performed worst, and coarse droplets were intermediate. In fungicide applications made with Hypro nozzles to soybeans seeded to wide rows, the response to droplet size was different: statistical separation was not observed, but medium droplets consistently optimized the yield gain.

Seeding soybeans at 100,000 viable seeds/ac reduced white mold severity in 2024, when moderate white mold pressure was observed, but not in 2025, when white mold pressure was low (Table 3). Yields were maximized with higher seeding rates.

Table 3. Impact of seeding rate on white mold management in soybeans seeded to 28-inch and 21-inch rows; Oakes, ND (2024 and 2025).

Soybean row spacing:	**Wide** (28-inch) **rows**		**Intermediate** (21-in.) **rows**	
year study was conducted:	2025	2024	2025	2024
PLANT POPULATION (at harvest)				
100,000 viable seeds/ac	89,262	74,707	91,258	73,463
140,000 viable seeds/ac	120,878	101,797	119,672	97,032
180,000 viable seeds/ac	151,944	123,108	151,332	121,286
WHITE MOLD (% of canopy at maturity)				
100,000 viable seeds/ac	**4** ab*	**5** a*	**3** a*	**7** a*
140,000 viable seeds/ac	**3** a	**7** b	**3** a	**11** b
180,000 viable seeds/ac	**4** b	**8** b	**3** a	**14** c
	CV: 15.5	CV: 15.5	CV: 18.4	CV: 21.0
YIELD (bu/ac, 13.5% moisture**)**				
100,000 viable seeds/ac	**51.5** a*	**63** ab*	**59** c*	**70** c*
140,000 viable seeds/ac	**52.1** a	**64** a	**61** b	**73** a
180,000 viable seeds/ac	**52.0** a	**63** b	**63** a	**71** b
	CV: 1.8	CV: 1.4	CV: 0.9	CV: 1.5

*Within-column means followed by different letters are significantly different (P < 0.05; Tukey procedure)

Discussion

The results suggest that additional improvements in white mold management can be achieved by adjusting fungicide application timing and droplet size and soybean seeding rate.

Under conditions favoring white mold as soybeans entered bloom, optimal fungicide application timing for white mold management differed when a single versus two sequential fungicide applications were made. The application timing that optimized white mold management with a single fungicide application was 2 to 5 days later than the application timing that optimized white mold management with the first application of a two-application fungicide program. These results closely parallel findings from fungicide application timing research conducted with one versus two sequential fungicide applications targeting white mold in pinto, black, navy and kidney beans.

The response to fungicide droplet size observed in this project suggests that the fungicide droplet size recommendations developed for optimizing white mold management in soybeans seeded to narrow (14-inch) and intermediate (21-inch) rows may not apply to soybeans seeded to 28-inch rows. In soybeans seeded to intermediate rows with 82-88% canopy closure when fungicides were applied, medium droplets optimized yield gain with TeeJet and Hypro nozzles, consistent with prior research conducted with TeeJet nozzles. In soybeans seeded to wide rows with 50-60% canopy closure when fungicides were applied, medium droplets optimized yield gain with Hypro nozzles. Fine droplets maximized the yield gain with TeeJet nozzles, with medium droplets performing worst and coarse droplets intermediate. These responses on fungicide application with Hypro in wide rows are different than those observed in prior research conducted with TeeJet nozzles on soybeans seeded to narrow and intermediate row spacing. In that research, fine droplets optimized white mold management when the canopy was open (<75% closure), with coarse droplets performing worst and medium droplets intermediate.

The response to seeding rate observed in these studies suggests that seeding soybeans at 100,000 viable seeds/ac can reduce white mold disease pressure but may not optimize soybean yields. Under the low to moderate white mold pressure observed in these studies, seeding soybeans at 140,000 or 180,000 viable seeds/ac maximized yield.

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Fungicide application timing, fungicide droplet size and soybean seeding rate trial.

Enhancing Spring Wheat Yields through Split In-Season Nitrogen and Sulfur Applications in Conventional and No-Till Systems

Szilvia Yuja and Sergio Cabello Leiva

After a decade of borderline drought conditions, nitrogen and sulfur response in our region was fairly predictable. Split application, while environmentally sound, did not seem economically attractive because leaching wasn't a significant problem. The past two growing seasons, which have been exceptionally rainy, showed us that this can change with a new weather cycle. Soil analysis results are often not accurate predictors of yield or grain quality response because of the influence of several climatic and other variables. Nitrogen and sulfur responses are particularly difficult to predict due to their mobile nature in the soil and because of the ever-shifting rates of mineralization from organic matter. Nitrogen and sulfur have long been known to have a synergistic relationship in affecting plant growth. Franzen et al. (2016) found that high nitrogen rates can increase sulfur deficiency severity and that active optical sensors can be a valuable tool for detecting in-season N and S deficiency. In a wet weather cycle, significant nutrient losses due to nitrate and sulfate leaching can be avoided by splitting the application between two timings. Furthermore, a split application of nitrogen can also mitigate nitrogen losses due to volatilization in no-till management where fertilizer cannot be incorporated.

Research Question/Objectives:

Hypothesis: The use of a split application of nitrogen and sulfur significantly increases wheat yield under conventional and no-till cropping systems.

Objectives:

- Determine the combined effect of nitrogen and sulfur rate splits, finding the correct ratio to achieve the highest wheat yield and quality in conventional and no-till systems.
- Determine the best method to predict nitrogen and sulfur plant status and fertilizer rates, considering regular soil testing, plant analysis, and multispectral data from active and passive sensors.

Materials and methods

In the growing seasons of 2024 and 2025, wheat trials were conducted in Carrington, ND, on a loam soil on no-till (2024 and 2025) and in Staples MN on sandy soil (2024 only) and in St. Paul, MN, on sandy loam soil (2025 only) with conventional tillage.

The treatments consisted of combinations of nitrogen and sulfur rates.

- Nitrogen rates: 0, 50, 75, 100 and 150 lbs N/acre
- Sulfur rates: 0, 10, 20 lbs S/acre

These nitrogen and sulfur levels were combined with each other in a full factorial arrangement accounting for 15 treatments. All 15 of those treatments were applied at a 60:40 split, with the first application being made at planting and the second applied at the Feekes 5 growth stage of wheat. A 16th treatment was used to contrast these treatments with a 100% starter application of 100 lbs of nitrogen and 20 lbs of sulfur (Table 1).

Table 1. Treatment structure.

Trt #	N rate (lbs/a)	S rate (lbs/a)	Application Timing	Treatment Abbreviation
1	0	0	60: 40 split	0N-0S
2	0	10	60: 40 split	0N-10S
3	0	20	60: 40 split	0N-20S
4	50	0	60: 40 split	50N-0S
5	50	10	60: 40 split	50N-10S
6	50	20	60: 40 split	50N-20S
7	75	0	60: 40 split	75N-0S
8	75	10	60: 40 split	75N-10S
9	75	20	60: 40 split	75N-20S
10	100	0	60: 40 split	100N-0S
11	100	10	60: 40 split	100N-10S
12	100	20	60: 40 split	100N-20S
13	150	0	60: 40 split	150N-0S
14	150	10	60: 40 split	150N-10S
15	150	20	60: 40 split	150N-20S
16	100	20	all starter	100N-20S-PD

At the Feekes 5 growth stage, wheat biomass and tissue samples were collected to determine biomass weight and nitrogen and sulfur content. Soil samples were also collected at that time from the 0-6 and 6-24 inch depths for analysis of nitrate and sulfate content. NDVI imagery was taken by UAV.

At harvest, grain yield, grain protein, and test weight data were collected. Soil samples from each plot were analyzed for nitrate and sulfate content from the 0–24-inch depth.

Results

In 2024, yields responded similarly to treatments across the two locations and there were significant differences among the treatments (Figure 1). Sulfur application increased wheat yield by 30.5% at the same nitrogen levels. Specifically, 150N-20S (55.7 bu/a) and 150N-10S (56.1 bu/a) treatments significantly outperformed the 150N-0S treatment (40 bu/a). There was no significant difference between the 100N-20S-PD (47.6 bu/a) and 75N-20S (46.8 bu/a) treatments, showing that a split application with 25% less nitrogen can match the effectiveness of a full-rate, single application at planting.

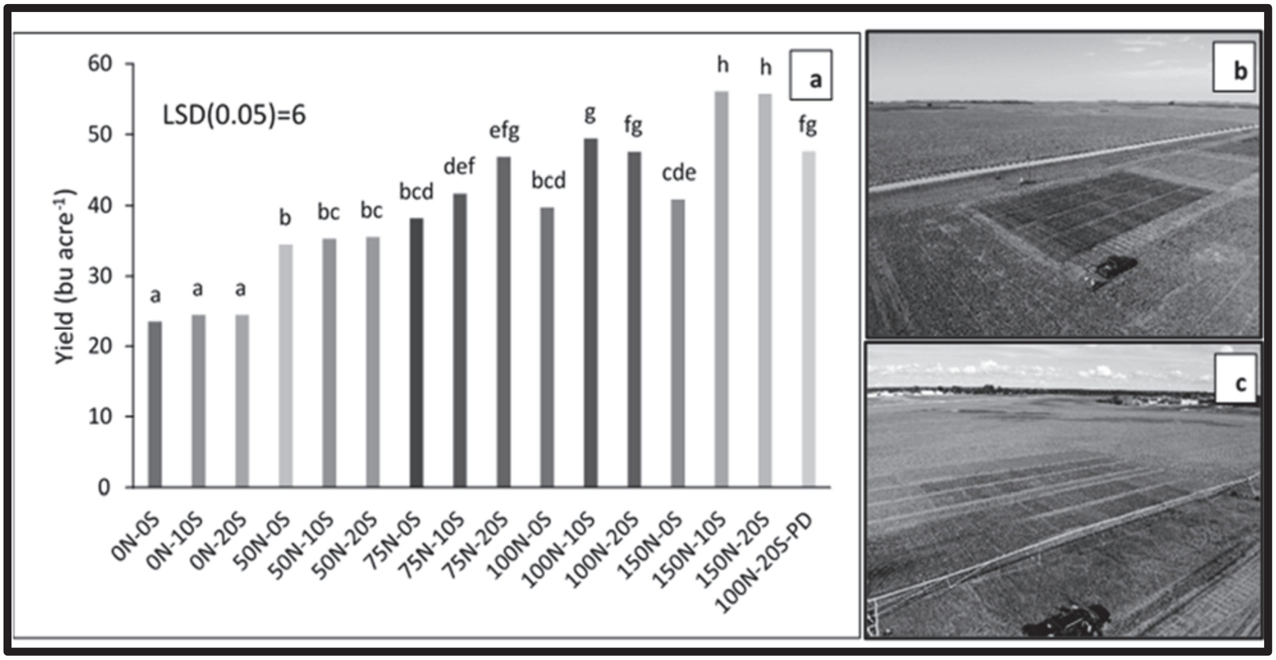

Figure 1. Wheat grain yield combined across Carrington, ND, and Staples, MN 2024 (a). Carrington aerial picture of spring wheat field trial at Feekes 5, June 2024 (b). Staples aerial picture of spring wheat field trial at Feekes 5, June 2024 (c).
Different lowercase letters above each graph bar indicate significant differences with 95% confidence.

Protein levels varied by location. Carrington maintained protein levels above 13% across treatments, thanks to fertile, loamy soil under no-till conditions. However, Staples showed protein content below 12% in most treatments, likely due to sandy soil conditions. Lower yields with higher N rates did show some increase in protein content. Total grain nitrogen was highest in treatments that included S, reinforcing the benefit of split applications, particularly in scenarios where N was reduced by 25% (Figure 2).

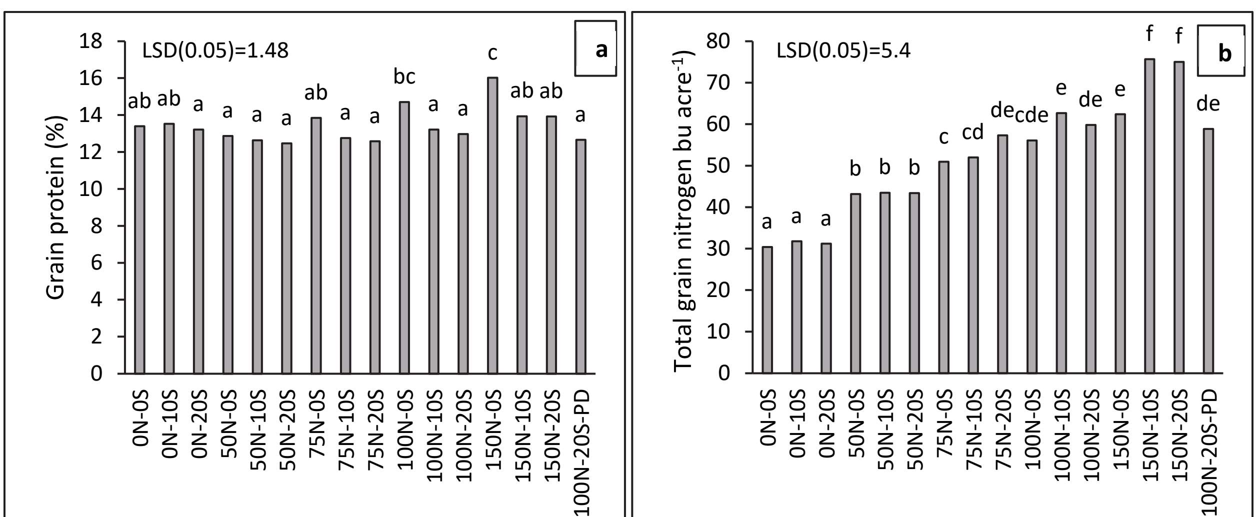

Figure 2. Wheat grain protein averaged across Carrington, ND, and Staples, MN 2024 (a). Wheat total grain nitrogen averaged across Carrington, ND, and Staples, MN 2024 (b).
Different lowercase letters above each graph bar indicate significant differences with 95% confidence.

In Carrington in 2025 above-average rainfall and a cool spring created very favorable early-season conditions for wheat. The site has fertile loamy soil, long-term no-till, high organic matter, and naturally high soil nutrient supply. When we measured the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Red Edge Index (NDRE) at Feekes 5, the values were high and uniform across treatments. NDVI and NDRE showed no significant differences among any of the nitrogen and sulfur rates. Even at this early stage, it was clear that fertilizer treatments were not separating, and yield potential appeared similar across the entire field (Figure 3b).

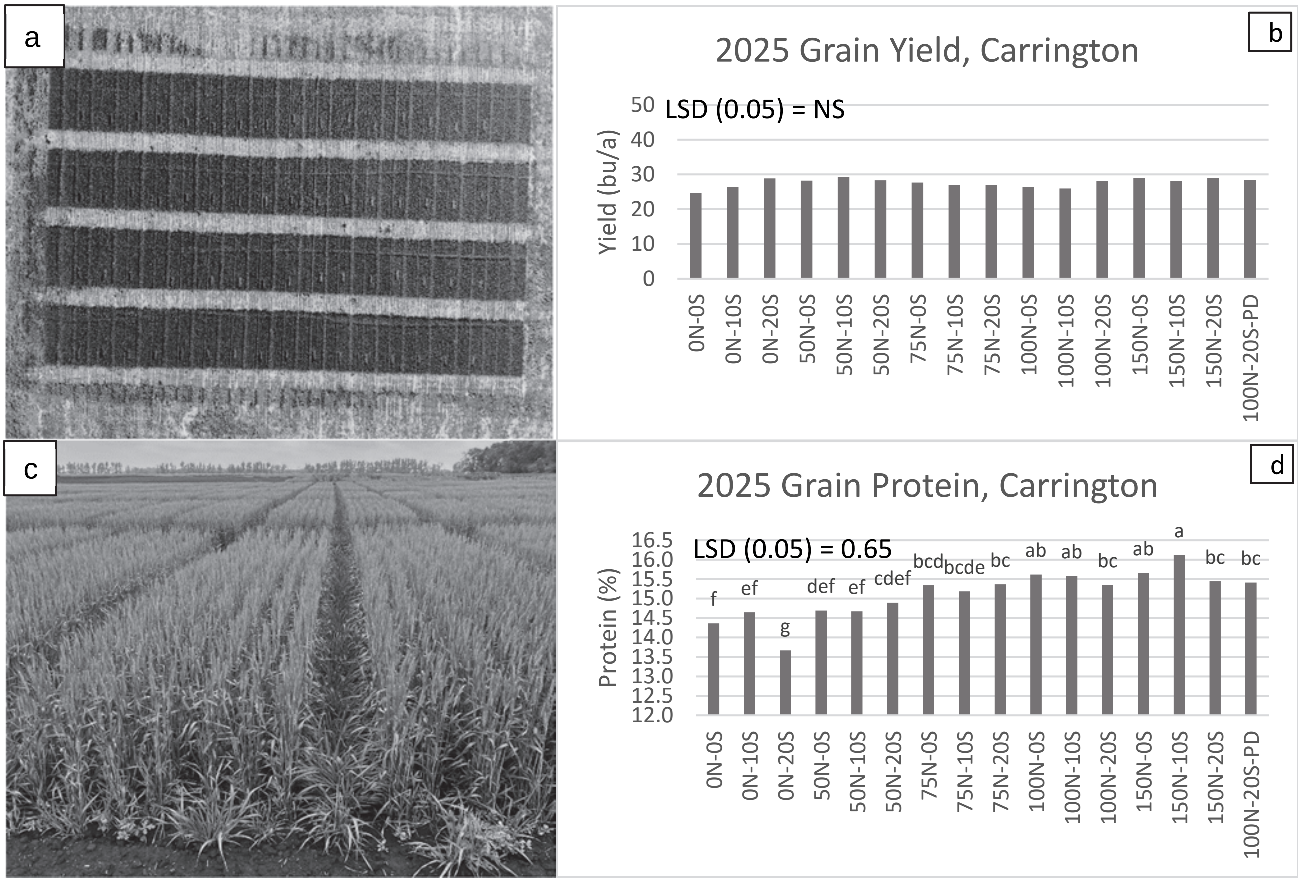

Figure 3. Spring wheat yield and quality, 2025, Carrington, ND. (a) Drone image at flowering stage, not simple differences observed; (b) Wheat yield graph; (c) Wheat at heading stage; (d) Spring wheat protein content graph.

As we approached harvest, visual observations, drone images, and plot photos all showed an even crop across all treatments. The yield data confirmed that there were no significant differences among treatments, with an average of 27.6 bu/acre. This yield is low for the area and was the result of several factors: heavy lodging after a wet August, declining numbers, and intense pressure from bacterial blight and *Fusarium*. The variety used, MN Rothsay, also struggled under these conditions. While yield did not respond, protein did (Figure 3d). Treatments with more than 75 lb N/acre produced noticeably higher protein, and combinations around 150 lb N with 10–20 lb S reached values above 16 percent. In this location, higher N and S improved quality, even though yield was limited by the season.

St. Paul in 2025 experienced a very wet growing season, with rainfall almost 20 percent above average, along with a cool spring. The soil is a sandy loam under conventional tillage, with naturally high fertility. Drone imagery at Feekes 5 showed a very uniform crop, and the NDVI and NDRE values confirmed this. NDVI averaged 0.75 and NDRE averaged 0.40, with no significant differences among N and S treatments. Just like in Carrington, early indicators suggested that yield differences would be minimal.

Later in the season, drone photos revealed heavy lodging caused by the extremely wet conditions (Figure 4a). Yield data, however, did show significant differences (Figure 4b). The highest yield, 71 bu/acre, occurred with the 50 lb N treatment and no sulfur. This plot had slightly less early vigor than the higher-N treatments, which may have allowed for better standability and more effective seed set under the lodging pressure. Protein content responded to nitrogen. A split application of 100 lb. N with 10 lb. S reached 15.8 percent protein, clearly higher than the 14.1 percent observed in the 0N–0S treatment (Figure 4d). Overall, the St. Paul site demonstrated that protein gains from N and S were consistent, even when lodging and weather limited yield.

Figure 4. Wheat yield and quality, 2025, Saint Paul, MN. (a) Drone image prior to harvest showing severe lodged plants; (b) Wheat yield graph; (c) Sergio Cabello-Leiva during the flowering period at the plots; (d) Spring wheat protein content graph.

Conclusions

Based on the two seasons of research, this study supports that a split application strategy for nitrogen and sulfur can be a sensible tool for spring wheat production, providing benefits that span both high-response and low-response growing conditions.

The 2024 season clearly demonstrated the potential for significant gains in both yield and efficiency when conditions are favorable for a response. Adopting split sulfur and N applications offers multiple benefits for wheat production. Sulfur rates of 10 and 20 lbs/acre increased wheat yield by $30.5\% at equal nitrogen levels. Furthermore, split applications with 25% less nitrogen proved as effective as full-rate applications applied entirely at planting. Overall, split N and S applications showed the potential for higher yields with less fertilizer, offering a promising strategy for sustainable wheat production.

In contrast, the 2025 season highlighted the importance of the split application system for risk management and economic decision-making. In a season shaped by heavy rainfall, temperature, and lodging, there were no meaningful differences in final yield across fertilizer treatments. The most important lesson from this project is the power of in-season diagnostics: by Feekes 5, NDVI and NDRE readings clearly indicated there would be no response to additional fertilizer. This is a significant practical opportunity for growers to save fertilizer and money.

In summary, the combined results support the use of a split N and S fertilizer program, specifically when integrated with precision agriculture tools. These tools, whether drone imagery, NDVI sensors, or handheld devices, offer a quick and reliable way to assess crop status. With a split application system in place, growers gain flexibility to maximize profitability by driving yield in responsive years (2024) and reduce input costs and environmental impact by confidently skipping unnecessary applications in non-responsive years (2025). While protein increases were significant at N rates above 75 lbs/acre, growers must weigh the cost of these increases and extra passes across the field against the benefit when final yield is unaffected. Further testing will help fine-tune N and S recommendations, but this research establishes an encouraging pathway toward more efficient, profitable, and environmentally friendly wheat farming.

References

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Effect of Rainfall During the Harvest Interval on Barley Preharvest Sprouting

Kristin Simons and Mike Ostlie

Barley nearing maturity is highly vulnerable to quality degradation during late-season rainfall. As grain transitions from the soft dough stage through physiological maturity and into dry-down, its natural dormancy mechanisms are gradually lost. When rainfall, high humidity, or prolonged wetting occur during this window, kernels may absorb moisture and initiate germination on the head (preharvest sprouting; PHS). PHS is a major concern for both feed and malting markets, but the economic risks are greatest for malting barley, where enzymatic activity, starch integrity, and uniform germination are essential for malt production.

PHS is driven by a simple biological trigger. Once mature kernels imbibe enough moisture, the hormonal balance between abscisic acid (ABA) and gibberellic acid (GA) shifts, signaling germination. Rainfall late in the season accelerates this process, especially when temperatures are warm and drying conditions are poor. Barley with poor dormancy, either genetically or due to environmental conditions during grain fill, is particularly susceptible. Repeated rainfall events, heavy dews, and extended periods of humidity above 85% are sufficient to damage quality even if kernels do not visibly sprout.

Producers often observe sprout damage after storms that occur when grain moisture has already fallen below 18%. At this point the crop is close to harvest and any re-wetting event can lead to rapid enzyme activation. Once activated, enzymes such as alpha-amylase begin breaking down starch, directly reducing test weight, altering grain hardness, and weakening end-use performance. Even moderate sprout damage can result in rejected malting contracts, downgraded feed grades, and/or substantial price discounts. For producers, understanding environmental drivers of PHS and the effect of moisture amounts and timing is key in the harvest decision.

This research report evaluates pre-harvest rainfall impacts on barley seed including test weight, protein, sprout damage, and germination.

Methods

The trials were split plot arrangement with irrigation timing being the main plot effect and the split-plot factor was a foliar mineral application. The goal was to apply water at three different times during grain dry-down, marginal (18-20% moisture), wet (15-17% moisture) and dry (12-14% moisture). The study was conducted in both 2024 and 2025. In 2024, the dry-down period was wet and the irrigation treatments were modified. Treatment one was no additional water, treatment two was one irrigation event at wet harvestability and treatment three was two irrigation events at both marginal and wet harvestability (Figure 1). In 2025, the dry-down period had little rainfall, and irrigation happened one time at marginal, wet or dry harvestability (Figure 2).

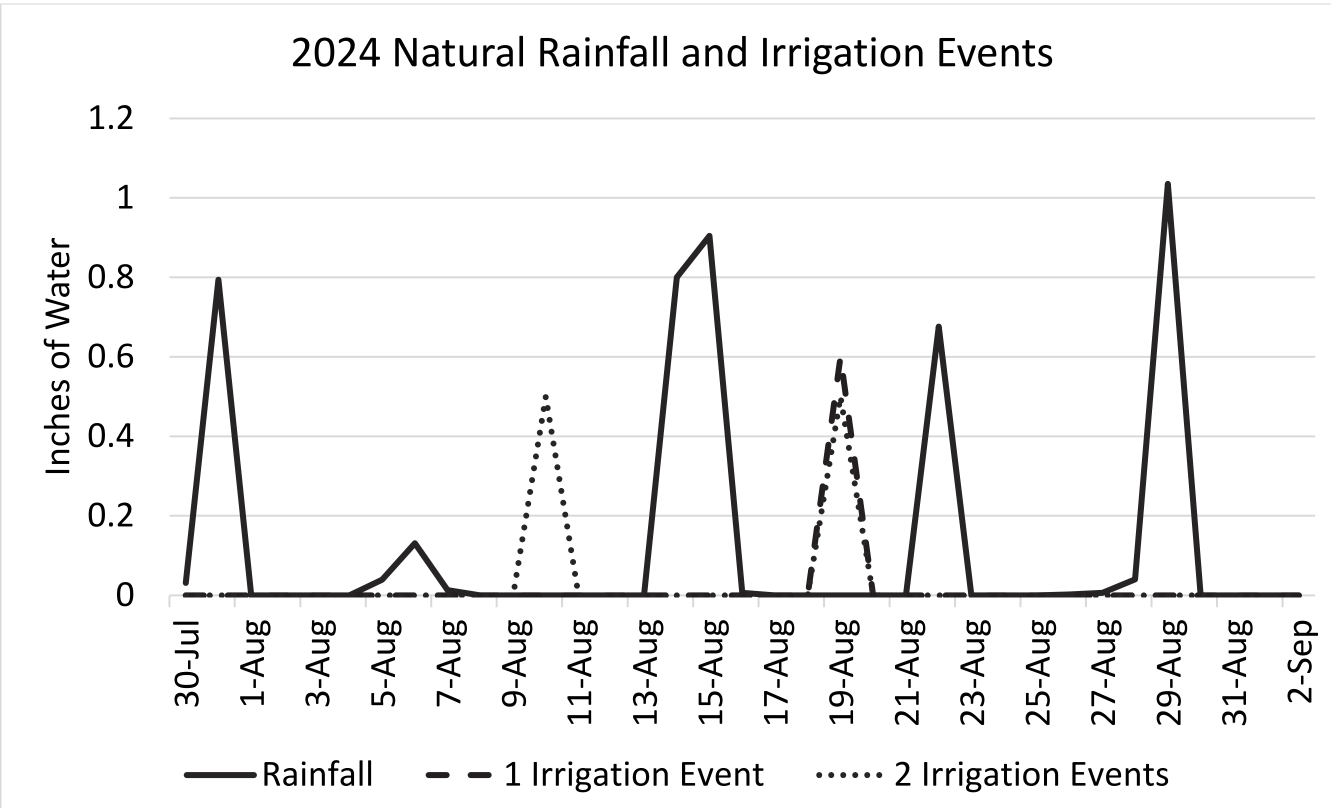


Figure 1. In 2024, rain fell regularly each week. The single irrigation event happened on August 19 when the barley was at 17% moisture. The two irrigation events happened on August 10 (20% moisture) and 19 (17%).

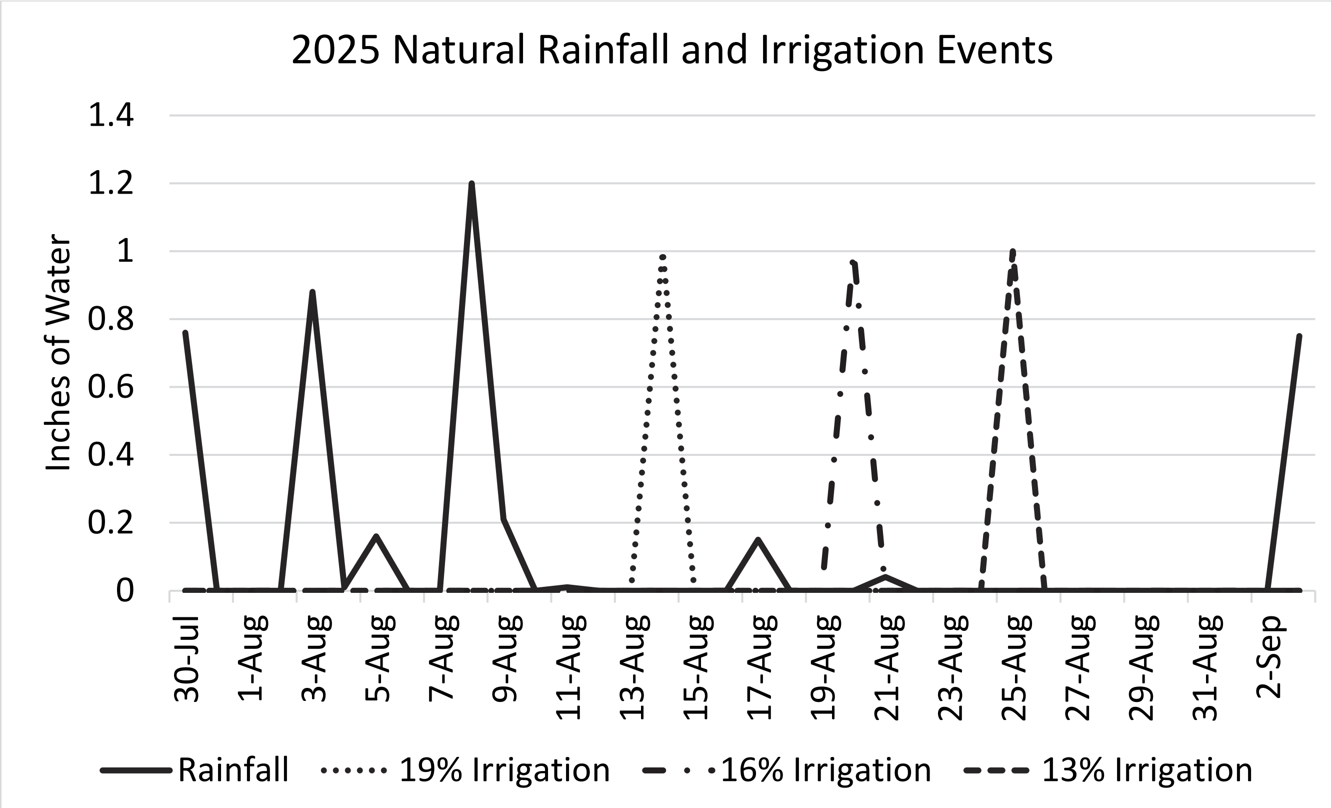


Figure 2. Rainfall was relatively scarce during barley dry-down in 2025. The single event irrigations happened at 19%, 16% and 13% moisture.

Data collected during the season included planting date, harvest date, rainfall, and irrigation events. Seed data included test weight, protein (NIR), immediate germination (dried one day after harvest), delayed germination (dried and stored 30-60 days after harvest) and sprout damage (partial processing by Anheuser-Busch). The foliar product (Stoller Sugar Power) was applied at 32 oz/acre at soft dough stage. Data analysis was completed using the ANOVA function in Genovix.

Results

The trial was planted on May 10, 2024. Several major storms occurred during the 2024 growing season and left the trial severely lodged. Since yield was not a major component of the trial, it was harvested on September 3, 2024. The moisture average during harvest was 13%. Across all traits, no significant differences were observed between Sugar Power and the untreated check. However, sprout damage differed significantly among irrigation treatments, although test weight, protein, and both germination measurements did not (Table 1). Significant differences were observed for the interaction between the foliar application and the irrigation events for only the germination done immediately after harvest, but this difference did not carry over into delayed germination or sprout damage (Table 2).

Table 1. Irrigation treatment significant differences were observed only in the amount of sprout damage found in each treatment.

	Protein	Test Weight	Germ 0 days	Germ 30 days	Sprout Damage	
No Irrigation	14.0	39.8	64.7	53.1	5.6	a
1 Irrigation Event	14.3	39.6	67.3	54.1	6.5	b
2 Irrigation Events	13.6	39.2	63.2	51.2	8.0	c
Mean	14.0	39.5	65.1	52.8	6.7	
C.V. (%)	5.5	2.4	11.4	17.2	24.2	
LSD (0.10)	NS	NS	NS	NS	0.8	

Values followed by different letters are significantly different at P = 0.10.

Table 2. Signficant interaction was identified only for the germination done immediately post harvest.

	Protein	Test Weight	Germ 0 days		Germ 30 days	Sprout Damage
2x Irrigation – Sugar Power	13.7	39.2	60.2	a	50.5	8.2
2x Irrigation – Untreated	13.5	39.3	66.2	ab	51.8	7.7
1x Irrigation – Sugar Power	14.6	39.6	68.0	b	56.3	6.1
1x Irrigation – Untreated	14.1	39.5	66.7	ab	51.8	6.9
0x Irrigation – Sugar Power	14.2	39.9	69.0	b	53.5	5.9
0x Irrigation – Untreated	13.8	39.6	60.3	a	52.7	5.3
Mean	14.0	39.5	65.1		52.8	6.7
C.V. (%)	5.5	2.4	11.4		17.2	24.2
LSD (0.10)	NS	NS	7.5		NS	NS

Values followed by different letters are significantly different at P = 0.10.

The trial was repeated in 2025 with planting and harvest dates within a day of 2024 dates. The harvest moisture was higher at 17% moisture due to the forecasted rainfall for the following day. As in 2024, Sugar Power did not significantly affect any seed quality trait. However, irrigation timing significantly influenced both sprout damage and harvest germination (Table 3). No interactions between irrigation timing and the foliar product were detected.

Table 3. Sprout damage was significantly less in the treatment that received irrigation during the marginal harvestability timeframe compared to the irrigation events occurring during the wet or dry harvestabilty timeframe.

	Protein	Test Weight	Germ 0 days		Germ 60 days	Sprout Damage		Germ AB*
Marginal (18-20%)	12.1	47.6	95.3	b	93.5	1.83 a	a	99.17
Wet (15-17%)	12.3	46.0	91.8	a	92.8	9.9 c	c	99.0
Dry (12-14%)	12.5	46.5	93.6	ab	93.4	7.9 b	b	99.3
Mean	12.3	46.7	93.6		93.4	6.51		99.1
C.V. (%)	2.23	2.03	2.4		3.8	8.6		0.6
LSD (0.10)	NS	NS	2.0		NS	2.0		NS

Values followed by different letters are significantly different at P = 0.10.

* Germ by Anheuser-Busch.

Discussion

Sprout damage values were tightly grouped in 2024, likely due to the consistently wet conditions during dry-down. When all treatments repeatedly experienced natural re-wetting, differences caused by controlled irrigation were minimized. In 2025, the drier conditions provided clearer treatment separation and highlighted how even a single rainfall or irrigation event after grain reaches ~19% moisture can sharply increase sprout susceptibility. It is also important to note that sprout damage was likely underreported, as values of 10% or greater were simply classified as “10+%.”

The effects of Sugar Power remain uncertain. In 2024, Sugar Power appeared to reduce sprout damage and increase germination in the one-irrigation and no-irrigation treatments, but the opposite pattern occurred in the two-irrigation treatment. Lodging, uneven maturity, and the prolonged wet period likely increased plot-to-plot variation and obscured treatment effects. In 2025, Sugar Power had no measurable impact on germination or sprout damage, and differences were associated with irrigation timing and not the foliar application.

Because Sugar Power is a foliar-applied mineral product, its performance is indirectly influenced by soil conditions. Variability arises from the soil’s inherent mineral supply and its ability to support uniform crop maturation. In fields where background nutrient availability is already sufficient to support a smooth dry-down process, additional foliar minerals may produce little visible effect. However, in soils with marginal micronutrient levels or imbalanced mineral profiles, the crop may be more responsive to supplemental foliar nutrition, particularly under weather conditions that disrupt normal dry-down. These are the environments where Sugar Power’s effects in reducing susceptibility to sprout damage may be more clearly observed. Ultimately, season-to-season weather variation (rainfall timing, humidity during maturation, and cooling periods) interacts with soil mineral status to determine how consistently such products perform.

This research was partially funded by the North Dakota Barley Council and Stoller.

Effects of Sprayer Travel Speed on Weed Control Applying Liberty Ultra

Jeff Stachler

Liberty Ultra has limited translocation in plants and when applied, it is best treated as a contact herbicide. Field observations have been made in which kochia plants are dead on one side and not the other. The theory behind the lack of control is that sprayer travel speed is too fast. With partial funding from the North Dakota Soybean Council, a sprayer travel speed trial using a pulse width modulation sprayer was established in 2025 at the Carrington Research Extension Center (CREC).

The sprayer travel speed trial was tilled May 28, 2025, and planted May 30, 2025, with an E3 soybean variety. Treatments included four sprayer travel speeds of 6, 8, 10, and 11.5 miles per hour. Plot size was 11 feet wide by 25 feet in length with treatments replicated five times. Due to seedbed and rainfall issues, few Powell amaranth, kochia, common lambsquarters, and annual grass species emerged initially, however, after significant rainfall, a second flush of Powell amaranth, kochia, and common lambsquarters emerged, but at a low density. Due to the low plant density, 12 to 20 individual plants of 3 to 6-inch kochia, common lambsquarters, and Powell amaranth were flagged prior to herbicide application to calculate plant mortality and separate the early emerging and taller (7 to 24 inches) plants from the later emerging (3 to 6 inch) plants allowing for more accurate visual control evaluations.

Liberty Ultra (29 fluid ounce per acre) plus ammonium sulfate (AMS) (3 pounds per acre) was applied July 24, 2025, at a spray volume of 20 gallons per acre using Wilger nozzles. The soil surface was moist to wet at the time of herbicide application. Visual control of the early emerged weeds (grasses, Powell amaranth, kochia, and common lambsquarters) and visual control and plant mortality of the late emerging flagged plants (Powell amaranth, kochia, and common lambsquarters) was evaluated 16 and 30 days after herbicide application. Based upon the similarity of three of the five replications having a significant density of early emerging weeds causing a difference in spray coverage of the smaller plants, only these three replications were used to analyze the data.

Sprayer travel speeds had no negative impact on control of small or large kochia and common lambsquarters plants with Liberty Ultra. Visual control and mortality of small Powell amaranth plants was maximized at sprayer travel speeds of 6 and 8 miles per hour compared to sprayer travel speeds of 10 and 11.5 miles per hour. Visual control of large Powell amaranth plants was best at a sprayer travel speed of 8 miles per hour. Unfortunately, this one-year trial demonstrates Liberty Ultra does not completely control Powell amaranth regardless of plant height. The best visual Powell amaranth control was only 88% at a 6 miles per hour sprayer travel speed. The taller the Powell amaranth, the poorer the visual control with maximum control reaching only 74% with Liberty Ultra at a sprayer travel speed of 8 miles per hour. More research needs to be conducted to better understand Powell amaranth control with Liberty.

Table 1. Effects of sprayer travel speed on three weed species with application of Liberty Ultra[1].

Sprayer Travel Speed	Visual Control		Mortality[2]	Visual Control		Mortality[2]	Visual Control		Mortality[2]
mph	%			%			%		
	Large PA	Small PA	Small PA	Large kochia	Small kochia	Small kochia	Large LQ	Small LQ	Small LQ
6	69	88	80	95	99	100	100	99	100
8	74	78	68	96	97	100	100	97	100
10	63	65	51	94	95	98	100	98	100
11.5	57	63	33	98	98	100	100	99	100
CV (%)	13.2	8.4	26.3	4.6	5	1.9	0	2.9	0
LSD (0.10)	13.8	10.2	26.3	NS	NS	NS	NS	NS	NS

[1]Liberty Ultra (29 fluid ounces/A) plus AMS (3 pounds/A) applied July 25, 2025. Trial evaluated August 23, 2025.

[2]Mortality based on the percentage of 12 to 20 flagged 3- to 6-inch plants of each species in each plot prior to herbicide application that died from Liberty Ultra application.

[2]Large plants were 7 to 24 inches tall; small plants were 3 to 6 inches tall.

Abbreviations: PA = Powell amaranth; LQ = common lambsquarters.

This research was partially funded by the North Dakota Soybean Council.

Early Planting and Hybrid Maturity Effects on Red Sunflower Seed Weevil (*Smicronyx fulvus*) Damage in North Dakota Sunflower Production

Kristin Simons and Jarrad Prasifka

The red sunflower seed weevil, *Smicronyx fulvus*, remains the most economically important insect pest of sunflowers in the northern Great Plains. In South Dakota, growers now routinely report severe yield and oil losses *as S. fulvus* populations have reached historic highs and developed resistance to pyrethroids. In contrast, populations in North Dakota have remained comparatively stable, though historically they have reached damaging levels exceeding 100 weevils per plant.

Early planting and early-maturing hybrids successfully reduced *S. fulvus* damage in trials conducted during the 1980s. Recent industry concerns combined with higher spring temperatures and shifts in tillage practices and insecticide efficacy raise the question of whether these cultural strategies could again be beneficial, particularly if North Dakota begins experiencing similar outbreaks. However, the later insurance-approved planting window for North Dakota may narrow the window of pest avoidance.

To address these uncertainties, this study summarizes results from multi-year field trials in both North Dakota and South Dakota focusing on the sites at Dickinson and Carrington, ND. This study evaluated whether early planting and early-maturing hybrids provided measurable reductions in *S. fulvus* damage and whether these strategies influenced yield or oil content under present ND pest pressure.

Materials and Methods

Trials were conducted at Dickinson (western ND) and Carrington (central ND) from 2022–2024, representing three site-years where *S. fulvus* was present at measurable levels. At each site, two hybrids (one early-maturing and one normal maturity) were planted across three or four planting dates aligned with the local crop insurance window. Plot sizes varied by site, but all received standard agronomic management and no insecticide applications.

A number of field observations were collected including the onset of pollen shed (≈10% R5). Combine harvests or hand-harvested subsamples were used to quantify yield (lb/a), and oil content was measured using NMR analysis. X-rayed subsamples (100–200 seeds per plot) were assessed for *S. fulvus* feeding injury and secondary lepidopteran damage. Each site-year was analyzed separately for effects of planting date, hybrid, and their interaction.

Results

North Dakota sites had more compressed bloom windows compared with South Dakota. Across ND site-years, planting dates differed by 28–33 days, yet bloom onset often differed by less than half that interval because later plantings accumulated heat units more rapidly. Reduced phenological separation limited opportunities for bloom to escape peak weevil emergence.

Seed damage by *S. fulvus* was variable by site and year.

Dickinson (2022)

- Hybrid × planting date interaction was significant in 2022.
- Early planting reduced weevil damage by >70% only in the early-maturing hybrid.
- The normal-maturity hybrid showed no significant date effect, indicating that hybrid choice influenced whether early planting provided any benefit.

Carrington (2023 and 2024)

- Planting date had no effect on *S. fulvus* damage and damage remained low across all timings 2023.
- In 2024 the early planting (17 May) showed slightly lower weevil damage, but injury was confounded by substantial seed feeding from *Cochylis hospes* (banded sunflower moth), making *S. fulvus*-specific patterns less clear.

The overall ND pattern showed very little effect of planting date. When planting date did reduce damage, the effects were hybrid specific. The low pest populations in ND during these study years likely contributed to the absence of detectable, consistent trends.

Effect of *Cochulis hospes* caused misshapen heads and confounded the weevil results for 2024.

Yield and Oil Content
Across ND site-years, yield (lb/a, data not shown) was not significantly influenced by planting date, with the exception of hybrid-related effects in some years. These findings contrast with South Dakota, where late-June plantings often yielded less due to higher *S. fulvus* pressure.

No clear, repeatable pattern emerged linking oil content to planting date in ND. Notably, regression analyses from South Dakota showed strong negative associations between weevil injury and oil content, but this relationship was much weaker in North Dakota because seed damage levels were lower and more variable.

Discussion
Across three location-years in North Dakota, early planting and early-maturing hybrids did not provide consistent reductions in *S. fulvus* seed damage. Several factors likely explain these results:

- Weevil abundance in ND remained modest compared with the severe infestations in South Dakota. Cultural tactics that rely on large phenological mismatches may be difficult to detect statistically when baseline pest pressure is low.
- North Dakota's crop insurance planting window begins about 15 days later than South Dakota's, limiting how early growers can plant. As a result, even the earliest ND plantings may still overlap significantly with weevil emergence.
- Rapid heat accumulation in late May and June shortened the interval between bloom in early vs. late plantings. This biological convergence reduces the potential for avoidance.
- At Dickinson in 2022, only the early-maturing hybrid showed reduced damage in early planting, suggesting that hybrid phenology may need to advance more than planting date alone to achieve consistent avoidance in ND.

Despite low weevil pressure during these trials, historical outbreaks in ND and strong gene flow across the region mean that resistance-driven population increases remain possible. If *S. fulvus* pressure rises in ND, cultural avoidance may become more beneficial—similar to the clear advantages demonstrated in South Dakota.

Effect of Maturity Grouping on Row Spacing Recommendation in ND

Agustin San Pedro and Kristin Simons

Soybean cultivation is expanding into Western North Dakota, but many of the management practices currently in use are based on research conducted under conditions typical of Central and Eastern North Dakota. One key finding from previous research is that narrower row spacing (less than 15 inches) generally leads to higher soybean yields compared to wider row spacing (greater than 15 inches). However, a 2024 on-farm demonstration near Wishek, ND, reported a counterintuitive finding where wide-spaced rows exhibited a 30% yield advantage over narrow-spaced rows. The primary objective of this subsequent 2025 study was to determine whether the yield results from the 2024 demonstration represented an anomalous environmental interaction or if they signaled a need to revise current soybean row spacing guidelines for the semi-arid climate zones of Western North Dakota.

Methods
The study was established near Wishek, ND, on May 28, 2025, employing a split-plot design with three replications. The treatment structure included three distinct row spacings: 15, 22, and 30 inches. Two soybean varieties, ND17009GT (maturity group 00.9) and ND2108GT73 (maturity group 0.8), were utilized to assess variety-specific responses. The earliest maturity variety, ND17009GT, was harvested on October 2, followed by ND2108GT73 on October 7. The study experienced a significant abiotic stress event with freezing temperatures occurring on September 6.

Results

The 2025 replicated study yielded results that contradicted the 2024 observation. Specifically, row spacings of 15 and 22 inches resulted in significantly higher yield compared to the 30-inch row spacing (Figure 1). Furthermore, statistical analysis indicated no significant yield differences between the two varieties tested. Seed count and height data revealed that the number of seeds did not significantly vary across row spacings or varieties, with an average of 96% of the seeds found above 10 cm from the ground across all treatments. The previous years where the 30-inch row spacing demonstrated superior yield could be related by a reduction in total rainfall during the critical August podding stage, suggesting a possible interaction between wide spacing and drought stress (Figure 2). Although close row spacing is known to promote rapid canopy closure for soil moisture conservation, the efficacy of different row spacings and maturity groups requires dedicated research on water use efficiency in semi-arid conditions. Plant height and test weight were found to be solely determined by variety and not influenced by row spacing, with variety 00.9 exhibiting significantly higher values for both parameters. This supports the general conclusion that pod height and plant height are primarily under genetic (varietal) control and are largely unaffected by the agronomic management practice of altering row spacing.

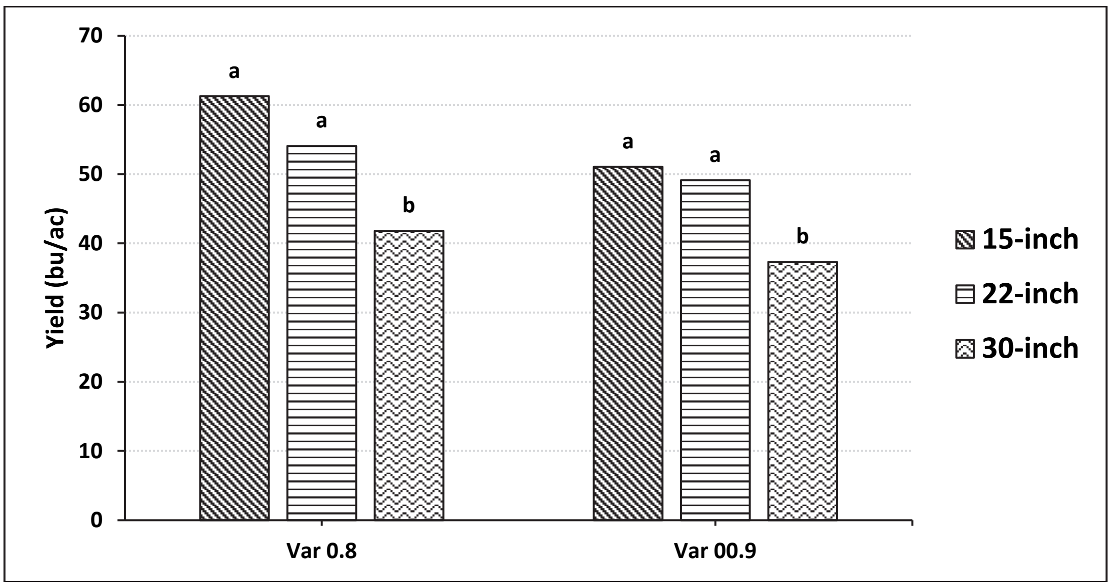


Figure 1. Soybean grain yield across varieties and row spacings.
Different lowercase letters above each graph bar represent significant differences at 95% confidence.

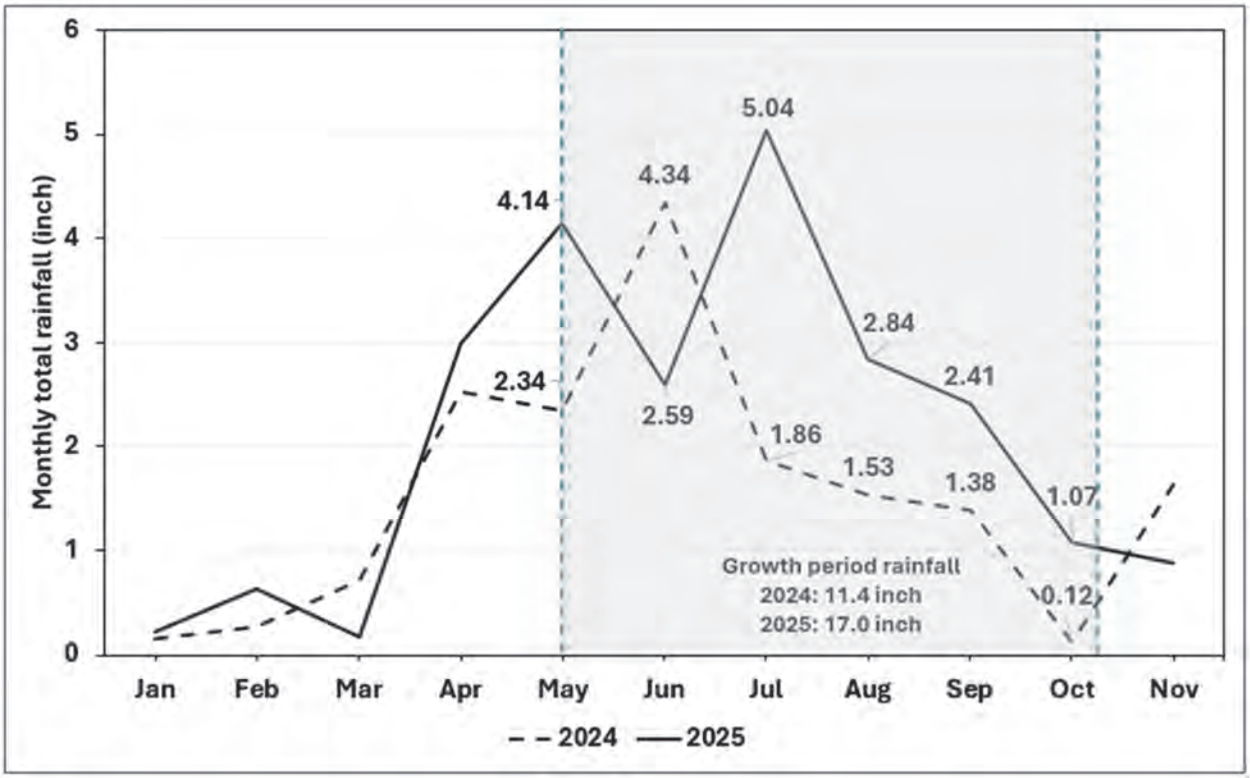


Figure 2. Monthly total rainfall during 2024 and 2025 in Wishek, ND.

The findings from the 2025 study suggest that the significant yield advantage observed with wider rows in the 2024 demonstration was an environmental anomaly likely linked to severe August drought conditions, and the results do not support a change in general row spacing guidelines for the region. Future research efforts should be strategically concentrated on evaluating the interaction between row spacing and variety selection specifically adapted for the drier climatic zones characteristic of Western North Dakota to provide optimal management recommendations for agricultural producers.

This research was partially funded by the North Dakota Soybean Council.

Beyond the Bushel: How Wheat Boosts Cover Cropping Opportunities.

Marcos Menghini, Luis F. B. Pires, Ezra Aberle, Maria E. Boemo, Marcos Centurion, Leandro Bortolon, Karen Kawakami, and Carlos B. Pires

Farmers' interest in planting cover crops has increased in North Dakota in recent years. The short growing season makes it challenging to intensify crop production. However, small grains such as hard red spring wheat (HRSW) create a valuable window of opportunity to establish cover crops that protect soil, improve soil health, and build more resilient cropping systems. To help define how best to use that window in eastern/central ND, we evaluated how different cover crop seeding timings and methods affect cover crop biomass production, weed suppression, canopy cover, and HRSW grain yield.

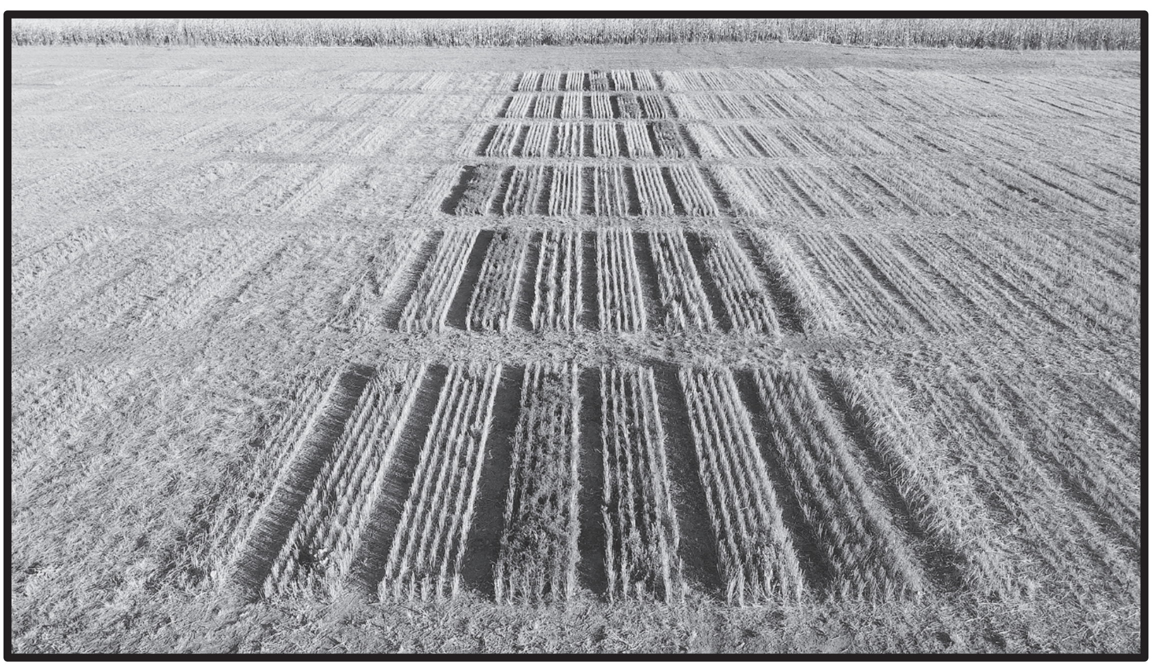
Materials and Methods

The first year of this three-year trial was conducted in 2025 at the Carrington Research Extension Center (CREC). Treatments were arranged in a randomized complete block design (RCBD) with six treatments and six replications under a no-till system (Table 1).

Table 1. Treatments, and trial management information.

Section	Description
Treatments	1. No cover – Volunteer HRSW terminated with Paraquat.
	2. Volunteer HRSW only
	3. Volunteer HRSW + turnip (8 lb/ac) and hairy vetch (15 lb/ac), broadcast at flowering (Feekes 10.5).
	4. Volunteer HRSW + turnip (5 lb/ac) and hairy vetch (10 lb/ac), drilled after harvest.
	5. Volunteer HRSW + cereal rye (80 lb/ac), broadcast at flowering (Feekes 10.5).
	6. Volunteer HRSW + cereal rye (80 lb/ac), drilled after harvest.
Trial information	HRSW planting: 5/14/2025; Cover crop broadcast: 7/17/2025; HRSW harvest: 8/27/2025; Cover crop drill: 8/28/2025; Plant and weed biomass sampling: 10/7/2025.
Variety seeding rate	ND Frohberg; 1.8 million pure live seeds/ac.
Plot size	5 ft wide × 25 ft long.
Herbicide program	5/24/2025: glyphosate, 32 oz/ac (7 mph NE, 67° F). 6/11/2025: fenoxaprop-p-ethyl, 11 oz/ac, and clodinafop-propargyl, 16 oz/ac (6 mph N, 49° F).

Hard red spring wheat was seeded on May 14, 2025, at 1.8 million pure live seeds per acre in 5-by-25-ft plots, giving a 105-day wheat growing season. Cover crops were broadcast into the wheat canopy at flowering (Feekes 10.5) on July 17, providing 82 days of growth before biomass sampling. Alternatively, cover crops were drilled into the wheat stubble on August 28, one day after grain harvest (August 27), resulting in 40 days of growth.



Trial overview at Carrington, ND, 2025.

Sampling was conducted on October 7, one day after the first killing frost. Aboveground cover crop biomass (including volunteer HRSW) and all weeds within each plot were sampled from a 2.7 ft^2 quadrat (Figure 1). Weeds were counted, identified, and collected to determine weed biomass. All biomass samples were oven-dried and weighed to obtain dry matter. At the time of biomass sampling, a digital photograph was taken of each plot and analyzed using Stover software to estimate the percentage of soil surface covered by living plants. Grain yield was measured for each plot and adjusted to 13.5% moisture content. Data were analyzed using analysis of variance (ANOVA), and when treatment effects were significant, means were separated by Fisher's LSD at the 5% probability level ($p \leq 0.05$).

Figure 1. Sampling using a 2.7 ft^2 quadrat at Carrington, ND, 2025.

Results and Discussion

Above-ground biomass was lowest in the no-cover crop treatment (T1) while all cover-crop treatments (T2-T6) produced more biomass and did not statistically differ from one another (Figure 2). However, adding a cover crop increased fall biomass from zero in the no-cover to roughly 2,000-2,600 lb/ac. Treatment 3, which included hairy vetch and turnip broadcast at HRSW flowering, produced the highest biomass at approximately 2,600 lb/ac. Canopy cover followed a similar pattern among treatments (Figure 3). The no-cover treatment again had the lowest value (4% canopy cover), whereas the broadcast turnip + hairy vetch treatment (T3) reached 90% cover. Drilled rye (T6) came with 85% cover, followed by drilled turnip + vetch (T4) and volunteer wheat (T2) in an intermediate group at around 80% cover. Broadcast winter rye (T5) had the lowest canopy cover among the cover-crop options. These patterns are consistent with work in the North American Great Plains showing that well-established cover crops can substantially increase biomass and ground cover, enhancing soil protection and soil health in wheat-based dryland systems (Obour et al., 2021).

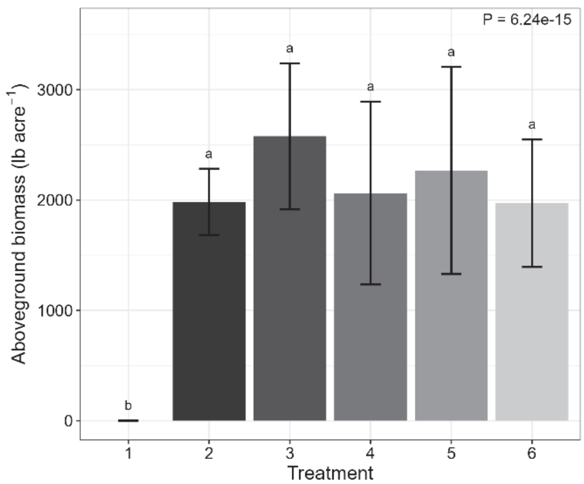


Figure 2. Cover crop aboveground biomass across treatments at Carrington, ND, 2025.
Means followed by the same letter are not significantly different according to Fisher's LSD at the 5% level.

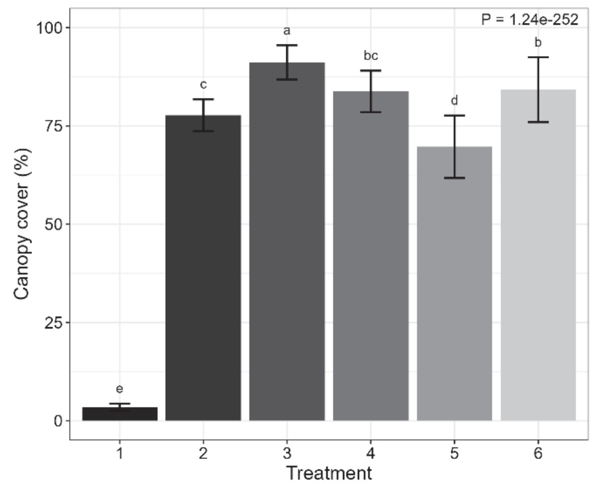


Figure 3. Canopy cover across treatments at Carrington, ND, 2025.
Means followed by the same letter are not significantly different according to Fisher's LSD at the 5% level.

Weed biomass and weed counts showed a consistent response to the cover-crop treatments. The no-cover and broadcast rye (T5) had the highest weed biomass and were not different from each other. In contrast, all the other cover-crop treatments (T2-T4 and T6) formed a lower group with reduced weed biomass (Figure 4). Weed counts showed that the highest densities occurred in the no-cover and were among the highest in broadcast rye, while both turnip + vetch treatments (T3 and T4) had the lowest weed counts (Figure 5). Drilled winter rye (T6) was better than no cover, and although volunteer wheat (T2) reduced weed density, it was not as effective as T3 and T4.

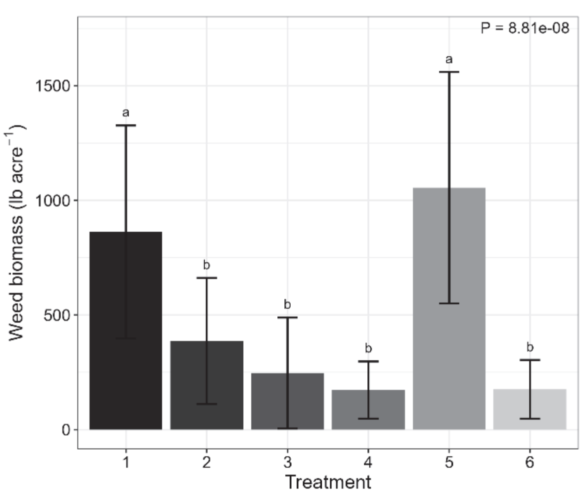


Figure 4. Weed biomass across treatments at Carrington, ND, 2025.
Means followed by the same letter are not significantly different according to Fisher's LSD at the 5% level.

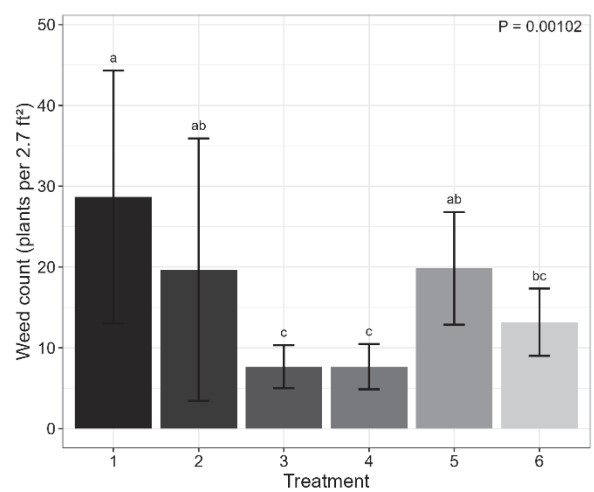


Figure 5. Weed density (plants per 2.7 ft² quadrat) across treatments at Carrington, ND, 2025. **Means followed by the same letter are not significantly different according to Fisher's LSD at the 5% level.**

Grain yield did not differ among treatments (Figure 6), indicating no detectable yield penalty from any cover-crop strategy in this first year. This combination of strong weed suppression with largely yield-neutral responses is in line with other data from the U.S. showing that cover crops can substantially reduce weed pressure while having little to no negative effect on grain yield when properly managed (Osipitan et al., 2019).

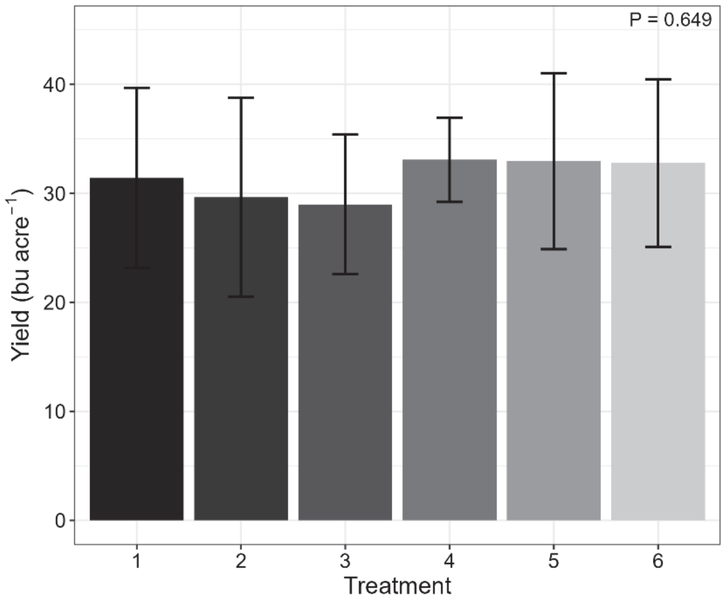


Figure 6. Hard red spring wheat grain yield across treatments at Carrington, ND, 2025. Analysis of variance was not significant.

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Spray Drones in North Dakota: Expanding Aerial Application Where Ground Rigs and Planes Can't Reach

Rupak Karn, Rob Proulx, and Aman Mehta

Spray drones are moving from futuristic concept to practical, working tools on North Dakota farms and ranches. In just a few years, unmanned aerial application has become a real part of the state's crop protection and pasture management toolbox. North Dakota's short growing season, unpredictable weather, and large field sizes create narrow spray windows. Ground sprayers and airplanes both play critical roles, but there are always acres that are difficult, risky, or uneconomical to reach. Spray drones fit into this gap. They are not replacing tractors or airplanes; instead, they offer a flexible third option for acres that other equipment cannot handle efficiently or safely. Figure 1 shows how quickly spray-drone activity is expanding. Since unmanned aerial applicator licensing began in 2022, the number of licensed spray-drone pilots has increased rapidly, and unmanned aerial application acres have risen from a few thousand acres to roughly 69,000 acres by 2024, while manned aircraft continue to treat approximately 4.8–5.4 million acres annually across the state.

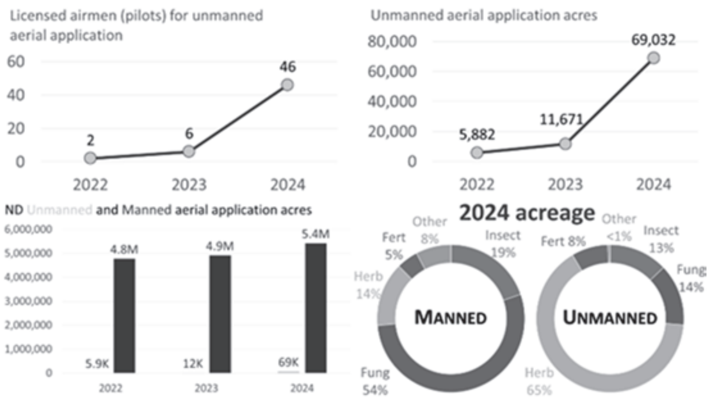

Figure 1. Growth of Manned and Unmanned Aerial Application in North Dakota, 2022–2024.

What Are Spray Drones and Why Are They Growing?

Modern spray drones are battery-powered, multi-rotor aircraft that take off vertically, hover, and follow GPS-guided routes over fields. They carry a spray tank with a boom or rotary nozzles, maintain a set flight height, and automatically shut off flow at field boundaries. Most brands have a range of models with spray widths of 10-40 feet and accommodate low-volume applications. Their appeal comes from a combination of flexibility, precision, and scale-appropriate entry. They can operate when fields are too wet, rough, or broken up for ground rigs, they can treat only the patches of weeds, insects, or disease that truly need attention, and they allow a farmer or custom applicator to start with a single unit rather than immediately investing in a full-size sprayer. Not surprisingly, adoption has been fastest where spray windows are tight and terrain is challenging, conditions that describe many North Dakota fields and pastures.

Reaching Wet, Rough, and Fragmented Acres

North Dakota farmers regularly face fields that are too wet to carry heavy equipment or are broken into awkward pieces by potholes, sloughs, and uneven ground. In these situations, ground sprayers either cut ruts and damage soil structure or leave high-risk areas untreated. Spray drones approach the field from above, not through it. They can fly over potholes, standing water, and soft ground without causing ruts or compaction and can reach small islands of crop surrounded by wet areas. In rolling or rough terrain, they can safely treat hillsides and coulees where traction and rollover risk are serious concerns for ground rigs. In no-till and minimum-till systems, this is especially important because drones allow operators to protect yield in problem spots without sacrificing soil structure or creating long-term traffic damage.

Hitting Critical Spray Windows

In North Dakota, timing is everything. A one- or two-day delay after rain can mean the difference between effective control and a missed opportunity. Spray drones help producers respond quickly. This is important when weeds emerge after a storm and require timely herbicide applications, when disease risk spikes during humid conditions and a fungicide pass is needed, or when insect populations flare up in localized areas. Because drones do not depend on soil trafficability, they can often fly when ground rigs must wait. They also lend themselves to spot spraying, allowing treatment only where needed rather than across an entire field. Under safe conditions and according to regulations, some flights can be planned in calmer evenings or early-morning periods, further improving application conditions and helping producers stay within narrow spray windows.

Labor, Equipment, and Entry Costs

Labor is tight on many North Dakota operations, especially during spring and summer when planting, spraying, and haying all compete for time. Operating large ground sprayers and coordinating airplane schedules require planning and experienced operators. Spray drones can ease some of this pressure because one licensed operator can manage multiple flights per day using stored and repeated flight plans. Custom applicators can add drones to their fleets to handle acres that are not ideal for their larger equipment or that require more targeted work. For smaller farms and beginning farmers, spray drones also provide a lower-cost entry into pesticide application. Instead of purchasing a self-propelled sprayer, some producers may choose to purchase a spray drone but hire manned aircraft or ground rigs for broad-acre passes and reserve the drone for high-priority or difficult acres.

Safety and Stewardship

Spray drones contribute to safety and stewardship across both cropland and rangeland. With drones, the operator stays on the ground and away from the spray boom, reducing direct exposure to chemicals. Difficult or dangerous areas, steep slopes, ravines, brushy draws, or rocky hillsides, can be treated without driving equipment into those locations, lowering rollover risk and mechanical damage. Careful planning of flight paths, droplet sizes, and operating heights can help keep applications on target and reduce off-site movement. In pasture and rangeland, drones are particularly well suited for treating small patches of invasive or noxious weeds. Ranchers can address thistles, leafy spurge, or brush in isolated draws or coulees without running ATVs or trucks through sensitive areas, protecting both vegetation and water resources while still maintaining effective control.

How Spray Drones Fit with Manned Aircraft

Spray drones complement, rather than replace, manned aircraft. The data in Figure 1 show that manned aircraft continue to treat millions of acres each year in North Dakota and are used primarily for fungicide and other broad-acre applications on large, continuous fields. Spray drones currently treat a much smaller acreage but are used mainly for herbicide and other targeted applications on smaller, fragmented, or harder-to-reach areas. This division of labor makes sense: airplanes excel at covering large, uniform blocks quickly and efficiently, while drones excel at flexibility, patch treatments, and challenging terrain. Together, they give producers and custom applicators a more complete set of tools to match the application method to the needs and conditions of each field.

NDSU - CREC’s Role and Conclusion

As spray-drone use expands, there is a clear need for North Dakota-specific research and guidance. The spray-drone program at the NDSU Carrington Research Extension Center is focused on evaluating spray coverage and performance under local weather, crop, and terrain conditions; developing operating guidelines for flight height, speed, droplet size, and nozzle configuration; and integrating spray drones into Extension education, demonstrations, and conversations with farmers, ranchers, and applicators. Spray drones are not a replacement for airplanes or ground rigs, but a flexible new tool that fits the realities of farming and ranching in North Dakota. Several emerging areas may one day rely heavily on spray drones including executing prescription spot-sprays in fields with herbicide resistant weed escapes, or application of fungicide or desiccant to tall crops such as corn or sunflower. By improving access to difficult acres, helping producers hit narrow spray windows, and offering a scalable entry into precision application, spray drones are becoming an important part of the state’s aerial application capacity. As adoption continues to grow, research and extension efforts at NDSU CREC and across the state will help farmers and ranchers use these tools safely, efficiently, and profitably in the years ahead. There are still a number of questions to answer such as coverage of contact products, uniformity of application, longevity of mechanical, electronic, or software components, and annual operational costs. If you are interested in learning more about this, or in collaborating with CREC on a project, please reach out; we would love to hear from you!

Energy and Protein Requirements of Finishing Steers Fed Dried Canola Meal

Colin Tobin, Zach Smith, Ana Clara Baiao Menezes, Federico Podversich, and Warren Rusche

Canola meal (CM) is a high-protein coproduct of canola oil extraction and an important feed ingredient for ruminants in regions where it is locally produced. Despite its favorable amino acid profile and digestibility, CM utilization in beef cattle finishing rations has historically remained low due to limited regional availability, higher transportation costs, and competition with other protein sources. However, the recent expansion of renewable fuel production and vegetable oil production across the northern Great Plains has increased both the supply and accessibility of CM, creating new opportunities for its use in feedlot systems.

As beef producers aim to balance performance efficiency with input costs, the potential of CM as a primary protein source warrants renewed investigation. Previous research has established that ruminants can effectively utilize CM without compromising intake or digestibility, yet limited data exist regarding its use in high-energy finishing diets. The protein content and degradability characteristics of canola meal differ from distillers grain plus solubles, with a higher proportion of rumen degradable protein (RDP) and reduced fat concentration, factors that may alter energy retention, fat deposition, and carcass composition when included at higher dietary crude protein (CP) levels.

Determining the optimal CP concentration when formulating canola meal–based finishing diets is critical for maximizing growth performance and carcass quality while maintaining cost-effective production. Incremental increases in dietary CP, such as from 13% to 15%, may influence energy utilization and marbling development, but excessive protein supplementation can reduce efficiency or increase nitrogen excretion.

To address these knowledge gaps, the North Dakota State University Carrington Research Extension Center (CREC) conducted an experiment to evaluate the energy and protein requirements of finishing steers fed canola meal as the sole supplemental protein source. The study compared growth performance, dietary energy utilization, and carcass traits among steers fed 13% and 15% CP rations. Results from this work contribute to a better understanding of how protein level adjustments in canola meal–based feedlot diets can affect finishing outcomes and the economic sustainability of beef production systems in the northern Great Plains.

Materials and Methods

All procedures involving the use of animals in these experiments were approved by the North Dakota State University Institutional Animal Care and Use Committee (approval number IACUC20240031). This experiment was conducted at the CREC between December 2024 and July 2025.

Treatments, animals, initial processing, and study initiation

The analyzed nutrient composition of feed ingredients is presented in Table 1.

Table 1. Nutrient composition of feed ingredients.

	Dietary Treatment[1]	
	13% CM	15% CM
Ingredient, % DM basis		
Dry-rolled corn	74.4	68.7
Barley straw	7.3	6.7
Corn silage	1.9	2.7
Canola meal	13.4	19
Dry Supplement[2] & Limestone	2.9	2.9
Nutrient Composition[3]		
NEm, Mcal/kg	1.95	1.94
NEg, Mcal/kg	1.31	1.29
CP, %	13.03	14.99
RDP, % of CP	61.52	66.42
RUP, % of CP	38.48	33.58
NDF, %	15.75	16.56
Ash, %	4.28	4.58
EE, %	4.28	3.47

[1] Once adaptation diets were stepped up to finishing ration, pens were fed either at 13% or 15% crude protein (CP) diet, depending on treatment.

[2] Provided 30g/ton of monensin as well as vitamins and minerals to exceed requirements (NASEM, 2016).

[3] Dry matter was measured biweekly, nutrient composition were analyzed from pooled monthly composite samples. Net energy and protein values were calculated from NASEM (2016). Dry matter (DM), net energy for maintenance (NEm), net energy for gain (NEg), crude protein (CP), rumen degradable protein (RDP), rumen undegradable protein (RUP), neutral detergent fiber (NDF), ether extract (EE).

One hundred forty-four cross-bred steers (808 ± 91 lbs, initial body weight (BW)) were used in this experiment. Steers were consigned and delivered to the CREC from multiple ranches across North Dakota throughout October and November 2024. Steers were backgrounded on a similar ration for approximately 65 days prior to the initiation of the study.

Steers were stratified by source (Block 1-3). On December 16, 2024, steers from Blocks 1 and 2 were weighed for BW collection, which was used for allotment purposes. On December 17, 2024, steers from Blocks 1 and 2 were reweighed, processed, sorted, and placed into randomly assigned one of 12 pens ([Block 1=8 pens, Block 2=4 pens]. On January 23, 2025, steers from Block 3 were weighed for BW collection used for allotment purposes. On January 24, 2025, steers from Block 3 were reweighed, processed, sorted, and placed into randomly assigned one of 12 pens. All pens were in a randomized complete block design (blocked by source). Pens were randomly assigned to one of two dietary treatments (6 pens/treatment): 13% crude protein with CM as the sole protein supplement (13% CM); 15% crude protein with CM as the sole protein supplement (15% CM). The experiment was initiated on June 13, 2025, with a 28-d adaptation period and a 183-, 169- and 171-d finishing period for Block 1,2, and 3, respectively. All live BW measurements were pencil shrunk 4% to account for digestive tract fill, in accordance with equations to determine shrunk body weight from NASEM (2016).

Steers were harvested when visually appraised by trained observers to have 12th rib fat (RF) thickness of 0.5 in. Final BWs were recorded at 0800 on shipping day, approximately 24 hours post final feeding the day prior. After weighing, steers to be harvested were comingled into a holding pen and offered water. Steers were gathered for delivery approximately 1200 h and shipped to the commercial abattoir located 800 km from the CREC. Electronic ID tags were used to determine harvest order. Hot carcass weights and video camera image carcass data were collected from the beef plant.

Growth performance, carcass trait, dietary net energy utilization calculations
Three steers (3 from 13% CM) died during the study, due to peritonitis (1), rectal prolapse (1), and respiratory disease (1). Steers that were removed from the study or that died during the study were assumed to have consumed feed equal to the pen mean dry matter intake (DMI) up to the point of removal or death. Overall average daily gain (ADG) was calculated as the difference between initial and final BW. Overall feed conversion efficiency (G:F) was calculated from ADG/DMI.

Observed dietary net energy (NE) was calculated from daily energy gain (EG; Mcal/d) according to the medium frame steer calf equation using the equivalent BW adjustment. Observed-to-expected (O:E) NEm and NEg were calculated from observed dietary NE values for maintenance or gain divided by tabular estimates of NE for maintenance or gain (NASEM, 2016).

Hot carcass weight (HCW) was captured immediately following the harvest procedure. Video image data were obtained from the commercial abattoir for rib eye area (REA), rib fat (RF), and USDA marbling scores. Kidney, pelvic, and heart fat (KPH) percentage was determined via plant-specific algorithm. Dressing percentage (DP) was calculated as: HCW/ (final BW × 0.96). Yield grade (YG) was calculated according to the USDA regression equation (USDA, 2017). Estimated empty body fat (EBF) percentage and adjusted final body weight (AFBW) were calculated from observed carcass traits (Guiroy et al., 2002).

Statistical Analysis
Data were analyzed using the GLIMMIX Procedure of SAS 9.4 (SAS Institute Inc., Cary, NC) with pen serving as the experimental unit. The model includes the fixed effects of protein amount (13%, 15%), and the random effect of block. For the distribution of categorical variables (distributions of USDA Yield and Quality grade), counts for each category were entered by pen, and a multinomial analysis for ordinal data was conducted following the procedure recommended by Bowley (2015), using pen within treatment as the subject. Significance was declared at $P \leq 0.05$, and tendencies were considered when $0.10 > P > 0.05$.

Results
Growth performance data are shown in Table 2. Initial BW or BW after diet adaptation did not differ (P = 0.57) among treatments. A tendency for increased final body weight (P = 0.05) and overall weight gain (P = 0.07) for steers fed 13% CP with a numerical increase of 26 lbs of overall weight gain. Additionally, a tendency (P = 0.08) for increased ADG was observed for steers fed 13% CM. No effect of crude protein level was observed in DMI (P = 0.56) or GF (P = 0.51) or FG (P = 0.33). Additionally, no effect of crude protein was observed for performance adjusted net energy (P = 0.86) or the observed-to-expected ratio of net energy (P = 0.49).

Table 2. Growth performance responses and efficiency of dietary net energy (NE) use.

	Dietary Treatment[1]			*P-value*
	13% CM	15% CM	SEM	*Protein Amount*
Initial bodyweight[2], lb	761	761	24.3	
Bodyweight after adaptation diet[2,3], lb	855	853	29.5	0.57
Final bodyweight[2], lb	1418	1389	37	**0.05**
Overall bodyweight gain, lb	560	534	45	**0.07**
Overall average daily gain, lb	3.84	3.66	0.22	**0.08**
Dry matter intake (DMI), lb	24.03	23.59	1.213	0.56
Overall ADG/DMI (G:F)	0.16	0.157	0.0128	0.51
Overall DMI/ADG (F:G)	6.29	6.5	0.55	0.33
paNE[4], Mcal/kg				
Maintenance	2.03	2.02	0.115	0.86
Gain	1.37	1.36	0.101	0.86
Observed-to-expected NE[5]				
O/E NEm	1.02	0.98	0.034	0.49
O/E NEg	1.02	0.97	0.045	0.49

[1] Treatments were applied from d 1 to 183 (Block 1), d 1 to 169 (Block 2), and d 1 to 171 (Block 3). canola meal (CM).

[2] Body weight was shrunk by 4% to account for digestive tract fill.

[3] Body weight utilized as initial body weight for performance adjusted net energy (paNE) calculations once animals finished adaptation diet. Day 28 (Block 1), d 28 (Block 2), d 35 (Block 3).

[4] Zinn et al., 2008

[5] Observed to expected ratio for NEm and NEg; ratio of paNE values to tabular NE estimates from NASEM (2016).

Carcass trait data are shown in Table 3. No effect of protein amount was observed in HCW, USDA YG, REA, marbling score, dressing percentage, EBF, retail cut %, or AFBW ($P > 0.17$). There was a tendency ($P = 0.06$) for greater rib fat thickness, with a numerical increase observed for steers fed 15% CP. Additionally, a tendency ($P = 0.05$) was observed for an increased distribution of prime graded carcasses for steers fed 15% CP.

Table 3. Carcass traits responses.

	Dietary Treatment[1] 13% CM	15% CM	SEM	*P-value* *Protein Amount*
Carcass Characteristics				
Hot carcass weight, lb	895	899	22.3	0.71
USDA Yield Grade	3.45	3.56	0.19	0.17
Ribeye area, sq in	13.1	13	0.33	0.64
Marbling score[2]	489	489	14.8	0.93
Rib fat, in	0.63	0.67	0.025	**0.06**
Dressing percentage[3], %	64.6	64.2	0.29	0.29
EBF, %	32.4	32.8	0.35	0.31
Retail Cut, %	47.8	48	0.26	0.59
Final BW at 28% EBW (AFBW)[4], lb	1252	1237	26.7	0.15
Quality Grade Distribution				
Prime, %	1.3	6.3	2.06	**0.05**
Upper 2/3 Choice[5], %	44.9	38.8	4.3	0.33
Low Choice, %	40.6	39	5.76	0.8
Select, %	14.8	16.4	3.52	0.71
Yield Grade distribution				
Y1. %	1.3	0	0.55	0.48
Y2, %	4.8	6.2	3.78	0.55
Y3, %	57.4	50.5	5.73	0.28
Y4, %	28.2	30.7	6.87	0.66
Y5, %	3.2	5.3	3.72	0.29

[1] Treatments were applied from d 1 to 183 (Block 1), d 1 to 169 (Block 2), and d 1 to 171 (Block 3). Canola meal (CM).

[2] USDA marbling score 400 = small00 = low choice; 500 = modest00 = average choice.

[3] HCW/final BW shrank by 4%.

[4] Adjusted final body weight, Guiroy et al. (2002).

Conclusion

Increasing dietary crude protein from 13% to 15% to cattle during finishing tended to reduce daily, final, and overall weight gain throughout the study. Cattle fed 15% crude protein tended to have increased rib fat thickness and tended to have greater distribution of prime graded carcasses. During periods of decreased canola meal and input costs, increasing levels of dietary crude protein using canola meal may be an economically feasible option.

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Energy and Protein Requirements of Finishing Steers Fed Dried Distillers Grains

Colin Tobin, Zach Smith, Ana Clara Baiao Menezes, Federico Podversich, and Warren Rusche

Dried distiller's grains plus solubles (DDGS) is a coproduct of the ethanol production process and has become a major component of feedlot cattle rations across the United States. The high nutrient density and relative cost competitiveness to corn have made DDGS a cornerstone of ruminant nutrition strategies. The increasing production of renewable fuels, particularly ethanol and corn oil, has further expanded the availability of these corn coproducts for livestock feeding. However, questions remain regarding the optimal inclusion rates and crude protein (CP) concentrations needed to maximize growth performance, carcass composition, and energetic efficiency of finishing beef cattle.

Previous research has demonstrated that DDGS can effectively replace portions of traditional protein and energy sources in feedlot diets without compromising performance. Yet, the protein requirements of finishing cattle vary considerably with body weight, rate of gain, and energy density of the diet. Excess dietary protein can increase ration cost and alter nitrogen retention, whereas insufficient protein may limit growth and marbling potential. Refining protein inclusion levels is therefore critical to balance production efficiency, carcass quality, and environmental stewardship.

The Northern Great Plains feedlot sector presents a unique context for these evaluations due to its reliance on local grain and ethanol coproduct streams, variable feed costs, and climatic constraints on feedlot management. Understanding how incremental increases in dietary CP, such as from 13% to 15%, affect growth performance and carcass characteristics is especially important for producers optimizing DDGS-based rations under fluctuating market and feed conditions.

This study conducted at the North Dakota State University Carrington Research Extension Center (CREC) aimed to determine the energy and protein requirements of North Dakota yearling steers fed DDGS-based finishing rations differing in crude protein concentration. By comparing animal performance, carcass composition, and energetic utilization between 13% and 15% CP diets, this research provides regionally relevant data to refine DDGS feeding strategies and guide economically and nutritionally sustainable beef production practices.

Materials and Methods
All procedures involving the use of animals in these experiments were approved by the North Dakota State University Institutional Animal Care and Use Committee (approval number IACUC20240031). This experiment was conducted at the CREC between December 2024 and July 2025.

Treatments, animals, initial processing, and study initiation

One hundred forty-five cross-bred steers (802 ± 84 lbs, initial body weight (BW)) were used in this experiment. Steers were consigned and delivered to the CREC from multiple ranches across North Dakota throughout October and November 2024. Steers were backgrounded on a similar ration for approximately 65 days prior to the initiation of the study.

Table 1. Nutrient composition of feed ingredients.

	Dietary Treatment[1]	
	13% DDGS	15% DDGS
Ingredient, % DM basis		
Dry-rolled corn	66.6	59
Barley Straw	7.5	7.1
Corn Silage	2.4	2.2
Dried Distillers plus solubles	20.7	29
Dry Supplement[2] & Limestone	2.8	2.7
Nutrient Composition[3]		
NEm, Mcal/kg	1.96	1.94
NEg, Mcal/kg	1.31	1.29
CP, %	13.1	15.14
RDP, % of CP	49.85	47.78
RUP, % of CP	50.15	52.22
NDF, %	18.88	20.58
Ash, %	4.39	4.65
EE, %	4.46	4.89

[1] Once adaptation diets were stepped up to finishing ration, pens were fed either at 13% or 15% crude protein (CP) diet, depending on treatment.

[2] Provided 30g/ton of monensin as well as vitamins and minerals to exceed requirements (NASEM, 2016).

[3] Dry matter was measured biweekly, nutrient composition were analyzed from pooled monthly composite samples. Net energy and protein values were calculated from NASEM (2016). Dry matter (DM), net energy for maintenance (NEm), net energy for gain (NEg), crude protein (CP), rumen degradable protein (RDP), rumen undegradable protein (RUP), neutral detergent fiber (NDF), ether extract (EE).

Steers were stratified by source (Block 1-3). On December 16, 2024, steers from Blocks 1 and 2 were weighed for BW collection, which was used for allotment purposes. On December 17, 2024, steers from Blocks 1 and 2 were reweighed, processed, sorted, and placed into randomly assigned one of 12 pens ([Block 1 = 8 pens, Block 2 = 4 pens]. On January 23, 2025, steers from Block 3 were weighed for BW collection used for allotment purposes. On January 24, 2025, steers from Block 3 were reweighed, processed, sorted, and placed into randomly assigned one of 12 pens. All pens were in a randomized complete block design (blocked by source). Pens were randomly assigned to one of two dietary treatments (6 pens/treatment): 13% crude protein with DDGS as the sole protein supplement (13% DDGS); 15% crude protein with DDGS as the sole protein supplement (15% DDGS). The experiment was initiated with a 28-d adaptation period and a 183-, 169- and 171-d finishing period for Block 1,2, and 3, respectively. All live BW measurements were pencil shrunk 4% to account for digestive tract fill, in accordance with equations to determine shrunk body weight from NASEM (2016).

Steers were harvested when visually appraised by trained observers to have 12th rib fat (RF) thickness of 0.5 in. Final BWs were recorded at 0800 on shipping day, approximately 24 hours post final feeding the day prior. After weighing, steers to be harvested were comingled into a holding pen and offered water. Steers were gathered for delivery approximately 1200 h and shipped to the commercial abattoir located 800 km from the CREC. Electronic ID tags were used to determine harvest order. Hot carcass weights and video camera image carcass data were collected from the beef plant.

Growth performance, carcass trait, dietary net energy utilization calculations
Two steers (1 from 13% DDGS, 1 from 15% DDGS) died during the study, due to respiratory disease. Growth performance for both experiments data reported on a deads and removals included basis. Steers that were removed from the study or that died during the study were assumed to have consumed feed equal to the pen mean dry matter intake (DMI) up to the point of removal or death. Overall average daily gain (ADG) was calculated as the difference between initial and final BW. Overall feed conversion efficiency (G:F) was calculated from ADG/DMI.

Observed dietary net energy (NE) was calculated from daily energy gain (EG; Mcal/d) according to the medium frame steer calf equation using the equivalent BW adjustment. Observed-to-expected (O:E) NEm and NEg were calculated from observed dietary NE values for maintenance or gain divided by tabular estimates of NE for maintenance or gain (NASEM, 2016).

Hot carcass weight (HCW) was captured immediately following the harvest procedure. Video image data were obtained from the commercial abattoir for rib eye area (REA), rib fat (RF), and USDA marbling scores. Kidney, pelvic, and heart fat (KPH) percentage was determined via plant-specific algorithm. Dressing percentage (DP) was calculated as: HCW/ (final BW × 0.96). Yield grade (YG) was calculated according to the USDA regression equation (USDA, 2017). Estimated empty body fat (EBF) percentage and adjusted final body weight (AFBW) were calculated from observed carcass traits (Guiroy et al., 2002).

Statistical Analysis
The experiment was analyzed separately using the GLIMMIX Procedure of SAS 9.4 (SAS Institute Inc., Cary, NC) with pen serving as the experimental unit. The model includes the fixed effects of protein amount (13%, 15%), and the random effect of block. For the distribution of categorical variables (distributions of USDA Yield and Quality grade), counts for each category were entered by pen, and a multinomial analysis for ordinal data was conducted following the procedure recommended by Bowley (2015), using pen within treatment as the subject. Significance was declared at $P \leq 0.05$, and tendencies were considered when $0.10 > P > 0.05$.

Results
Growth performance data are shown in Table 2. Initial BW or BW after diet adaptation did not differ (P = 0.37) among treatments. No differences in Final BW, BW gain, or ADG were observed ($P \geq 0.31$). No differences in DMI, GF, FG, performance adjusted net energy for gain or maintenance, or the observed-to-expected ratio of net energy were observed ($P \geq 0.30$).

Table 2. Growth performance responses and efficiency of dietary net energy (NE) use.

	Dietary Treatment[1]			*P-value*
	13% DDGS	15% DDGS	SEM	*Protein Amount*
Initial Bodyweight[2], lb	756	756	27.3	
Bodyweight after adaptation diet[2]	866	873	26.9	0.37
Final Bodyweight[2], lb	1422	1435	34.2	0.31
Overall bodyweight gain, lb	556	562	27.6	0.53
Overall average daily gain, lb	3.81	0.39	0.09	0.52
Dry matter intake (DMI), lb	25.79	26.68	0.904	0.3
Overall ADG/DMI (G:F)	0.16	0.157	0.0128	0.43
Overall DMI/ADG (F:G)	6.29	6.5	0.55	0.49
paNE[4], Mcal/kg				
Maintenance	2.03	2.02	0.115	0.41
Gain	1.37	1.36	0.101	0.41
Observed-to-expected NE[5]				
O/E NEm	1.02	0.98	0.034	0.96
O/E NEg	1.02	0.97	0.045	0.96

[1] Treatments were applied from d 1 to 183 (Block 1), d 1 to 169 (Block 2), and d 1 to 171 (Block 3). Dried distillers grains with solubles (DDGS).

[2] Body weight was shrunk by 4% to account for digestive tract fill.

[3] Body weight utilized as initial body weight for performance adjusted net energy (paNE) calculations once animals finished adaptation diet. Day 28 (Block 1), d 28 (Block 2), d 35 (Block 3).

[4] Zinn et al., 2008.

[5] Observed to expected ratio for NEm and NEg; ratio of paNE values to tabular NE estimates from NASEM (2016).

Carcass trait data are shown in Table 3. Hot carcass weight was greater ($P = 0.02$) for steers fed 15% DDGS compared with steers fed 13% DDGS, by an average of 2.3% No effect of protein amount were observed in USDA YG, REA, marbling score, dressing percentage, EBF, retail cut %, AFBW, or distribution of USDA Yield and Quality grades ($P \geq 0.12$). There was a tendency ($P = 0.06$) for increased rib fat thickness with a numerical increase observed for steers fed 15% CP.

Table 3. Carcass traits responses.

	Dietary Treatment[1]			*P-value*
	13% DDGS	15% DDGS	SEM	*Protein Amount*
Carcass Characteristics				
Hot carcass weight, lb	897	917	21.8	0.02
USDA Yield Grade	3.45	3.56	0.19	0.15
Ribeye area, sq in	13.1	13.3	0.22	0.47
Marbling score[2]	489	489	14.8	0.54
Rib fat, in	0.65	0.7	0.018	0.06
Dressing percentage[3], %	64.6	64.2	0.29	0.95
EBF, %	32.4	32.8	0.35	0.12
Retail Cut, %	47.8	48	0.26	0.95
Final BW at 28% EBW (AFBW)[4], lb	1239	1243	29.5	0.78
Quality Grade Distribution				
Prime, %	1.3	6.3	2.06	0.13
Upper 2/3 Choice[5], %	44.9	38.8	4.3	0.52
Low Choice, %	40.6	39	5.76	0.81
Select, %	14.8	16.4	3.52	0.95
Yield Grade distribution				
Y1. %	1.3	0	0.55	0.56
Y2, %	4.8	6.2	3.78	0.53
Y3, %	57.4	50.5	5.73	0.52
Y4, %	28.2	30.7	6.87	0.65
Y5, %	3.2	5.3	3.72	0.74

[1] Treatments were applied from d 1 to 183 (Block 1), d 1 to 169 (Block 2), and d 1 to 171 (Block 3). Dried distillers grains with solubles (DDGS).

[2] USDA marbling score 400 = small = low choice; 500 = modest = average choice.

[3] HCW/final BW shrank by 4%.

[4] Adjusted final body weight, Guiroy et al. (2002).

[5] Average or high-choice quality grade.

Conclusion

Increasing dietary crude protein from 13% to 15% to cattle during finishing increased hot carcass weight. Cattle fed 15% crude protein tended to have increased rib fat thickness. No differences in intake or net energy performance were observed in this study. During periods of decreased DDGS and input costs, increasing levels of dietary crude protein using DDGS may be an economically feasible option.

This research was partially funded by the North Dakota Corn Utilization Council. This research was supported, in part, by the intramural research program of the U.S. Department of Agriculture, National Institute of Food and Agriculture, Hatch project accession number, 7006839. The findings and conclusions in this preliminary publication have not been formally disseminated by the U. S.

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Calves consigned to Dakota Feeder Calf Show.

2024-2025 Dakota Feeder Calf Show Feedout : Discovering Performance and Value in North Dakota Calves

Karl Hoppe

Although cattle prices are trending upward, cow calf producers need to be competitive with increasing production costs and increasing returns. By determining calf value through a feedout program, cow-calf producers can identify profitable genetics under common feedlot management. Substantial marketplace premiums are provided for calves that have exceptional feedlot performance and produce a high-quality carcass.

Cost-effective feeding performance is needed to justify the expense of feeding cattle past weaning. Price premiums are provided for cattle producing highly marbled carcasses. Knowing production and carcass performance can lead to profitable decisions for ranchers raising North Dakota-born and fed calves. This ongoing feedlot project provides cattle producers with an understanding of cattle feeding and cattle selection in North Dakota.

The Dakota Feeder Calf Show was developed for cattle producers willing to consign steer calves to a show and feedout project. The calves were received in groups of three or four on October 19, 2024, at the Turtle Lake Weighing Station, Turtle Lake, N.D., for weighing, tagging, veterinary processing, and display. The calves were evaluated for conformation and uniformity, with the judges providing a discussion to the owners at the beginning of the feedout. The number of cattle consigned was 112, of which 96 competed in the pen-of-three contest.

The calves were then shipped to the Carrington Research Extension Center, Carrington, N.D., for feeding. Prior to shipment, calves were vaccinated, implanted with Synovex-S, dewormed and injected with a prophylactic long-acting antibiotic.

Calves were sorted and placed on corn and distiller grains-based receiving diets. After an eight-week backgrounding period, the calves were transitioned to a 0.62 megacalorie of net energy for gain (Mcal NEg) per pound finishing diet. Cattle were weighed every 28 days, and updated performance reports were provided to the owners. Cattle were reimplanted with Synovex-One on December 17, 2024.

The cattle were harvested on June 19, 2025 (110 head). The cattle were sold to Tyson Fresh Meats, Dakota City, Nebraska, on a grid basis, with premiums and discounts based on carcass quality. Carcass data were collected after harvest.

Cattle consigned to the Dakota Feeder Calf Show feedout project averaged 603.8 pounds upon delivery to the Carrington Research Extension Center Livestock Unit on October 19, 2024. After an average 242-day feeding period, cattle averaged 1,460.6 pounds (at plant, shrunk weight). Two steers died during the feeding period.

Average daily feed intake per head was 30.7 pounds on an as-fed basis and 22.8 pounds on a dry-matter basis. Pounds of feed required per pound of gain were 8.94 on an as-fed basis and 6.64 pounds on a dry-matter basis.

The overall feed cost per pound of gain was $0.618. The overall yardage cost per pound of gain was $0.116. Bedding cost was $0.060 per pound of gain. The combined cost per pound of gain, including feed, yardage, veterinary, trucking and other expenses except interest, was $0.903.

Overall, the carcasses contained U.S. Department of Agriculture Quality Grades at 0.9 percent Prime, 77.3 percent Choice (including 26.4 percent Certified Angus Beef), 20.9 percent Select and 0.9 percent ungraded. The USDA Yield Grades were 0.9 percent YG1, 18.2 percent YG2, 46.3 percent YG3, 18.2 percent YG4, and 16.4 percent YG5.

Carcass value per 100 pounds (cwt) was calculated using the actual base carcass price plus premiums and discounts for each carcass. The grid price received for June 19, 2025, was $385.57 Choice YG3 base with premiums: Prime $25, CAB $6, YG1 $6.50 and YG2 $3, and discounts: Select minus $16, ungraded (dark cutter) minus $55, YG4 minus $10, YG4 minus $22 and carcasses heavier than 1100 pounds minus $15 or lighter than 650 pounds minus $20.

Results from the calves selected for the pen-of-three competition are listed in Table 1.

Table 1. Feeding performance - 2024-2025 Dakota Feeder Calf Show Feedout								
Pen of three	Best Three Score Total	Average Birth Date	Average Weight per Day of Age, lbs	Average Harvest Weight, lbs.	Average Daily Gain, lbs.	Average Marbling Score (1)	Ave Calculated Yield Grade	Ave Feeding Profit or Loss / Head
1	2.1943	8-Mar-24	1.89	1518	3.65	584	3.32	$ 1,165.73
2	2.1311	26-Feb-24	2.13	1708	4.19	550	4.32	$ 1,314.70
3	2.0175	7-Mar-24	1.97	1522	3.82	597	4.47	$ 1,226.69
4	2.0081	15-Mar-24	2.14	1557	4.07	515	4.19	$ 1,244.04
5	1.9885	5-Mar-24	2.06	1619	4.00	515	3.84	$ 1,117.81
Average Top 5 Herds	2.07	6-Mar-24	2.04	1584.7	3.95	552.3	4.03	$ 1,213.79
6	1.9692	19-Apr-24	2.04	1421	3.59	551	3.51	$ 1,037.31
7	1.9209	28-Mar-24	2.20	1596	4.06	626	5.20	$ 1,174.42
8	1.9157	30-Mar-24	1.92	1490	3.52	516	3.42	$ 1,056.76
10	1.9072	23-Mar-24	2.13	1622	3.97	574	4.83	$ 1,200.69
11	1.8983	10-May-24	2.11	1390	3.51	438	2.64	$ 979.57
12	1.8675	16-Mar-24	1.83	1401	3.47	553	3.79	$ 1,031.78
13	1.8624	13-Mar-24	1.62	1355	3.08	573	3.32	$ 954.85
14	1.8453	5-Apr-24	1.99	1485	3.60	487	3.43	$ 1,008.06
15	1.8225	11-Mar-24	1.82	1499	3.49	549	3.68	$ 935.09
16	1.7768	16-Apr-24	1.96	1418	3.43	556	3.97	$ 981.56
17	1.7605	17-Mar-24	1.73	1425	3.26	492	3.35	$ 982.85
18	1.7281	28-Mar-24	2.06	1553	3.81	539	5.06	$ 1,101.95
19	1.6975	8-Apr-24	1.98	1534	3.56	428	3.46	$ 995.00
20	1.6510	5-Apr-24	2.07	1495	3.76	517	4.70	$ 1,043.02
21	1.6108	10-Mar-24	1.77	1439	3.40	442	3.39	$ 875.02
22	1.6022	9-Apr-24	2.24	1595	4.01	606	5.82	$ 1,021.22
23	1.5834	24-Apr-24	1.90	1335	3.30	521	4.01	$ 873.73
24	1.5406	23-Apr-24	1.86	1358	3.24	469	3.74	$ 886.03
25	1.5142	3-May-24	1.87	1275	3.17	402	2.86	$ 749.17
26	1.2026	3-Mar-24	1.54	1289	2.99	346	3.17	$ 654.05
Average Bottom 5 Herds	1.49	12-Apr-24	1.88	1370	3.34	469	3.92	$ 836.84
Overall average: pens of three	1.80	28-Mar-24	1.95	1,475.93	3.60	517.89	3.90	$ 1,024.44
Standard deviation		20.4	0.2	110.4	0.3	67.7	0.8	152.7
number		25	25	25	25	25	25	25

(1) Marbling score 300-399 = select, 400-499 = low choice, 500-599 = average choice, 600-699 = high choice, 700-799 = low prime

The top-profit pen-of-three calves with superior genetics returned $1,314.70 per head, while the bottom pen-of-three calves returned as of $749.17 per head. The profit of the five top-scoring pens of steers averaged $1,213.79 per head, while the profit of the bottom five scoring pens of steers averaged $836.84 per head.

For the pen-of-three competition, average profit was $1,024.44 per head. The spread in profitability between the top and bottom five herds was $376.95 per head.

North Dakota calf value is improved with superior carcass and feedlot performance. Favorable average daily gains, weight per day of age, harvest weight and marbling score can be found in North Dakota beef herds. Exceptional profit per head was a result of exceptional market price improvement in 2025. Feedout projects continue to provide a source of information for cattle producers to learn about feedlot performance and individual animal differences and discover cattle value.

Farm Profits Declining After Record-Setting Years

Jason Fewell

From 2021 to 2022, farmers saw near record-high profits. With the cyclical nature of agricultural profits, it is expected that profits would decline after very high years. While most farmers know this, the reality of it can be difficult to handle. Many factors affect profitability and choosing just one thing often misses the whole story. It is important to consider both input and output prices when evaluating farm profitability. But it is also important to consider several risk factors beyond operators' control, including weather risk, market risk, and geo-political events.

Net farm income is expected to decrease again in 2025 and remain low in 2026 without government support. With the exception of livestock, 2025 farm commodity prices are low while expenses are stubbornly high. Input costs continue to increase, causing net income to fall each year since 2022. Figure 1 shows the net farm income for farms enrolled in the Carrington Area Farm Management Education Program from 2010 to 2024. Note that farms are not always in a low- or high-20% area. They can move from one profitability level to another.

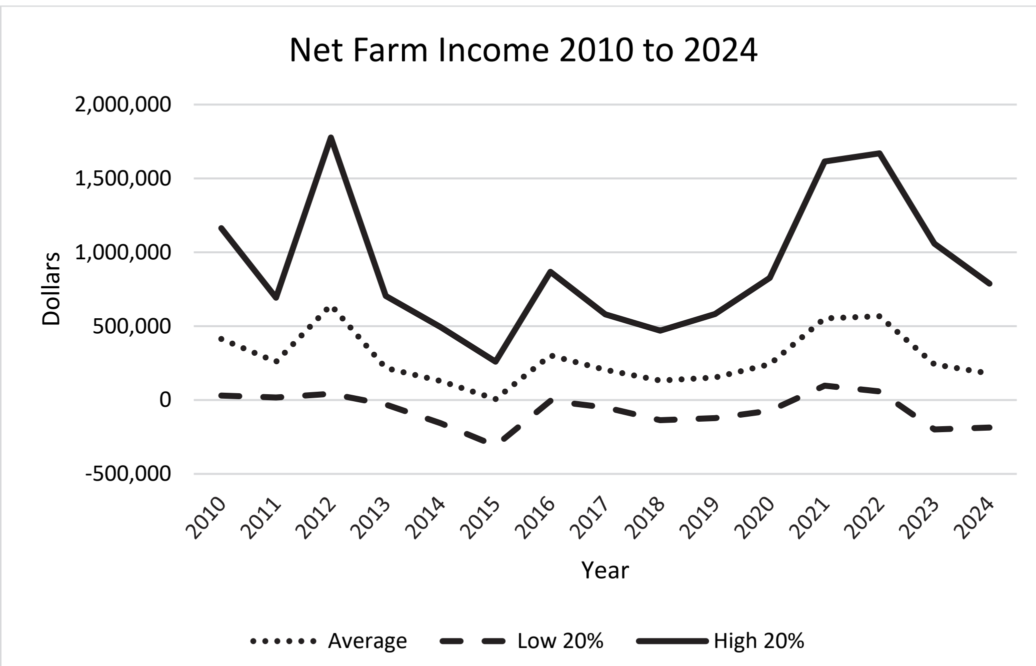


Figure 1. Net Farm Income 2010 to 2024.

After a record income year in 2012, net income dropped for three years before rebounding slightly, only to fall again and remain relatively low for three years until large government payments in 2020 due to the Covid-19 pandemic increased incomes. This was also the beginning of higher commodity prices due to supply disruptions associated with the pandemic. 2021 and 2022 saw the continuation of large government payments and high commodity prices due to increased demand after the pandemic and other supply problems. However, input inflation also began in these years and has not slowed.

A potentially bigger problem for farmers is the decline in equity in low-profit years. Figure 2 shows the return on assets and return on equity for the period 2010 to 2024 for farms in the Carrington Farm Management Education Program. In the years following the highest net farm income years, returns on assets and equity decline greatly. Note that in the years of decline, return on assets is greater than return on equity. This indicates a couple important things. First, debt is not paying for itself, so farm equity is needed to make debt payments. Second, farm profits are not high enough to provide a return on the value of farm assets. This can occur if farm assets are valued too high, but is most often due to low incomes, high expenses, or a combination of both.

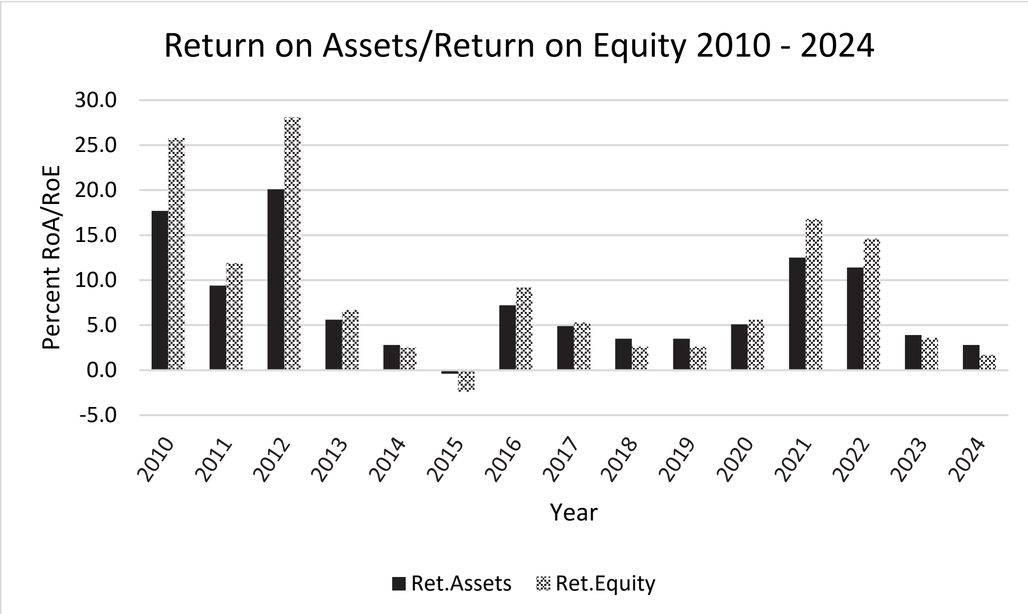


Figure 2. Return on Assets/Return on Equity from 2010 to 2024.

Return on assets was greater than return on equity in six of the last 15 years (2014-15, 2018-19, 2023-24) and is likely to be so again in 2025. While not all farms lose equity in these years, many do. Decreasing equity leaves farmers in a poor financial position to retire, make land purchases, or refinance debt. Low commodity prices coupled with high input, machinery, and land costs create a problem for farmers' ability to produce adequate income to increase net worth and grow their farm businesses. It is important to value assets properly. Assigning values higher than their productive use, while seemingly helping increase net worth and collateral levels, can create a situation where profitability measures suffer.

We greatly appreciate the farmers enrolled in the Farm Business Management program that provide this data.

Evaluating the Usefulness, Changes Made, and Benefits Realized from NDSU Extension Horse Management Webinars

Mary A. Keena, Paige F. Brummund and Emily E. Kinkade

Since 2020, NDSU Extension's Horse Management Webinar Series has delivered practical, research-based guidance that helps owners make measurable, real-world improvements in herd health and resource management. The shift from in-person meetings to online webinars significantly broadened access, allowing owners and stable managers from across North Dakota (and beyond) to participate. The strong response (nearly 5,500 total live and recorded views over five years) and the high rate of behavior change (44% of respondents implementing at least one change) indicate the program delivers practical, actionable information.

Background

In 2017, the National Agricultural Statistics Service (NASS) estimated the statewide equine population in North Dakota to be 29,423 head. Ten counties accounted for 45% of the herd — underscoring the concentration of horse owners in select regions of the state.

At the request of NDSU Extension stakeholders, a multi-county, in-person horse-owner outreach effort was planned. However, the onset of the COVID-19 pandemic disrupted these plans in 2020. In response, the program was reimagined – transformed into an online platform to extend reach and maintain engagement across the state.

Program Scope & Participation

Over the course of five years, the webinar series delivered 23 sessions covering 18 topics, including: arena and facility footing, bedding management, biosecurity practices, drought management, communicable disease management, emergency field aid, equine conditioning, facility management, fencing, genetic disease management, geriatric horse or foal care, grazing management, haying management, manure management, mortality management, parasite management, weed management and winter horse management.

A total of 972 participants attended live sessions, and 4,472 additional views of recorded webinars occurred via the NDSU Extension YouTube channel.

Survey feedback from 2021 to 2024 (320 respondents) showed that 82% of participants rated the webinars as "very useful" or "extremely useful."

In December 2024, a comprehensive five-year review was conducted, with 96 respondents completing the survey. Among them, 66% were horse owners and 12% were stable owners or managers. <u>Respondents reported adopting new practices across all 18 topic areas; 44% made between one and five changes to their management practices.</u>

Impact — Management Changes Made and Benefits Realized

Respondents identified six primary areas in which they adapted their operations as a result of the webinars:

- Grazing management — 40% (rotational grazing, adjusting pasture rest periods)
- Manure management — 34% (moving, piling, composting manure)
- Haying management — 31% (more selective hay use, feeding efficiency)
- Winter horse management — 30% (improved winter care, shelter, nutrition)
- Emergency first aid — 25% (better preparedness)
- Weed management — 25% (improved pasture weed control)

Changes Made

The following are examples of changes made by respondents after viewing the webinars:

- *"I have changed my grazing rotation and used electric fencing to make the horses graze a smaller area for a short period of time. I have also been more aware of the length of grass I allow the horses to graze the pasture down to."*
- *"Moving, piling, and composting manure."*
- *"Working on better manure management plan (it's a work in progress)."*
- *"Your webinar on weed management has helped us identify and mitigate weeds that we had in our pasture."*
- *"I have been more selective about the quality of hay that I have been purchasing."*
- *"We went from generic feed for everyone to individual needs-based feed."*

Benefits Gained

The following are examples of benefits resulting from management changes:

- *"The benefit has been to our horses by providing better pasture grass to them."*
- *"Pasture is healthier due to delayed spring grazing and early removal in the fall. Additional changes to manure management will yield fewer flies, more changes to be made."*
- *"It's more money saved with more pasture producing forage and manure fertilizing it."*

- *"The weedy areas of my pasture are going away, and my pasture has more even forage coverage."*
- *"Hay is lasting longer as it is fed more wisely in the winter, which saves money."*
- *"Animal [individual] based feed has helped keep weight on my old guys."*

Conclusion
The five-year review of the NDSU Extension Horse Management Webinar Series reveals an overwhelmingly positive influence on horse-owner practices across North Dakota and the surrounding region. From improved grazing and manure management to more strategic haying and weed control, participants have applied knowledge that bettered their operations — often saving money, enhancing environmental outcomes, and improving horse health and welfare. As the program continues, the online webinar format will remain a vital tool for bridging distances and delivering timely, research-based guidance to the region's equine community.

Foundation Seedstocks Project

Dave Copenhaver

The Carrington Research Center's Foundation Seedstocks Program planted 30 different varieties across 11 different crops. Eight crops with 25 varieties were part of the seed increase program. Each year the Foundation Seedstocks Program works to bring new varieties to market in the area. In many cases the varieties are brought to CREC starting with a handful of bushels and multiplied one to three years so that new varieties are brought to market with adequate bushels to distribute for commercial seed production.

This year one NDSU winter rye, three 2-row barley varieties (two are NDSU varieties with one of the two being experimental and the other one is a new North Dakota Crop Improvement and Seed Association (NDCISA) variety from Canada), two NDSU durum lines (one experimental), and four NDSU wheats with two being released this coming spring through the NDCISA. We have five field peas (one NDSU variety, two Valesco Genetics varieties, and two NDCISA varieties), four flaxes (two are yellow; one NDSU experimental and one NDCISA variety from Canada) and two are brown (one NDSU experimental and one NDCISA variety from Canada), and six NDSU soybeans (three conventional and three Roundup Ready 1 (RR1) with one RR1 getting released this spring through NDCISA).

The remaining five varieties among three crops are planted for the livestock unit as cattle feed. We planted corn silage, hay barley and a custom mix for grazing purposes.

Our seed program operates on about 1,250 acres with about 50% of the acres being rented from five different landowners. Our land rent contracts range from one to three years. We thank the landowners for the opportunity to produce seed on these acres.

New varieties being released include ND Horizon HRSW, adapted to the east. In the Red River Valley and surrounding area, it has similar yield and protein to ND Stampede but with shorter stature and better straw strength. ND Roughrider is bred to be a far western wheat with a high yield potential, especially in drier conditions.

CDC Churchill was bred in Canada and is a high yielding 2-row malting barley with strong straw strength and low protein. It is licensed and sold through NDCISA.

ND18-20092GT is a 0.1 RR1 soybean. It has Soybean Cyst Nematode (SCN) resistance and is moderately tolerant to Metribuzin. It has about a three-bushel yield advantage over ND17009GT and ND21008GT20.

Our bulk storage capacity has grown to about 90,000 bushels, with mostly hopper bins with torpedo-style air systems. We also have capacity for about 10,000 bushels in totes. We continue to remove flat storage bins for more hopper bins. We currently have twelve 4,000-bushel bins, fifteen 2,000-bushel bins, two 3,000-bushel bins, one 2,500-bushel bin, one 1,500-bushel bin, and seven 1,000-bushel bins.

This year we had 21,000 bushels of carryover seed and brought in 50,000 bushels from the current crop year's seed production fields for conditioning. Seed conditioning started in August to accommodate the winter rye seed sales season; field peas and the deadlines related to releasing new varieties. The conditioning usually takes at least four months. Our new mill will comfortably run at about 200 bushels an hour for most varieties.

Finally, we are continually grateful for the High Plains Equipment Rental Agreement between Case IH and NDSU. This program includes tractors, a sprayer, a combine with a pickup header, and a skid steer for the seedstocks program. It would be very difficult for the center to function properly without the agreement.

Tractors from the Case IH rental agreement.

CREC 2025 Administrative Updates

Mike Ostlie

In 2025 we had some of the best and some very average yields across crops for both research plots and seed increases. For the second year in a row some trials got hailed out. This time it was the soybean trials at the Dazey site which had areas of near 100% damage. Another long, cool growing season and frequent rains created a high yielding and, in some cases, high disease environment for crops. Two major pests moved into our locations as Sudden Death Syndrome was identified in soybeans at the Oakes Irrigation Research Site and a few stray waterhemp plants were removed from fields at the CREC.

The CREC was fortunate this year during the legislative session. For a number of years, we had been working to get funding for a storage shed. This was finally approved. As of this writing, the project is out for bids. The remainder of the Oakes Irrigation Research Site headquarters building was also funded. That project is set to begin in January. In 2024 the shell of the building and a shop was built by the Garrison Diversion Conservancy District and then donated to the CREC. The remaining parts of the building include offices, lab space, and public meeting space.

As for previously funded projects, construction wrapped up this fall on the Smartfeed facility and pen expansion at the livestock unit. We are expecting to start our first study there in January. We are looking forward to being able to collect data in a new way with this structure and the Smartfeeders. These units will track animals as they enter the feed bunk to measure how long, how often, and how much they eat. This not only provides valuable data to support our long-standing feeding research, but it also opens up a whole new area of behavioral research.

The CREC was able to acquire three used plot harvesters this past year. These machines help fill a critical need within the crops research programs. We were also able to purchase a spray drone with plans to conduct robust research into this emerging field to better understand the best use cases, return on investment, and identify difference in applied product and adjuvant performance.

In 2025 the last of the original Foundation Seedstocks seed cleaning equipment was sold to a local producer. It is difficult to see a piece of history go, but it is nice to see the unit brought back into use and remain in the area. The Seedstocks Program also removed three older flat-bottom bins and replaced them with a single 3,000-bushel hopper bottom bin. This year also saw the removal of the last of the original irrigation trenches that were used for flood irrigation. These channels were not usable and were hazardous to people and vehicles in the area. Finally, tree removal occurred between the two main driveways to mark the start of a multi-year renovation project of that space.

Over the past year the CREC has welcomed several new employees including Rupak Karn as our Precision Ag Specialist; Billy Jo Caulfield as our custodian, and Thomas Miorini as the Site Manager at the Oakes Irrigation Research Site. We have also filled our Fruit Project Manager position, who will begin in March of 2026. Several employees departed this past year as well. Sergio Cabello Leiva (Soil Science) and Colin Tobin (Animal Science) moved on to other opportunities. Steve Schaubert (Agronomy and Organic Research) retired after 21 years as a research technician.

For those of you reading this, thank you. We wouldn’t be here without your support. Know that we take all suggestions and advice very seriously and that all of us at CREC are joined in passion and mission to serve the needs of our region. I am very proud of the people at CREC, and the work conducted on behalf of those we serve. As in all agriculture professions, few things are certain from year to year. But one thing I am certain of is that all CREC staff, whether part-time or full-time, believe in our mission of service and are doing our best to solve the real-world problems in agriculture each and every year. Your patronage is what keeps us going and we are grateful for your involvement!

Weather Summary

Monthly Temperatures (°F) and Normals

	Max Temp				Min Temp				Monthly Avg. Temp			
Month	2025	Norm*	2024	2023	2025	Norm*	2024	2023	2025	Norm*	2024	2023
Apr	52	53	54	39	30	29	32	24	41	41	43	32
May	71	67	65	74	45	42	44	49	58	54	55	62
June	74	76	73	81	53	53	53	60	64	65	63	70
July	78	81	79	77	57	57	59	55	68	69	69	66
Aug	77	81	76	77	56	54	54	56	66	67	65	67
Sept	73	72	77	73	49	45	52	49	61	58	65	61
Avgs:	71	72	71	70	48	47	49	49	60	59	60	60

*Normals = 1991-2020 averages

Monthly Precipitation (in) and Normals

	2025 Monthly Precipitation*				
Month	NDAWN	NOAA	Normal[1]	2024	2023
Apr	2.17	2.06	1.25	2.63	1.39
May	2.26	2.59	2.76	4.02	4.19
June	4.68	5.67	3.78	4.56	3.33
July	4.26	4.26	3.60	3.79	2.09
Aug	1.85	1.77	2.33	3.65	1.83
Sept	2.01	2.13	1.97	1.19	2.24
Totals:	17.23	18.48	15.69	19.84	15.08

[1] Normals = 1991-2020 averages * NDAWN and NOAA are two different weather stations at the CREC.

Monthly Growing Degree Days and Normals

	Wheat GDD				Sunflower GDD				Corn GDD			
Month	2025	Norm*	2024	2023	2025	Norm*	2024	2023	2025	Norm*	2024	2023
Apr	330	311	366	132	---	---	---	---	---	---	---	---
May	794	694	708	911	467	360	366	577	341	258	250	424
June	949	982	935	1154	590	622	575	794	432	461	404	597
July	1114	1159	1156	1049	745	787	784	654	559	583	598	498
Aug	1067	1098	1025	1072	698	726	653	724	522	540	478	513
Sept	877	792	978	874	536	445	620	529	396	322	462	377
Totals	5131	5036	5168	5192	3036	2940	2998	3278	2250	2164	2192	2409

*Normals = 1991-2020 averages

Growing season GDD Totals, Normals, and Killing Frost Dates

Year	Frost Date	Corn Temp (°F)	Total GDD	Frost Date	Sunflower Temp (°F)	Total GDD
2023	Oct 6	28	2470	Oct 26	22	3242
2024	Oct 30	24	2383	Oct 31	22	3046
2025	*Oct 21	27	2398	**Oct 29	25	2991

*Normal Corn GDD for date = 2249 **Normal Sunflower GDD for date = 2908

Total corn GDD = May 1 to frost date Total sunflower GDD = May 20 to frost date

Normals = 1991-2020 averages Source: NDAWN

Agronomic Research Trials List

If you have questions or feedback, please contact us at NDSU.Carrington.REC@ndsu.edu or visit our website (https://www.ag.ndsu.edu/CarringtonREC) to find specific individuals. We are happy to help whenever possible.

The following information is a list of agronomic research conducted at the Carrington Research Extension Center. CREC and other NDSU research staff provide this list to illustrate specific research issues that are being addressed. The listing briefly describes the trial and indicates project collaborators who are working in cooperation with CREC agronomy team leaders. Results of this work may be made available at a later date by contacting the CREC.

Cover Crop

Corn: Cover crop effects on corn; *North Dakota Corn Utilization Council*
Misc: Cover crop demonstration
Wheat: Legume interseeding Year 1
Wheat: Legume interseeding Year 2

Crop Fertility

Corn: Sulfur rates for corn; *Bortolon/Gruener (North Central REC)*
Dry Bean: Effect of nitrogen rates and inoculants on dry bean yield; *Northarvest Bean Growers Assoc.*
Forages: Winter rye forage high nitrogen trial; *KWS*
Lupin: Lupin inoculant evaluation
Soybean: Rhizosorb product evaluation (soybean year: year 2); *Phospholution*
Wheat: Nitrogen and sulfur split application for wheat - Carrington; *Minnesota Wheat Research and Promotion Council*
Wheat: Nitrogen and sulfur split application for wheat - St. Paul, MN; *Minnesota Wheat Research and Promotion Council*
Wheat: Nitrogen extenders and split-application of nitrogen in wheat; *North Dakota Wheat Commission*
Wheat: Nitrogen fixing biological products in wheat; *North Dakota Wheat Commission*

Crop Management

Canola: Canola planting date by variety; *USDA North Central Regional Canola/Johnson/Del Rio (Plant Sciences)*
Corn: Cover crops and biological tillage to enhance corn grain yield and mitigate soil compaction in no-till systems; *North Dakota Corn Utilization Council*
Corn: Reducing carbon intensity through corn-pea intercropping strategies; *North Dakota Corn Utilization Council*
Dry Bean: Dry bean spring cover crop timing; *Northarvest Bean Growers Association*
Field Pea: Field pea inoculant - high pea history - ND Dawn; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Field Pea: Field pea inoculant - high pea history - PG Greenback; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Field Pea: Field pea inoculant - low pea history - ND Dawn; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Field Pea: Field pea inoculant - low pea history - PG Greenback; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Intercropping: Pea and canola intercropping seeding rates
Intercropping: Pea and oat intercropping seeding rates; *Worral (North Central REC)*
Intercropping: Wheat legume intercropping
Kernza: Kernza establishment and nitrogen treatments demonstration
Kernza: Kernza salt tolerant treatments; *DeSutter (Soil Science)*
Lentil: Lentil inoculant - high pulse history; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*

Lentil: Lentil inoculant - low pulse history; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Lupin: Lupin planting date and density evaluation; *SBARE New and Emerging Crops*
Misc: Soybean, wheat, corn and dry bean planting hail adjuster training
Misc: Planting date demonstration
Misc: Preventative plant forage demonstration at Fingal; *Agassiz Seed*
Soybean: Biofumigation for soybean - fall planting
Soybean: Evaluation of soybean maturity group and row spacing under no till conditions; *North Dakota Soybean Council*
Soybean: Mitigating salinity effects in soybean using cover crops; *North Dakota Soybean Council*
Soybean: Winter cereal and soybean intercropping
Wheat: Hybrid wheat seeding rates; *AgriPro Hybrid Wheat*
Wheat: Integrating legumes with wheat; *North Dakota Wheat Commission*

Crop Rotation
Barley: Cropping systems experiment - rotation, tillage, and fertility
Corn: Cropping systems experiment - rotation, tillage, and fertility
Field Pea: Cropping systems experiment - rotation, tillage, and fertility
Soybean: Cropping systems experiment - rotation, tillage, and fertility
Sunflower: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Agronomic and environmental benefits of diversifying crop rotations with wheat; *North Daktoa Wheat Commission/Pires (School of Natural Resource Sciences)*
Wheat: Cropping systems experiment - rotation, tillage, and fertility

Product Evaluation
Barley: Barley sprout reduction evaluation; *Corteva/North Dakota Barley Council*
Corn: Biological inoculation for corn; *North Dakota Corn Utilization Council/Bortolon (North Central REC)*
Corn: Evaluation of Humega, a humic and fulvic acid product (corn year); *Bioflora*
Corn: Fertility product evaluation: Bioflora starter fertilizer enhancement; *Bioflora*
Corn: Green Lightning corn treatments; *Topp Farms*
Corn: Fertilizer amendments evaluation (fall and spring applied); *Koch*
Wheat: Biological seed treatments (4x4); *Mosaic*
Wheat: Biological seed treatments (6x6) - dryland; *Mosaic*
Wheat: Biological seed treatments (6x6) - irrigated; *Mosaic*
Wheat: Biological product evaluation on wheat at Carrington; *Corteva*
Wheat: Biological product evaluation on wheat at Dazey; *Corteva*
Wheat: Biological product evaluation on wheat at TriCounty; *Corteva*
Wheat: Fungicide product evaluation on wheat at Carrington; *Corteva*
Wheat: Fungicide product evaluation on wheat at Dazey; *Corteva*
Wheat: Fungicide product evaluation on wheat at TriCounty; *Corteva*
Wheat: Soil applied biologicals in wheat; *Wilbur-Ellis*

Plant Pathology
Canola: Evaluation of foliar fungicides for management of white mold in canola; *BASF*
Chickpea: Chickpea fungicide droplet size - Proline; *ND Crop Protection Product Harmonization & Registration Board / Northern Pulse Growers Assoc.*
Chickpea: Chickpea fungicide droplet size - Proline + Bravo WS; *ND Crop Protection Product Harmonization & Registration Board / Northern Pulse Growers Assoc.*
Chickpea: Chickpea germplasm screening; *NuCicer*
Chickpea: Evaluation of foliar fungicides for management of Ascochyta in chickpeas; *Bayer*
Chickpea: Evaluation of foliar fungicides for management of Ascochyta in chickpeas; *Gowan*
Chickpea: Evaluation of seed treatments for management of Ascochyta in chickpeas; *Syngenta*
Chickpea: Field evaluation of fungicides for management of Ascochyta blight of chickpeas; *BASF*

Chickpea: Field evaluation of fungicides for management of Ascochyta blight of chickpeas; *Syngenta*
Chickpea: Field evaluation of fungicides for management of Ascochyta blight of chickpeas; *Vive Crop*
Chickpea: Field evaluation of fungicides for management of Ascochyta blight of chickpeas; *Wilbur-Ellis*
Dry bean: Dry bean white mold variety screening; *USDA National Sclerotinia Initiative / Michigan State University*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *BASF*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *Bayer*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *Gowan*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *United Phosphorous*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *Vive Crop*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans; *Wilbur-Ellis*
Dry bean: Evaluation of fungicide seed treatments for management of Rhizoctonia and Fusarium root rots in dry beans; *Albaugh*
Dry bean: Evaluation of fungicide seed treatments for management of Rhizoctonia and Fusarium root rots in dry beans; *Wilbur-Ellis*
Dry bean: Fungicide application interval relative to chemistry, white mold in kidney beans; *Northarvest Bean Growers Assoc.*
Dry bean: Fungicide application interval relative to chemistry, white mold in pinto beans; *Northarvest Bean Growers Assoc.*
Dry bean: Fungicide application sequence, white mold in kidney beans; *Northarvest Bean Growers Assoc.*
Dry bean: Fungicide application sequence, white mold in pinto beans; *Northarvest Bean Growers Assoc.*
Dry bean: Optimizing fungicide application interval and frequency in black and navy beans; *ND Crop Protection Product Harmonization & Registration Board*
Dry bean: Optimizing fungicide application timing, interval and frequency in kidney and pinto beans; *Northarvest Bean Growers Assoc. / ND Crop Protection Product Harmonization & Registration Board*
Durum: Prosaro Pro efficacy in durum; *Bayer*
Field pea: Comparative efficacy, foliar fungicides for management of Ascochyta in field peas; *Bayer*
Field pea: Comparative efficacy, foliar fungicides for management of Ascochyta in field peas; *VM Agritech*
Field pea: Comparative efficacy, foliar fungicides for management of powdery mildew in field peas - Empire peas; *ND Crop Protection Product Harmonization & Registration Board*
Field pea: Comparative efficacy, foliar fungicides for management of powdery mildew in field peas - Navarro peas; *ND Crop Protection Product Harmonization & Registration Board*
Field pea: Comparative efficacy, foliar fungicides for management of powdery mildew in field peas - Salamanca peas; *ND Crop Protection Product Harmonization & Registration Board*
Field pea: Comparative efficacy, foliar fungicides for management of powdery mildew in field peas; *VM Agritech*
Field pea: Evaluation of fungicide seed treatments for management of Aphanomyces root rot in field peas - AAC Julius peas, early planting; *Valent*
Field pea: Evaluation of fungicide seed treatments for management of Aphanomyces root rot in field peas - ND Victory peas, late planting; *Valent*
Field pea: Evaluation of fungicide seed treatments for management of Aphanomyces root rot in field peas; *Corteva*
Field pea: Evaluation of fungicide seed treatments for management of Fusarium root rot in field peas; *Syngenta*
Field pea: Evaluation of fungicide seed treatments for management of Rhizoctonia root rot in field peas; *Corteva*
Field pea: Evaluation of planting date, variety selection and fungicide seed treatment for management of Aphanomyces and Fusarium root rots in field peas; *USDA Specialty Crop Block Grant/Northern Pulse Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*

Field pea: Evaluation of planting date, variety selection and fungicide seed treatment for management of Aphanomyces and Fusarium root rots in field peas - Roseglen on-farm site; *USDA Specialty Crop Block Grant/ Northern Pulse Growers Assoc.*

Field pea: Evaluation of planting date, variety selection and fungicide seed treatment for management of Aphanomyces and Fusarium root rots in field peas - Webster on-farm site; *USDA Specialty Crop Block Grant/ Northern Pulse Growers Assoc.*

Field pea: Field pea seed treatment evaluation; *BASF*

Field pea: Large-plot assessment of planting date, variety selection and fungicide seed treatment for management of Aphanomyces and Fusarium root rots in field peas - Roseglen on-farm site; *Northern Pulse Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*

Field pea: Large-plot assessment of planting date, variety selection and fungicide seed treatment for management of Aphanomyces and Fusarium root rots in field peas - Webster on-farm site; *Northern Pulse Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*

Field pea: Optimizing fungicide application timing for management of powdery mildew in field peas - Empire peas; *ND Crop Protection Product Harmonization & Registration Board*

Field pea: Optimizing fungicide application timing for management of powdery mildew in field peas - Navarro peas; *ND Crop Protection Product Harmonization & Registration Board*

Field pea: Optimizing fungicide application timing for management of powdery mildew in field peas - Salamanca peas; *ND Crop Protection Product Harmonization & Registration Board*

Field pea: Optimizing fungicide application timing for management of powdery mildew in field peas - Shamrock peas; *ND Crop Protection Product Harmonization & Registration Board*

Lentil: Evaluation of foliar fungicides for management of anthracnose in lentils; *Bayer*

Lentil: Evaluation of fungicide seed treatments for management of Aphanomyces root rot in lentils; *Valent*

Lentil: Evaluation of fungicide seed treatments for management of Fusarium root rot in lentils; *Corteva*

Lentil: Evaluation of fungicide seed treatments for management of Pythium in lentils; *Syngenta*

Lentil: Evaluation of fungicide seed treatments for management of Rhizoctonia root rot in lentils; *Corteva*

Soybean: Biofumigation with brassica cover crops to control soil-borne diseases; *USDA Specialty Crop Block Grant*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans; *BASF*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans; *Bayer*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans; *Corteva*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans; *BASF*

Soybean: Field evaluation of fungicide seed treatments in soybeans; *North Dakota Soybean Council/ Webster (Plant Pathology)*

Soybean: Impact of corn residue level on early season disease development in soybean; *Mathews (Plant Pathology)*

Soybean: Impact of tillage history on early-season disease development in soybean; *Mathews (Plant Pathology)*

Soybean: Optimizing fungicide application timing for white mold management in soybeans; *North Dakota Soybean Council*

Soybean: Optimizing fungicide droplet size for management of white mold in soybeans; *North Dakota Soybean Council*

Soybean: Soybean white mold droplet size, Oakes; *North Dakota Soybean Council*

Soybean: Soybean white mold fungicide application timing, Oakes; *North Dakota Soybean Council*

Sunflower: Effect of fungicide on sunflower phomopsis development; *Mathews/Markell (Plant Pathology)*

Sunflower: Evaluation of fungicide seed treatments for management of Sclerotinia basal stalk rot in sunflowers; *Syngenta*

Sunflower: Sunflower rust resistance nursery; *USDA Specialty Crop Block Grant Program/Markell (Plant Pathology)*

Various: Impact of crop rotation interval and crop rotation sequence on management of Fusarium and Aphanomyces root rot in field peas; *Northern Pulse Growers Assoc.*

Wheat: Evaluation of foliar fungicides for management of Fusarium head blight of wheat; *BASF*
Wheat: Evaluation of fungicide seed treatments for management of Rhizoctonia root rot in spring wheat; *Corteva*
Wheat: Evaluation of fungicide seed treatments for management of Rhizoctonia, Fusarium and common root rot in spring wheat; *Bayer*
Wheat: Prosaro Pro efficacy in spring wheat; *Bayer*
Wheat: Prosaro Pro ergot evaluation; *Bayer*
Wheat: USWBSI Integrated Management Scab Trial; *U.S. Wheat and Barley Scab Initiative/Friskop (Plant Pathology)*

Germplasm Evaluation/Cultivar Development
Barley: Barley breeder nursery; *Horsley (Plant Sciences)*
Barley: Drill strip demonstration plots
Barley: Dryland variety trial
Barley: Irrigated variety trial
Barley: Barnes County (Dazey) variety trial
Barley: Tri-County (Wishek) variety trial
Buckwheat: Organic variety trial
Camelina: Camelina nursery; *Forever Green*
Canola: Canola breeder nursery; *Rahman (Plant Sciences)*
Canola: Conventional performance test; *Industry*
Canola: Liberty Link performance test; *Industry*
Canola: Roundup Ready performance test; *Industry*
Corn: Dryland hybrid performance test; *Industry*
Corn: Fingal hybrid performance test; *Industry*
Corn: Irrigated hybrid performance test; *Industry*
Corn: Dryland corn silage performance test; *Industry*
Corn: Performance test; *GDM*
Corn: Irrigated corn silage performance test; *Industry*
Dry bean: Dry bean breeder nursery; *Osorno (Plant Sciences)*
Dry bean: Dryland variety trial; *Industry/Norharvest Bean Growers Assoc.*
Dry bean: Irrigated variety trial; *Industry/Northarvest Bean Growers Assoc.*
Dry bean: Organic variety trial; *Industry/Northarvest Bean Growers Assoc.*
Dry bean: Tri-County/Wishek variety trial
Durum: Drill strip demonstration plots
Durum: Dryland variety trial
Durum: Organic variety trial
Durum: TriCounty variety trial
Durum: Uniform Regional Durum Nursery - dryland; *Elias (Plant Sciences)*
Durum: Uniform Regional Durum Nursery - irrigated; *Elias (Plant Sciences)*
Field Pea: Field pea breeder nursery – advanced yield trial; *Worral (North Central REC)*
Field Pea: Field pea breeder nursery - observational; *Worral (North Central REC)*
Field Pea: Field pea breeder nursery – preliminary yield trial; *Worral (North Central REC)*
Field Pea: Organic variety trial; *Northern Pulse Growers Assoc.*
Field Pea: Variety trial; *Northern Pulse Growers Assoc./Industry*
Field Pea: Organic winter pea nursery
Field Pea: Organic winter pea nursery
Field Pea: Organic winter pea spring increase
Field Pea: Winter pea variety trial; *Industry/Northern Pulse Growers Assoc.*
Flax: TriCounty variety trial
Flax: Variety trial; *AmeriFlax*
Flax: Flax breeder nursery; *Rahman (Plant Sciences)*
Flax: Organic variety trial; *AmeriFlax*
Forages: Winter rye forage variety trial; *Industry*

Hemp: Performance test for grain and fiber; *Johnson (Plant Sciences)*
Kernza: Kernza demonstration plot
Lentil: Organic variety trial
Lupin: Lupin variety evaluation; *Northern Pulse Growers Assoc.*
Oats: Oat breeder nursery; *McMullen (Plant Sciences)*
Oats: Drill strip demonstration plots
Oats: Dryland variety trial
Oats: Organic variety trial
Pennycress: Pennycress breeding nursery; *Forever Green*
Potato: Organic potato variety demonstration
Rye: Winter rye variety trial; *Industry*
Sorghum: Grain sorghum nursery
Sorghum: Grain sorghum yield trial
Soybean: Barnes County (Dazey) Roundup Ready variety performance test; *Industry*
Soybean: Breeder Nursery: 23 CAR third/fourth year conventional - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year conventional - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year conventional - Wishek; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year conventional - Dazey; *Miranda (Plant Sciences)*
Soybean: LaMoure Roundup Ready performance test; *Industry*
Soybean: Dryland conventional performance test; *Industry*
Soybean: Dryland Roundup Ready performance test; *Industry*
Soybean: Irrigated conventional performance test; *Industry*
Soybean: Irrigated Roundup Ready performance test; *Industry*
Soybean: Barnes County (Dazey) conventional performance test; *Industry*
Soybean: LaMoure conventional performance test; *Industry*
Sunflower: Non-oil hybrid performance test; *Industry*
Sunflower: Oil hybrid performance test; *Industry*
Wheat: Barnes County (Dazey) variety trial
Wheat: Drill strip demonstration plots
Wheat: Organic variety trial
Wheat: Spring wheat breeder nursery; *Green (Plant Sciences)*
Wheat: Dryland variety trial
Wheat: Irrigated variety trial
Wheat: Tri-County (Wishek) variety trial
Wheat: Uniform Regional Spring Wheat Nursery; *Green (Plant Sciences)*
Winter wheat: Winter wheat elite breeder's nursery; *Marais (Plant Sciences)*
Winter wheat: Variety trial; *Industry*

Weed Science
Canola: Glufosinate formulations efficacy in canola; *BASF*
Canola: Liberty systems evaluation in canola; *BASF*
Corn: Corn residual performance comparison; *BASF*
Corn: Timing of weed removal regional trial; *Ikley (Plant Sciences)/North Dakota Corn Utilization Council*
Lupin: Lupin herbicide preliminary testing
Misc: Herbicide site of action demonstration
Misc: Silphium herbicide tolerance
Misc: Tine weeder brand comparison
Misc: Weed arboretum species demonstration
Soybean: Enlist soybean Liberty Ultra and Enlist One adjuvants; *Helena*
Soybean: Enlist soybean Liberty Ultra Delta T
Soybean: Enlist soybean Liberty Ultra plus additional herbicides; *Helena*
Soybean: Enlist soybean Liberty Ultra timing
Soybean: Enlist soybean sprayer travel speed; *North Dakota Soybean Council*

Soybean: Enlist soybean Teejet droplet size; *North Dakota Soybean Council*
Soybean: Enlist soybean Wilger droplet size; *North Dakota Soybean Council*
Soybean: Enlist system kochia management strategies; *Pioneer*
Soybean: Liberty Ultra evaluation in soybeans; *BASF*
Soybean: Roundup Ready soybean herbicide demonstration, Wishek
Soybean: Soybean integrated weed management
Soybean: Soybean uniform regional efficacy trial; *North Dakota Soybean Council/Ikley (Plant Sciences)*
Soybean: Sulfentrazone and metribuzin safety in soybeans; *North Dakota Soybean Council/Ikley (Plant Sciences)*
Wheat: Fall herbicide strategies; *UPL*
Wheat: Post-emergence herbicide demonstration

Soil sampling in long-term Cropping Systems experiment.

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds / Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
WB9590	55	28	15.5	15.6	62.5	30.3	14,997	66.5	67.1	67.7
SY Valda	57	31	14.9	15.0	63.1	34.0	13,407	77.1	77.2	75.6
AP Murdock	56	31	14.5	15.1	61.7	30.9	14,732	84.2	81.2	76.0
MN Torgy	56	32	14.9	15.5	63.1	30.9	14,706	79.5	76.0	70.1
SY Ingmar	57	32	15.3	15.5	63.1	28.2	16,102	71.2	73.3	69.1
AP Smith	59	31	15.1	15.1	62.1	27.4	16,585	75.1	76.1	72.2
Faller	57	36	13.5	14.3	62.9	34.5	13,187	86.4	81.3	78.7
AC Hockley	56	32	15.6	--	63.9	29.6	15,403	66.4	--	--
AC Hodge	55	36	15.4	--	63.6	28.6	15,967	72.7	--	--
AP Dagr	58	30	14.0	--	61.0	28.2	16,120	81.7	--	--
AP Iconic	58	32	14.2	--	62.8	26.6	17,117	76.2	--	--
AP Elevate	59	31	14.8	--	61.5	26.8	16,958	78.7	77.3	--
AP Gunsmoke CL2	56	31	15.5	16.4	62.1	31.4	14,585	76.9	66.9	68.6
Ascend-SD	60	38	15.1	15.7	63.4	28.1	16,127	79.8	77.8	79.7
Brawn-SD	57	35	13.7	14.7	64.0	30.2	15,082	85.3	77.9	76.5
CP 3055	63	35	13.9	--	58.1	30.3	15,033	72.4	65.4	--
CP3555	57	32	14.0	--	61.9	29.6	15,374	76.8	--	--
CP3678	58	32	15.1	--	62.3	31.7	14,331	71.8	--	--
Dagmar	54	34	14.7	--	63.0	34.7	13,080	81.3	--	--
Driver	59	35	14.4	14.7	63.4	28.9	15,694	70.9	71.8	72.4
Enhance-SD	54	35	15.1	--	62.7	30.9	14,701	87.5	82.4	--
Lang-MN	59	34	14.9	--	63.5	28.7	15,843	70.5	--	--
LCS Ascent	54	31	13.4	14.2	63.0	27.9	16,281	77.9	78.3	71.9
LCS Rimfire	55	29	13.9	--	62.7	31.8	14,425	82.0	--	--
LCS Cannon	53	31	14.6	14.9	63.8	29.6	15,365	72.2	76.7	70.4
MN Rothsay	59	30	14.9	15.1	63.0	27.3	16,655	79.2	74.7	74.1
MS Charger	56	31	13.4	13.9	62.4	29.4	15,479	81.0	84.0	77.2
MS Cobra	56	31	14.8	15.3	62.8	26.5	17,173	75.9	74.9	70.7
MS Nova	55	30	15.0	--	62.4	23.7	19,214	69.3	69.4	--
MT Carlson	56	30	14.1	--	62.0	31.5	14,443	75.3	72.3	--
ND Frohberg	57	33	15.4	15.6	63.5	34.6	13,118	69.9	69.0	69.0
ND Heron	55	33	15.0	15.5	64.0	30.9	14,693	69.9	68.7	64.9
Trial Mean	57	32	14.5	--	62.6	29.9	15,317	76.9	--	--
C.V. (%)	2	4	3.8	--	0.7	5.9	6	5.4	--	--
LSD (0.10)	2	2	0.6	--	0.5	2.1	1,082	4.8	--	--

Planting Date = May 8; Harvest Date = August 28; Previous Crop = Durum

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds / Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
ND Horizon	56	32	15.5	15.6	62.9	29.9	15,209	80.7	77.6	75.1
ND Roughrider	57	33	14.5	14.9	61.7	29.8	15,217	83.5	83.5	86.8
ND Stampede	57	32	14.4	15.0	62.6	30.6	14,838	81.6	83.1	79.0
NDSU Ceres*	60	43	16.2	--	60.3	27.1	16,793	54.5	--	--
ND Thresher	56	31	14.5	15.0	61.6	27.7	16,395	75.4	71.7	71.0
PFS Muffins	57	29	14.0	--	62.2	30.5	14,881	82.1	--	--
PFS Rolls	59	34	15.0	--	62.3	31.9	14,235	75.7	69.5	--
PG Predator	59	29	14.6	--	61.6	27.7	16,420	73.1	75.5	--
Shelly	59	32	14.7	14.8	62.7	29.3	15,505	71.7	70.4	68.8
SY611 CL2	55	30	14.6	15.3	62.9	26.4	17,226	79.1	76.2	75.1
TCG Badlands	57	33	14.5	--	62.5	29.3	15,513	79.8	76.3	--
TCG Wildcat	57	32	14.3	15.3	63.5	31.3	14,491	78.7	80.5	77.5
TCG Zelda	55	29	14.3	--	62.9	32.5	14,042	82.5	82.0	--
TW Olympic	55	33	14.1	--	63.1	29.4	15,455	75.2	--	--
TW Trailfire	55	31	14.5	--	62.8	29.0	15,825	72.3	--	--
TCG Arsenal	60	32	14.4	--	62.0	32.9	13,792	71.1	--	--
LCS Dual	59	32	14.3	14.9	63.3	27.7	16,443	73.5	69.8	66.6
LCS Buster	57	36	13.1	13.3	61.8	30.3	14,977	85.4	75.8	74.3
LCS Hammer AX	55	31	14.5	14.8	61.9	28.9	15,718	79.7	78.4	73.6
LCS Boom	56	32	14.2	15.1	63.9	31.0	14,628	78.3	80.1	71.4
LCS Trigger	61	36	12.7	12.9	63.3	30.4	14,933	88.7	80.5	77.9
Virtue Andina	57	28	14.6	--	62.0	31.1	14,630	88.0	--	--
Trial Mean	57	32	14.5	--	62.6	29.9	15,317	76.9	--	--
C.V. (%)	2	4	3.8	--	0.7	5.9	6	5.4	--	--
LSD (0.10)	2	2	0.6	--	0.5	2.1	1,082	4.8	--	--

Planting Date = May 8; Harvest Date = August 28; Previous Crop = Durum

* NDSU Ceres released in 1926.

There was no notable lodging present in the trial.

Hard Red Spring Wheat - Irrigated — Carrington (Page 1 of 2)

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds / Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
WB9590	53	28	15.3	14.1	63.0	36.1	12,615	84.9	76.1	73.5
SY Valda	55	33	14.9	13.7	63.0	33.1	13,734	88.5	83.6	81.7
AP Murdock	54	31	14.5	13.9	63.3	34.8	13,057	85.6	80.2	78.1
MN Torgy	54	33	15.4	14.1	64.0	33.1	13,713	87.0	81.3	75.9
SY Ingmar	54	33	15.3	14.8	63.9	28.9	15,774	81.4	75.7	70.0
AP Smith	55	31	15.3	14.4	62.8	27.5	16,493	80.2	76.6	75.1
Faller	55	36	14.8	13.4	62.9	35.5	12,815	91.3	83.6	81.5
AC Hockley	53	32	16.2	--	63.1	28.6	15,947	68.6	--	--
AC Hodge	53	36	15.8	--	63.8	31.1	14,619	79.1	--	--
AP Dagr	55	31	14.2	--	61.1	30.3	15,033	87.3	--	--
AP Iconic	54	34	14.2	--	63.7	27.5	16,607	92.9	--	--
AP Elevate	55	30	15.0	--	62.7	31.8	14,420	89.0	81.9	--
AP Gunsmoke CL2	54	33	16.0	14.2	62.8	32.4	14,110	87.2	79.5	73.6
Ascend-SD	55	36	15.4	13.9	63.7	29.2	15,581	95.1	84.8	86.1
Brawn-SD	54	34	14.5	13.3	65.0	33.9	13,414	88.6	81.6	79.4
CP 3055	60	36	13.6	--	60.6	32.6	13,956	90.2	81.4	--
CP3555	53	31	14.5	--	62.1	31.7	14,367	83.3	--	--
CP3678	54	33	15.5	--	62.0	32.1	14,165	78.0	--	--
Dagmar	53	35	15.2	--	63.5	35.1	12,981	87.8	--	--
Driver	55	37	14.7	13.5	64.0	29.3	15,528	82.7	77.9	73.2
Enhance-SD	52	35	15.3	--	63.5	33.8	13,508	93.9	84.0	--
Lang-MN	56	38	15.2	--	64.2	29.6	15,355	83.2	--	--
LCS Ascent	52	32	14.0	13.3	63.7	30.6	14,837	89.4	80.9	76.6
LCS Rimfire	54	31	14.6	--	62.7	34.9	13,000	88.4	--	--
LCS Cannon	52	32	14.7	14.2	64.9	32.1	14,170	89.1	78.8	75.1
MN Rothsay	57	31	15.1	14.0	63.6	29.1	15,667	82.3	76.2	74.1
MS Charger	53	33	13.6	12.9	61.6	28.4	16,008	90.4	81.8	79.3
MS Cobra	53	31	14.8	14.0	63.3	28.8	15,832	84.5	75.6	70.4
MS Nova	53	31	15.1	--	63.2	27.0	16,865	84.4	72.7	--
MT Carlson	54	32	14.8	--	62.4	32.8	13,997	77.2	72.1	--
ND Frohberg	53	35	15.3	14.2	64.0	37.7	12,055	82.3	75.0	71.3
ND Heron	53	34	15.4	14.6	64.0	33.4	13,607	79.1	71.9	69.1
Trial Mean	54	33	14.9	--	63.2	31.6	14,470	86.4	--	--
C.V. (%)	1	5	1.9	--	0.7	5.6	6	4.1	--	--
LSD (0.10)	1	2	0.3	--	0.5	2.1	941	4.2	--	--

Planting Date = May 9; Harvest Date = September 3; Previous Crop = Field Pea

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds / Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
ND Horizon	53	32	15.7	14.3	62.7	32.2	14,095	90.1	81.4	81.3
ND Roughrider	54	35	14.8	13.5	62.3	30.9	14,708	95.4	88.0	86.5
ND Stampede	54	34	15.3	13.8	62.5	30.5	14,898	94.4	85.5	82.7
ND Thresher	55	32	15.2	13.8	62.8	29.1	15,602	82.0	76.5	75.7
PFS Muffins	54	31	14.5	--	62.9	31.8	14,297	88.9	--	--
PFS Rolls	56	34	14.9	--	63.2	33.5	13,595	80.6	77.1	--
PG Predator	54	30	14.9	--	62.6	31.1	14,625	87.0	81.1	--
Shelly	56	32	14.8	13.7	63.5	31.9	14,264	83.7	77.2	71.0
SY611 CL2	54	31	15.1	14.0	63.4	29.1	15,655	85.4	80.8	77.4
TCG Badlands	54	34	14.7	--	63.4	31.9	14,322	86.9	79.1	--
TCG Wildcat	55	34	15.5	14.2	64.2	34.8	13,066	89.0	83.6	80.0
TCG Zelda	53	30	14.7	--	63.8	33.7	13,490	92.9	83.4	--
TW Olympic	53	35	15.1	--	62.9	30.0	15,147	86.9	--	--
TW Trailfire	52	34	14.7	--	63.2	32.3	14,079	89.9	--	--
TCG Arsenal	57	34	14.4	--	63.2	33.0	13,859	83.8	--	--
LCS Dual	53	33	14.7	13.3	63.7	32.5	14,054	82.5	76.4	72.0
LCS Buster	53	37	13.1	12.3	61.8	30.4	14,967	91.9	86.2	81.2
LCS Hammer AX	53	32	15.5	13.9	63.3	30.2	15,061	87.1	76.9	71.2
LCS Boom	52	32	14.8	14.1	64.7	32.6	13,944	91.4	81.2	76.8
LCS Trigger	60	36	13.0	12.1	63.2	28.8	15,809	84.0	80.0	75.1
Andes	55	27	14.6		62.8	33.6	13,540	92.2	--	--
Trial Mean	54	33	14.9	--	63.2	31.6	14,470	86.4	--	--
C.V. (%)	1	5	1.9	--	0.7	5.6	6	4.1	--	--
LSD (0.10)	1	2	0.3	--	0.5	2.1	941	4.2	--	--

Planting Date = May 9; Harvest Date = September 3; Previous Crop = Field Pea

There was no notable lodging present in the trial.

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds/ Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
WB9590	52	27.2	16.0	15.0	58.9	30.2	15,038	51.8	60.8	64.6
SY Valda	53	28.7	14.7	14.1	59.9	32.0	14,279	65.8	75.1	73.7
AP Murdock	52	28.2	14.5	14.1	59.8	29.9	15,176	68.1	76.2	73.3
MN Torgy	55	31.7	15.2	15.0	60.7	30.3	14,977	66.3	75.1	69.7
SY Ingmar	50	28.0	15.5	15.0	60.6	27.1	16,739	59.8	72.1	66.6
AP Smith	53	28.0	15.2	14.6	59.3	25.9	17,505	61.6	70.5	69.7
Faller	54	31.5	14.3	13.9	60.5	33.2	13,708	74.6	77.9	79.1
AC Hodge	49	30.7	16.2	--	60.4	27.2	16,686	57.8	--	--
AP Dagr	51	29.3	14.6	--	57.0	26.5	17,175	63.7	--	--
AP Iconic	52	30.1	14.6	--	59.4	25.4	17,892	68.5	--	--
AP Elevate	50	28.7	15.1	--	58.7	27.3	16,680	62.3	--	--
AP Gunsmoke CL2	52	30.7	16.2	--	57.2	26.2	17,334	57.1	--	--
Ascend-SD	53	33.1	15.2	14.5	61.2	26.9	16,870	77.7	83.7	84.5
Brawn-SD	52	29.7	14.7	14.0	60.3	28.3	16,083	69.8	80.2	82.4
CP 3055	55	31.9	14.1	--	53.0	26.9	16,858	56.9	70.4	--
CP3555	51	29.5	14.7	--	58.1	27.2	16,720	63.6	--	--
CP3678	54	32.1	15.7	--	57.4	27.1	16,759	54.5	--	--
Dagmar	51	29.5	16.0	--	59.0	28.6	16,015	61.8	--	--
Enhance-SD	51	30.1	15.4	--	59.0	27.9	16,285	68.6	--	--
Lang-MN	55	33.3	14.9	--	61.0	27.7	16,374	67.9	--	--
LCS Ascent	49	28.2	14.4	13.7	59.1	23.6	19,273	61.5	72.5	71.9
LCS Rimfire	50	28.4	15.5	--	58.3	29.6	15,349	59.7	--	--
LCS Cannon	51	29.1	14.9	--	59.9	25.6	17,867	53.2	--	--
MN Rothsay	55	29.9	14.8	14.4	58.6	24.6	18,508	63.6	71.8	71.6
MS Charger	50	29.9	14.0	--	59.2	26.4	17,245	59.0	--	--
MS Cobra	51	31.1	15.6	--	58.4	23.7	19,220	55.9	67.6	--
MS Nova	48	29.5	14.9	--	58.8	23.3	19,531	56.2	62.7	--
ND Frohberg	52	30.5	14.7	14.3	61.0	32.8	13,849	62.0	70.2	72.0
ND Heron	51	29.7	15.7	--	60.2	28.3	16,088	56.5	--	--
ND Horizon	50	28.9	15.9	--	59.9	28.9	15,736	65.2	--	--
ND Stampede	49	29.7	15.9	14.7	58.7	28.0	16,269	62.4	74.2	74.6
ND Thresher	52	28.4	15.2	14.8	59.0	27.1	16,752	59.0	63.5	65.9
Trial Mean	52	29.7	15.0	--	59.1	27.6	16,554	62.5	--	--
C.V. (%)	5	4.5	2.0	--	1.3	5.4	5	9.8	--	--
LSD (0.10)	3	1.6	0.3	--	0.9	1.8	1,054	7.2	--	--

Planting Date = May 13; Harvest Date = August 26; Previous Crop = Soybean

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds/ Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
PFS Muffins	50	28.0	14.9	--	59.0	30.0	15,108	65.0	--	--
PFS Rolls	53	29.3	14.5	--	58.9	29.5	15,447	60.2	75.2	--
PG Predator	49	28.4	15.3	--	59.3	26.6	17,054	65.3	75.5	--
Shelly	52	29.3	14.5	--	58.3	25.7	17,659	57.0	--	--
SY611 CL2	51	29.1	15.6	--	59.1	26.2	17,378	60.5	--	--
TCG Wildcat	51	29.9	15.1	--	59.9	29.4	15,454	65.4	--	--
TCG Zelda	50	27.6	15.6	--	58.7	28.2	16,140	62.5	--	--
LCS Dual	51	30.1	15.0	14.1	58.8	25.2	18,115	60.2	66.0	67.4
LCS Buster	55	31.7	12.4	12.2	57.2	27.5	16,546	67.0	77.7	79.5
LCS Hammer AX	53	28.0	15.0	14.2	59.1	27.8	16,352	60.0	67.1	66.1
LCS Boom	50	27.8	14.8	14.4	61.1	27.5	16,541	61.0	67.4	65.3
LCS Trigger	56	32.5	12.4	--	60.0	28.9	15,726	75.5	--	--
Trial Mean	52	29.7	15.0	--	59.1	27.6	16,554	62.5	--	--
C.V. (%)	5	4.5	2.0	--	1.3	5.4	5	9.8	--	--
LSD (0.10)	3	1.6	0.3	--	0.9	1.8	1,054	7.2	--	--

Planting Date = May 13; Harvest Date = August 26; Previous Crop = Soybean

There was no notable lodging present in the trial.

ND Horizon hard red spring wheat Foundation seed increase.

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000	bu/a	bu/a	bu/a
WB9590	54	29	15.4	15.3	57.9	29.4	49.3	47.6	54.1
SY Valda	53	33	15.3	14.6	58.1	29.0	57.7	58.9	63.8
AP Murdock	53	31	14.4	14.2	59.6	29.4	64.9	61.1	67.8
MN Torgy	55	36	15.2	14.8	59.2	29.4	60.3	56.6	62.5
SY Ingmar	56	32	15.5	15.4	58.6	25.2	51.6	50.5	51.3
AP Smith	57	31	15.3	15.0	56.9	24.5	51.1	48.5	56.1
Faller	55	35	14.6	13.9	58.7	30.2	59.4	59.4	66.0
AC Hodge	52	36	15.7	--	59.5	26.7	57.0	--	--
AP Dagr	56	31	14.7	--	55.9	26.8	56.1	--	--
AP Iconic	55	33	14.6	--	57.9	23.5	63.1	--	--
AP Elevate	56	30	15.1	--	57.5	26.1	60.0	55.2	--
AP Gunsmoke CL2	52	31	16.3	--	57.5	26.7	52.9	--	--
Ascend-SD	55	38	15.2	14.4	60.5	27.7	76.0	68.5	73.2
Brawn-SD	52	33	14.3	14.1	60.6	30.3	67.0	65.6	71.9
CP 3055	59	36	14.7	--	49.0	24.5	32.9	44.1	--
CP3555	55	33	14.7	--	57.2	27.3	55.1	--	--
CP3678	57	34	15.8	--	55.6	25.6	44.7	--	--
Enhance-SD	51	34	15.7	--	58.2	27.7	63.8	--	--
Lang-MN	54	37	15.1	--	60.0	26.6	60.5	--	--
LCS Ascent	52	33	14.0	13.8	59.8	25.7	59.1	57.1	63.7
LCS Rimfire	52	30	15.0	--	58.8	30.9	47.8	--	--
LCS Cannon	49	31	14.6	--	60.4	27.6	59.0	--	--
MN Rothsay	56	31	15.0	--	58.0	25.2	55.5	--	--
MS Charger	54	34	13.8	--	57.5	26.0	59.3	--	--
MS Cobra	52	31	15.6	--	58.4	25.1	50.7	--	--
MT Carlson	54	30	14.8	--	55.9	26.6	40.8	--	--
ND Frohberg	55	37	14.9	--	59.6	30.1	57.0	--	--
ND Heron	51	33	15.2	--	60.7	28.5	53.5	--	--
ND Horizon	53	32	15.4	--	58.8	28.2	57.3	59.2	--
ND Roughrider	56	35	15.2	14.1	55.6	25.6	53.2	59.0	67.0
ND Stampede	53	33	15.6	--	57.3	25.9	60.8	--	--
ND Thresher	55	31	15.5	15.2	58.0	27.8	54.3	53.3	56.8
Trial Mean	54	33	15.0	--	57.9	27.1	55.1	--	--
C.V. (%)	3	6	2.2	--	1.8	5.4	14.0	--	--
LSD (0.10)	2	2	0.4	--	1.2	1.7	9.0	--	--

Planting Date = May 15; Harvest Date = August 28; Previous Crop = Soybean

Hard Red Spring Wheat **Tri-County - Wishek (Page 2 of 2)**

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000	bu/a	bu/a	bu/a
PFS Muffins	54	30	14.9	--	56.9	28.8	51.7	--	--
PFS Rolls	56	33	14.9	--	55.9	25.8	49.3	56.0	--
PG Predator	55	32	14.9	--	56.2	26.4	61.0	57.3	--
Shelly	56	32	14.7	14.0	58.4	26.5	52.1	52.5	59.6
SY611 CL2	53	30	15.2	--	59.5	27.5	54.7	--	--
TCG Wildcat	55	33	15.2	--	58.0	26.9	55.9	56.5	--
TCG Zelda	53	30	15.5	--	57.7	28.7	49.8	--	--
TW Olympic	54	33	15.1	--	58.8	26.8	59.1	--	--
TW Trailfire	51	32	14.9	--	58.9	26.5	56.8	--	--
LCS Dual	52	33	14.9	14.5	58.8	27.2	54.7	51.5	57.3
LCS Buster	58	36	13.3	13.0	53.8	26.6	48.9	52.2	59.9
LCS Hammer AX	53	30	15.2	14.4	55.3	24.1	38.2	42.5	49.0
LCS Boom	51	31	14.6	14.6	60.7	27.2	58.9	57.4	58.0
LCS Trigger	60	34	13.0	--	56.8	27.1	50.3	--	--
Trial Mean	54	33	15.0	--	57.9	27.1	55.1	--	--
C.V. (%)	3	6	2.2	--	1.8	5.4	14.0	--	--
LSD (0.10)	2	2	0.4	--	1.2	1.7	9.0	--	--

Planting Date = May 15; Harvest Date = August 28; Previous Crop = Soybean

There was no notable lodging present in the trial.

Seed preparation in the agronomy lab.

Hard Red Spring Wheat - Organic — Carrington

Variety	Days to Heading	Plant Height	Lodging	----- Protein ----- 2025	3-yr. Avg.	KWT	Test Weight	Moisture	Gluten	------- Yield ------- 2025	3-yr. Avg.
	days	inch	1-9	-------- % --------		g/1000	lb/bu	%		-------- bu/a --------	
WB9590	59	28.9	1.0	15.5	--	28.8	58.6	11.6	37.0	59.3	--
SY Valda	59	32.3	1.3	14.8	--	28.8	59.9	11.6	32.6	58.5	--
AP Murdock	68	33.1	2.5	15.0	--	32.4	61.2	11.8	34.6	67.7	--
MN Torgy	67	32.7	1.0	15.5	13.8	29.5	60.9	11.8	38.4	67.4	49.1
SY Ingmar	53	31.7	1.3	15.2	--	26.2	60.3	12.0	35.6	53.4	--
AP Smith	60	29.3	1.0	15.1	--	25.6	59.7	11.9	32.9	60.1	--
Faller	63	35.0	2.5	14.6	12.9	32.9	59.4	11.8	33.9	63.2	46.5
FBC Dylan	55	34.4	2.5	14.7	--	35.4	62.1	11.8	36.6	55.0	--
Red Fife	31	42.9	5.2	15.6	13.4	27.6	57.1	11.5	37.1	31.2	25.9
Ceres	40	41.1	4.5	16.2	--	28.2	59.4	11.4	38.9	39.5	--
Mida	41	43.1	3.0	16.4	--	38.8	60.1	11.8	38.5	41.1	--
Bolles	61	33.9	1.5	17.2	14.9	31.6	59.4	11.7	37.9	60.9	41.9
Glenn	54	35.6	1.5	15.9	14.2	30.4	62.8	12.3	39.2	53.8	37.2
Dapps	60	39.4	3.0	16.7	--	31.4	60.4	11.7	39.5	60.4	--
Trial Mean	53	35.3	2.3	15.6	--	30.5	60.1	11.8	36.6	55.1	--
C. V. (%)	1.3	3.2	32.8	1.2	--	5.5	0.7	2.0	1.9	8.4	--
LSD (0.10)	0.8	1.4	0.9	0.2	--	2.0	0.5	0.3	0.8	5.5	--

Planting Date = May 9; Harvest Date = August 21; Previous Crop = Fallow

Lodging: 1 = no lodging; 9 = plants lying flat.

Baling durum straw.

Durum - Dryland										**Carrington**
			----- Protein -----					---------- Yield ----------		
	Days to	Plant		3-yr.	Test		Seeds/		2-yr.	3-yr.
Variety	Heading	Height	2025	Avg.	Weight	KWT	Pound	2025	Avg.	Avg.
	days	inch	-------- % --------		lb/bu	g/1000		---------- bu/a ----------		
Maier	58.0	37.3	12.7	13.1	58.9	36.7	12,408	62.6	61.6	55.8
Mountrail	58.5	39.0	12.0	12.4	58.5	35.3	12,904	69.2	67.4	60.9
Alkabo	57.8	38.2	11.9	12.5	60.0	39.6	11,478	71.9	69.1	62.4
Divide	59.3	38.8	12.9	12.7	58.8	35.1	12,973	65.0	66.1	62.1
Carpio	58.8	40.4	12.5	12.9	60.7	40.4	11,233	69.2	67.7	61.2
Joppa	58.3	37.2	11.6	12.0	59.9	39.2	11,601	75.1	71.9	63.1
ND Grano	59.0	40.6	12.3	12.6	59.8	38.1	11,942	69.2	67.3	62.1
ND Riveland	58.3	40.4	11.9	12.5	60.9	41.5	10,957	73.4	72.6	66.6
ND Stanley	58.5	38.0	12.4	12.7	61.2	40.1	11,339	77.0	72.0	64.8
Strongfield	57.8	39.0	12.8	13.2	58.4	35.5	12,838	65.7	61.8	57.9
CDC Verona	58.0	37.6	12.0	--	59.6	36.8	12,375	64.7	--	--
AAC Spitfire	57.8	37.4	12.3	--	58.9	39.2	11,626	71.6	--	--
CDC Defy	56.8	39.8	11.8	12.4	60.7	37.4	12,148	75.6	71.3	66.5
CDC Vantta	61.5	33.9	13.3	--	56.1	29.8	15,249	51.1	--	--
MT Blackbeard	59.0	42.5	12.4	--	60.0	39.0	11,706	68.4	--	--
AAC Stronghold	57.0	36.0	12.4	--	59.6	37.2	12,225	73.9	--	--
ACC Schrader	58.5	39.0	12.6	--	60.0	37.8	12,058	68.4	--	--
TCG-Ranger	57.5	35.8	10.9	--	60.0	39.2	11,586	66.2	--	--
Trial Mean	58.5	38.8	12.3	--	60.0	39.1	11,707	68.7	--	--
C.V. (%)	1.0	6.7	3.1	--	0.8	6.0	6	7.8	--	--
LSD (0.10)	0.7	3.1	0.5	--	0.6	2.8	845	6.3	--	--

Planting Date = May 5; Harvest Date = August 26; Previous Crop = Chickpea

There was no notable lodging present in the trial.

Durum - Irrigated — Carrington

Variety	Days to Heading	Lodging	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds/ Pound	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	1-9	%	%	lb/bu	g/1000		bu/a	bu/a	bu/a
Mountrail	57	3	13.6	13.5	58.2	34.0	13,340	72.0	61.8	54.4
Divide	61	4	14.5	13.8	58.4	34.5	13,180	69.7	65.8	58.6
Carpio	60	3	14.3	13.8	59.3	36.7	12,385	69.8	61.9	55.7
Joppa	58	3	13.3	13.1	59.0	36.5	12,545	75.1	70.5	62.8
ND Riveland	58	3	13.7	13.6	60.3	39.2	11,570	83.4	73.2	66.8
ND Grano	58	3	13.8	13.7	59.8	35.2	12,907	74.9	68.4	61.2
ND Stanley	58	2	13.7	13.5	61.0	37.3	12,181	80.7	72.2	65.2
Trial Mean	58	3	13.9	--	59.7	36.9	12,350	75.7	--	--
C.V. (%)	1	22	1.4	--	0.8	5.7	6	3.6	--	--
LSD (0.10)	1	1	0.2	--	0.5	2.5	846	3.2	--	--

Planting Date = May 9; Harvest Date = August 27; Previous Crop = Field Pea

Lodging: 1 = no lodging; 9 = plants lying flat.

Durum - Dryland — Wishek

Variety	Days to Heading	Plant Height	Lodging	Protein	Test Weight	Seeds/ Pound	Yield
	days	inch	1-9	%	lb/bu		bu/a
Maier	60	32	2	14.6	55.1	14,007	34.8
Mountrail	61	32	2	14.0	54.7	14,031	29.8
Divide	60	33	2	14.2	55.5	12,998	37.5
Carpio	61	33	2	14.0	55.5	13,347	41.8
Joppa	61	31	2	13.7	54.7	13,845	29.5
ND Grano	61	31	2	14.0	55.4	13,515	39.8
ND Riveland	59	36	2	13.5	56.3	11,745	44.8
ND Stanley	60	32	2	13.8	55.9	12,878	38.3
Strongfield	59	31	3	14.7	55.2	12,862	39.0
MT Blackbeard	62	37	2	14.2	53.8	13,075	28.0
AAC Stronghold	60	30	1	14.8	53.8	14,205	33.2
Trial Mean	61	32	2	14.2	55.1	13,289	35.2
C.V. (%)	1	4	19	1.7	1.2	3	8.1
LSD (0.10)	1	1	0	0.2	0.5	287	2.4

Planting Date = May 8; Harvest Date = August 28; Previous Crop = Soybean

Significant spatial affect led to reporting all values as Best Linear Estimates.

Durum - Organic									Carrington
								------- Yield -------	
Variety	Days to Heading	Plant Height	Lodging	Protein	KWT	Test Weight	Moisture	2025	2-yr. Avg.
	days	inch	1-9	%	g/1000	lb/bu	%	------- bu/a -------	
Alkabo	53.0	39.0	1.8	14.5	34.2	58.4	11.5	54.3	50.6
Divide	55.0	39.2	1.5	16.1	32.9	56.8	11.5	53.3	51.8
ND Riveland	54.8	38.4	1.5	15.3	35.2	58.3	11.3	58.0	52.7
ND Stanley	54.5	39.2	2.3	15.0	35.3	59.6	11.6	63.8	59.1
Trial Mean	54.3	38.9	1.8	15.2	34.4	58.3	11.5	57.4	--
C. V. (%)	1.2	4.1	60.2	0.8	2.6	1.2	0.8	7.6	--
LSD (0.10)	0.8	2.1	1.4	0.2	1.2	0.9	0.1	5.7	--

Planting Date = May 9; Harvest Date = August 21; Previous Crop = Fallow

Barley - Dryland									Carrington
Variety	Days to Heading	Plant Height	Lodging	Protein	Test Weight	KWT	Seeds/ Pound	Plump	Yield
	days	inch	1-9	%	lb/bu	g/1000		%	bu/a
Two Row									
Conlon	52	37	7	15.9	51.6	45.7	9,921	95	105.9
Pinnacle	52	36	6	14.8	50.9	46.5	9,767	96	106.2
ND Genesis	53	38	7	14.9	52.3	43.6	10,438	95	112.2
AAC Synergy	54	38	8	15.7	50.7	45.0	10,086	94	112.1
Explorer	54	33	7	15.4	48.2	43.4	10,554	92	100.9
ABI Cardinal	54	36	6	15.7	51.3	44.7	10,186	97	104.6
CDC Fraser	54	37	6	16.1	50.1	44.7	10,172	95	100.5
CDC Prairie	54	38	7	15.1	50.3	42.1	10,825	94	104.1
CDC Churchill	54	35	7	16.0	50.8	43.8	10,374	92	112.9
Firefoxx	54	33	8	14.9	46.1	43.4	10,478	84	98.0
2SM184	53	36	3	14.7	52.2	44.5	10,204	97	121.5
KWS Kayis	54	33	8	14.6	49.0	44.7	10,182	97	103.1
KWS Acantis	53	31	8	14.7	48.5	46.7	9,740	94	106.9
SY Stanza	54	34	8	14.7	47.1	43.3	10,497	94	111.3
Six Row									
Tradition	53	35	4	15.9	49.1	40.1	11,308	95	128.7
ND Treasure	53	35	3	15.3	48.9	36.5	12,487	96	127.1
Trial Mean	53	35	6	15.1	49.7	44.5	10,290	94	110.5
C.V. (%)	1	6	17	2.1	1.5	4.8	5	3	7.0
LSD (0.10)	0	2	1	0.4	0.9	2.5	632	4	9.1

Planting Date = May 8; Harvest Date = August 13; Previous Crop = Field Pea

Lodging: 1 = no lodging; 9 = plants lying flat.

Barley - Irrigated — Carrington

Variety	Days to Heading	Plant Height	Protein 2025	Protein 3-yr. Avg.	Test Weight	KWT	Seeds/ Pound	Plump	Yield 2025	Yield 3-yr. Avg.
	days	inch	%	%	lb/bu	g/1000		%	bu/a	bu/a
Two Row										
Conlon	51	32	15.8	14.5	53.2	48.1	9,424	97	101.1	84.5
Pinnacle	53	33	14.3	12.9	51.3	45.0	10,139	97	109.7	95.1
ND Genesis	53	33	14.2	12.9	53.2	43.2	10,698	98	103.1	101.1
AAC Synergy	54	30	14.9	13.7	51.7	47.1	9,647	97	109.6	94.8
Explorer	54	28	14.3	13.4	50.3	47.0	9,676	95	111.3	95.7
ABI Cardinal	54	33	15.3	13.8	51.9	45.6	9,947	97	109.8	97.5
CDC Fraser	54	31	15.2	13.6	50.6	44.9	10,104	95	109.3	100.7
CDC Prairie	54	32	15.0	13.7	52.1	44.4	10,273	95	105.4	93.8
CDC Churchill	54	31	15.2	--	52.0	44.5	10,212	95	112.9	--
Firefoxx	54	30	14.0	--	47.1	43.5	10,452	94	113.4	--
2SM184	52	29	14.1	--	53.1	44.1	10,328	98	110.8	--
KWS Kayis	54	31	13.8	--	48.5	44.6	10,186	96	118.4	--
KWS Acantis	53	28	14.2	--	50.9	49.6	9,145	96	111.0	--
SY Stanza	55	27	14.1	--	48.7	45.5	9,991	97	115.4	--
Six Row										
Tradition	53	34	15.6	14.3	50.5	40.3	11,273	97	114.7	101.5
ND Treasure	52	30	14.4	13.4	50.3	39.8	11,403	95	124.7	114.0
Trial Mean	53	31	14.5	--	50.9	45.4	10,095	96	111.8	--
C.V. (%)	1	6	2.3	--	1.5	6.7	7	2	6.1	--
LSD (0.10)	1	2	0.4	--	0.9	3.6	862	2	8.0	--

Planting Date = May 9; Harvest Date = August 15; Previous Crop = Field Pea

There was no notable lodging present in the trial.

Barley									**Barnes County - Dazey**
			------- Protein -------				---------- Yield ----------		
	Days to	Plant		3-yr.	Test			2-yr.	3-yr.
Variety	Heading	Height	2025	Avg.	Weight	Plump	2025	Avg.	Avg.
	days	inch	---------- % ----------		lb/bu	%	---------- bu/a ----------		
Two Row									
Conlon	53	30	14.2	14.6	44.1	90	53.9	63.4	65.8
Pinnacle	54	31	12.5	12.5	42.9	93	78.7	81.9	85.9
ND Genesis	54	33	12.0	12.4	43.8	93	79.2	88.7	93.5
AAC Synergy	55	31	13.2	13.4	43.9	90	83.3	87.9	93.2
Explorer	55	28	13.5	13.9	42.3	84	63.1	66.8	76.7
ABI Cardinal	55	31	13.1	13.7	42.6	89	85.4	89.0	93.8
CDC Fraser	55	31	13.6	13.6	43.4	92	74.0	82.7	91.3
CDC Prairie	55	32	13.4	--	43.4	85	73.6	82.2	--
CDC Churchill	55	31	14.3	--	43.2	82	80.9	--	--
Firefoxx	55	28	13.4	--	37.1	75	54.7	--	--
2SM184	54	30	12.8	--	44.4	94	81.6	--	--
KWS Kayis	55	28	12.5	--	36.8	84	53.2	--	--
KWS Acantis	55	27	13.2	--	40.3	84	62.3	--	--
Six Row									
Tradition	53	31	14.3	14.2	42.9	85	87.4	88.6	96.6
ND Treasure	54	30	14.1	13.7	41.8	88	85.0	94.2	96.4
Trial Mean	54	30	13.4	--	42.1	86	73.5	--	--
C.V. (%)	1	3	2.5	--	1.9	3	9.2	--	--
LSD (0.10)	1	1	0.4	--	0.9	3	8.0	--	--

Planting Date = May 13; Harvest Date = August 15; Previous Crop = Soybean

Site received hail and high winds on June 20 but no damage was observed.

There was no notable lodging present in the trial.

Barley									Tri-County - Wishek
			------ Protein ------				---------- Yield ----------		
Variety	Days to Heading	Plant Height	2025	3-yr. Avg.	Test Weight	Plump	2025	2-yr. Avg.	3-yr. Avg.
	days	inch	--------- % ---------		lb/bu	%	---------- bu/a ----------		
Two Row									
Conlon	54	29	14.1	15.7	46.3	96	67.1	57.9	61.5
Pinnacle	55	29	12.4		44.1	94	68.0	73.4	
ND Genesis	55	28	12.1	12.9	44.0	96	68.1	68.5	76.0
AAC Synergy	57	29	12.8	14.5	44.0	94	76.2	83.1	87.2
Explorer	56	26	14.3	14.8	42.4	92	56.7	69.7	68.3
ABI Cardinal	57	28	13.5	14.6	44.8	96	78.7	84.1	87.4
CDC Fraser	58	30	12.6	14.3	43.6	96	75.1	75.8	82.6
Brewski	56	28	12.2	13.2	42.7	93	58.3	71.7	74.1
CDC Prairie	57	29	13.2	--	44.9	92	78.9	72.4	--
CDC Churchill	57	27	13.2	--	45.2	94	72.4	--	--
Firefoxx	56	24	12.4	--	41.6	90	69.2	--	--
Six Row									
Tradition	55	25	15.3	15.4	44.3	95	62.6	72.0	79.2
ND Treasure	55	24	13.7	14.9	41.8	94	65.6	77.2	81.0
Trial Mean	56	27	13.2	--	43.8	94	68.9	--	--
C.V. (%)	1	7	4.7	--	2.2	2	12.0	--	--
LSD (0.10)	1	2	0.8	--	1.1	3	9.9	--	--

Planting Date = May 8; Harvest Date = August 15; Previous Crop = Soybean

There was no notable lodging present in the trial.

Barley breeder nursery at Carrington.

Oat - Organic								Carrington
Variety	Days to Heading	Plant Height	Lodging	Protein	KWT	Test Weight	Moisture	Yield
	days	inch	1-9	%	g/1000	lb/bu	%	bu/a
AAC Douglas	55.5	41.5	8.0	11.7	27.3	32.5	10.0	106.4
Beach	55.0	40.7	6.0	13.0	33.3	38.6	10.4	115.6
CDC Endure	57.5	41.3	3.2	12.1	31.3	34.7	9.9	110.4
CS Camden	56.5	40.6	8.3	11.5	26.4	31.7	10.2	110.5
Deon	58.0	46.5	6.2	12.6	30.2	35.5	9.7	112.9
HiFi	57.3	40.7	6.7	12.6	25.9	34.9	10.2	106.3
Killdeer	54.0	36.6	7.8	11.8	24.2	31.7	10.4	98.6
ND Carson	56.5	39.0	5.0	11.8	29.7	35.0	10.1	128.2
Crema	58.3	45.1	6.7	12.9	25.3	35.8	10.0	77.3
ND Heart	56.5	43.9	5.7	12.7	31.0	36.3	10.0	101.2
ND Spilde	56.8	43.9	4.5	11.8	31.8	34.0	10.7	114.0
Newburg	57.5	40.7	6.2	11.5	24.4	29.9	10.2	108.2
ORE3541M	54.8	37.0	4.2	12.3	29.7	35.7	10.4	105.2
Paul	60.8	50.0	4.0	14.4	24.8	40.4	9.9	58.7
Rockford	57.3	42.5	7.2	11.7	25.3	35.1	10.2	107.5
ND Miller	56.5	39.4	5.7	12.4	32.9	36.8	10.1	115.6
ND Williams	57.3	44.1	7.0	12.3	33.7	35.6	10.3	100.7
Trial Mean	57.2	42.5	5.7	12.6	29.4	35.6	10.1	104.8
C. V. (%)	1.2	4.3	27.7	4.7	7.2	2.4	4.7	16.2
LSD (0.10)	0.8	2.2	1.9	0.7	2.5	1.0	0.6	20.1

Planting Date = May 8; Harvest Date = August 19; Previous Crop = Fallow

Lodging: 1 = no lodging; 9 = plants lying flat.

Oat drill strip demonstration.

Canola - Liberty Link Cultivars **Carrington**

Brand	Hybrid	Blackleg Resistance	Clubroot Resistant	Herbicide Trait	Status	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Oil	1000 KWT	Seeds/ Pound	Test Weight	------ Yield ------ 2025*	2-yr. Avg.
						DAP	days	DAP	inch	%	grams		lb/bu	------- lb/a -------	
Winfield Un/Croplan	CP7130LL	R	Yes	LL	CA	49	21	92	43	45.2	3.1	147,919	51.7	2249	2067
Winfield Un/Croplan	CP7250LL	R	Yes	LL	CA	48	22	92	43	45.6	3.0	152,293	52.8	2333	1992
Bayer/Dekalb	DK400TL	R	Yes	TFLL	CA	48	21	92	45	45.4	3.4	132,674	51.5	2158	1957
Bayer/Dekalb	DK401TL	R	Yes	TFLL	CA	46	23	92	44	47.0	3.7	126,301	52.4	2130	2055
Bayer/Dekalb	DK800LL	R	Yes	LL	CA	46	23	92	43	46.9	3.5	131,792	52.6	2269	2155
Bayer/Dekalb	DK801LL	R	Yes	LL	CA	46	21	92	45	46.3	3.2	142,551	52.3	2072	2121
Canterra Seeds	CS4200LL**	R	Yes	LL	Exp	49	22	93	44	47.7	3.2	141,873	52.4	2623	--
DL Seeds Inc	DL232637	R	Yes	LL	Exp	46	24	93	45	48.0	3.1	147,113	52.6	2583	--
DL Seeds Inc	DL241738	R	Yes	LL	Exp	45	23	92	44	47.9	3.6	127,214	51.7	2322	--
DL Seeds Inc	DL241745	R	Yes	LL	Exp	45	23	91	42	47.6	3.5	130,307	51.7	2466	--
DL Seeds Inc	DL241841	R	Yes	LL	Exp	47	23	92	44	46.7	3.4	134,125	52.8	2601	--
DL Seeds Inc	DL242028	R	Yes	LL	Exp	47	21	92	43	46.7	3.5	131,318	52.7	2386	--
DL Seeds Inc	DL242343	R	Yes	LL	Exp	48	23	94	46	47.6	3.2	142,688	52.7	2339	--
DL Seeds Inc	DL242406	R	Yes	LL	Exp	49	22	93	42	43.9	3.4	137,383	53.0	2202	--
Canterra Seeds	CS4100 LL	R	Yes	LL	CA	46	24	92	45	47.6	3.7	123,194	52.5	2394	--
Canterra Seeds	CS Exp 25-4 LL	R	Yes	LL	Exp	47	22	92	42	47.2	2.8	161,570	51.8	2611	--
InVigor (BASF)	L330PC	R	Yes	LL	CA	45	23	92	43	45.3	3.1	148,161	52.6	2569	--
InVigor (BASF)	L333PC	R	Yes	LL	CA	49	20	93	44	44.6	3.2	144,805	52.6	2601	2442
InVigor (BASF)	L340PC	R	Yes	LL	CA	47	21	92	44	44.8	3.3	136,928	51.7	2545	2568
InVigor (BASF)	L343PC	R	Yes	LL	CA	47	20	91	44	45.4	3.4	134,760	51.3	2372	2351
InVigor (BASF)	L345PC	R	Yes	LL	CA	50	18	92	44	44.5	3.3	139,582	53.3	2622	2571
InVigor (BASF)	L350PC	R	Yes	LL	CA	53	18	93	44	45.7	2.9	159,938	53.2	2593	2389
InVigor (BASF)	LR354PC	R	Yes	TFLL	CA	51	19	93	40	46.2	3.1	147,304	54.1	2567	2531
InVigor (BASF)	L355PC	R	Yes	LL	CA	51	19	93	44	47.5	2.9	159,779	53.2	2642	--
DynaGro Seeds	DG 661 LCM	R	Yes	LL	CA	48	22	92	39	46.6	3.0	153,414	52.9	2337	2093
Trial Mean						48	21	92	44	46.3	3.3	141,400	52.5	2375	--
C.V. (%)						3	7	1	8	1.9	10.2	10	0.9	6	--
LSD (0.10)						1	2	1	4	1.0	0.4	17,379	0.6	103	--

Planting Date = May 7; Harvest Date = August 14; Previous Crop = Durum

* Best Linear Unbiased Estimate; ** Pending registration

There was no notable lodging present in the trial.

Canola - Roundup Ready Cultivars — Carrington

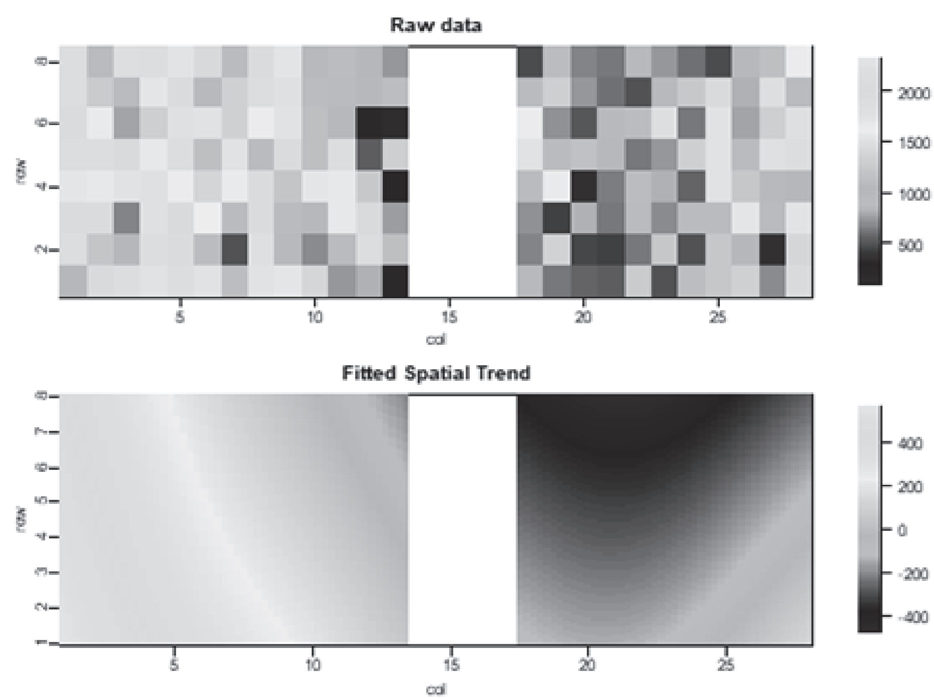
Brand	Hybrid	Blackleg Resistance	Clubroot Resistant	Herbicide Trait	Availability	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Oil	1000 KWT	Test Weight	Yield 2025*	Yield 2-yr. Avg.
						DAP	days	DAP	inch	%	grams	lb/bu	lb/a	lb/a
Winfield Un/Croplan	CP9978TF	R	No	TF	CA	45	13	94	44	48.4	3.9	55.6	2865	2581
Winfield Un/Croplan	CP9221TF	R	Yes	TF	CA	45	13	92	45	45.2	3.9	53.7	2924	2484
Winfield Un/Croplan	CP9551TF	N/A	N/A	TF	CA	45	13	92	43	48.6	3.7	54.6	2975	--
Bayer/Dekalb	DK904TF	R	Yes	TF	CA	45	13	93	45	50.7	3.9	56.7	3242	--
Canterra Seeds	CS3300 TF	R	Yes	TF	CA	45	13	92	48	47.7	3.6	54.1	3167	--
Canterra Seeds	CS3200 TF	R	Yes	TF	CA	45	14	95	49	51.4	3.7	56.9	3435	--
InVigor (BASF)	LR354PC	R	Yes	TFLL	CA	49	10	94	46	51.3	3.2	57.6	3418	2885
DynaGro Seeds	DG 781 TCM	R	Yes	TF	CA	45	13	93	47	48.1	4.2	55.0	3055	2471
Trial Mean						45	13	93	46	48.9	3.8	55.5	3064	--
C.V. (%)						1	7	1	8	2.0	3.3	1.0	3	--
LSD (0.10)						1	1	1	5	1.2	0.2	0.7	92	--

Planting Date = May 7; Harvest Date = August 14; Previous Crop = Fallow

* Best Linear Unbiased Estimate

There was no notable lodging present in the trial.

An internal alley was cut to allow desiccation of the sunflower trial this year. After desiccation, several severe storms occurred and left significant lodging. The Raw Data image shows the yields that were obtained from the trial. A spatial analysis was attempted and can be seen in the Fitted Data image. However, the spatial analysis significantly deflated the yield values. As such, lodge ranges and yield ranges are reported.



Brand	Hybrid	Hybrid Status	Oil Type	Conoil	Trait	DM Resist.	Days to Bloom	Days to Maturity	Plant Height	Oil Content	Test Weight	Max Lodge	Min Lodge	Min Yield	Max Yield
							DAP	DAP	inch	%	lb/bu	1-9	1-9	lb/ac	lb/ac
USDA	Hybrid 894	Check					65	114	70	38.9	33.7	5	1	663	1043
USDA	559CL	Check					71	120	82	39.6	34.3	5	4	1221	1739
USDA	8N270CLDM	Check					65	117	73	37.4	33.7	3	1	458	987
Winfield Un./Croplan	CP4255E	CA	HO	No	EX	Yes	68	131	71	36.6	33.2	2	1	1139	1553
Winfield Un./Croplan	CP4475E	CA	HO	No	EX	Yes	68	124	77	37.5	32.2	4	1	805	1877
Winfield Un./Croplan	CP4490E	CA	HO	No	EX	Yes	73	126	75	36.3	30.4	4	1	984	1769
Winfield Un./Croplan	CP455E	CA	HO	No	EX	Yes	69	127	77	36.7	32.7	4	2	688	1300
Winfield Un./Croplan	CP5249CL	CA	HO	No	CL	Yes	67	119	69	43.3	31.3	4	2	904	1512
Winfield Un./Croplan	CP7919CL	CA	HO	No	CL	na	71	127	71	39.8	32	5	2	860	1631
Nuseed	N4H422 CL	CA	HO	No	CL	Yes	69	121	81	38.2	33.9	4	2	619	1766
Nuseed	N4H470 CLP	CA	HO	No	CP	Yes	71	124	79	40.5	33	6	1	733	2307
Nuseed	N4H490 E	CA	HO	No	EX	Yes	71	121	76	40.1	34.4	7	2	747	1481
Nuseed	N4H205 E	CA	HO	No	EX	Yes	70	115	72	41.3	31.6	9	5	252	1058
Nuseed	N5H493 CL	CA	HO	Yes	CL	No	71	119	77	28.5	29.3	5	2	709	1925
Nuseed	N4H337 E	CA	HO	No	EX	Yes	70	118	76	40.1	33.9	8	4	505	1935
Nuseed	N4H462 E	CA	HO	No	EX	Yes	72	121	77	40.7	32.8	8	4	541	1380
Thunder Seed	TSU1561H	CA	HO	No	EX	Yes	70	116	72	40.7	32.3	8	6	467	550
Thunder Seed	TSU1582H	CA	HO	No	EX	Yes	71	124	79	39.6	33.9	3	3	900	1941
Thunder Seed	TSU1512H	CA	HO	No	EX	No	69	122	80	38.4	32.2	4	2	470	1813
Thunder Seed	TSU1592N	CA	NS	No	EX	No	71	123	76	38.4	35.4	3	1	1048	1990
Thunder Seed	TCP1533H	CA	HO	No	CP	Yes	71	123	76	40.7	34	2	1	1207	2074
Limagrain	LG50459 SX	EXP	HO	N/A	EX	Yes	72	122	78	35	33.2	3	1	857	1612
Limagrain	LG50487 CLP	EXP	HO	N/A	CP	Yes	67	119	75	37.7	32.3	4	2	677	1118
Limagrain	LG50540 CLP	EXP	HO	N/A	CP	Yes	67	121	73	36.1	31.4	1	1	986	1445
Trial Mean							70	122	77	38.4	32.8				
C.V. (%)							2	2	6	2.3	3				
LSD (0.10)							2	3	5	1	1.2				

Planting Date = June 6; Harvest Date = November 6 and 12; Previous Crop = Durum

Brand	Hybrid	Hybrid Status	Oil Type	Conoil	Trait	DM Resist.	Days to Bloom	Days to Maturity	Plant Height	Oil Content	Test Weight	Max Lodge	Min Lodge	Min Yield	Max Yield
							DAP	DAP	inch	%	lb/bu	1-9	1-9	lb/ac	lb/ac
Proseed	50068CL	CA	HO	No	CL	Yes	69	124	78	38.1	34.1	2	1	1392	2136
Proseed	E-93 E	CA	HO	No	EX	N/A	72	123	82	38.3	32.5	8	2	313	1198
Proseed	E-2446 E	CA	HO	No	EX	N/A	73	117	87	37	32.1	7	2	622	981
Proseed	EXP2609 E	Exp	HO	No	EX	N/A	69	116	83	38.1	32.4	5	1	616	1708
Proseed	EXP2624 E	EXP	HO	No	EX	N/A	72	124	85	33.9	30.6	2	1	717	2039
Proseed	EXP2625 E	CA	HO	No	EX	N/A	73	126	88	34.1	29.3	2	1	660	1568
Proseed	2578 E	CA	HO	No	EX	Yes	71	116	68	40.2	32.1	8	2	348	1122
Proseed	2534 E	CA	HO	No	EX	Yes	72	123	78	40.2	34.3	6	2	690	1789
Proseed	EXP 2691 CP	Exp	HO	No	CP	Yes	70	125	75	40.6	34.2	7	3	712	1506
Advanta Seeds	ADV 5205CLHO	Exp	HO	N/A	CL	Yes	74	125	84	37.4	33.1	9	1	212	1848
Nutrien/Dyna-Gro	XH41H56 CL	Exp	HO	No	CL	Yes	63	118	56	35.6	30.7	1	1	805	926
Nutrien/Dyna-Gro	H49HO19 CL	CA	HO	No	CL	Yes	73	122	78	39.2	32.8	4	2	1462	2125
Nutrien/Dyna-Gro	H50HO20 CP	CA	HO	No	CP	Yes	71	123	78	40.6	34.6	8	3	586	1630
Nutrien/Dyna-Gro	H45HO10 EX	CA	HO	No	EX	No	70	121	79	38.8	31.1	4	3	596	1621
Nutrien/Dyna-Gro	H47HO11 EX	CA	HO	No	EX	Yes	70	131	83	37	34.9	2	1	910	1357
Nutrien/Dyna-Gro	XH41H90 EX	Exp	HO	No	EX	Yes	71	122	79	40.1	33.4	8	2	424	2063
Nutrien/Dyna-Gro	XH41H54 CL	CA	HO	No	CL	Yes	68	121	79	39.3	34.7	5	1	404	1681
Sunrich Products	4425CL	CA	MO	Yes	CL	No	67	121	76	34.1	31.8	2	1	1214	1896
Sunrich Products	4415HO/DMR/CLP	CA	HO	No	CP	Yes	70	120	77	36.9	33	4	1	954	1899
Advanta Seeds	ADV 5310CL	Exp	Trad.	N/A	CL	Yes	73	122	77	42.3	32.9	4	1	1643	1885
Advanta Seeds	ADV 5407CL	Exp	Trad.	N/A	CL	Yes	73	117	77	43.8	31.3	4	1	1269	2034
Advanta Seeds	Hysun 182IT	Exp	Trad.	N/A	CL	Yes	69	118	77	36.4	33.6	3	1	1028	2149
Advanta Seeds	Hysun 302IT	Exp	Trad.	N/A	CL	Yes	72	120	80	36.7	33.7	6	2	928	1963
Advanta Seeds	ADV 5420CL	Exp	Trad.	N/A	CL	Yes	74	126	75	43.4	32.3	2	1	1969	2222
Trial Mean							70	122	77	38.4	32.8				
C.V. (%)							2	2	6	2.3	3				
LSD (0.10)							2	3	5	1	1.2				

Planting Date = June 6; Harvest Date = November 6 and 12; Previous Crop = Durum

Storms with strong winds were prevalent during dry-down and resulted in uneven lodging significantly affecting yield.

Lodging: 1 = no lodging; 9 = plants lying flat.

Flax									Carrington
							---------- Yield ----------		
		Plant	Days to	Days to	Oil	Test		2-yr.	3-yr.
Variety	Color	Height	Flower	Maturity	Content	Weight	2025	Avg.	Avg.
		inch	DAP	DAP	%	lb/bu	---------- bu/a ----------		
AAC Marvelous	Brown	25	47	90	39.4	42.9	21.7	25.7	27.5
CDC Glas	Brown	25	47	90	39.3	40.6	23.8	24.6	26.7
CDC Kernen	Brown	25	47	90	37.6	38.6	18.9	23.3	25.4
CDC Neela	Brown	26	50	90	38.1	42.4	22.7	28.0	28.7
CDC Rowland	Brown	27	49	91	38.3	41.1	24.1	27.6	27.1
ND Hammond	Brown	26	46	90	37.9	42.2	24.3	25.3	26.3
TCG-Webster	Brown	28	46	91	38.4	43.4	24.4	27.1	27.3
York	Brown	26	44	90	37.6	44.5	23.7	27.1	28.7
Linore	Brown	27	46	91	37.1	45.9	23.6	--	--
AAC Bright	Yellow	24	44	88	40.8	39.0	22.2	21.6	24.7
CDC Durado	Yellow	23	41	85	38.8	37.8	13.4	15.2	--
Carter	Yellow	24	45	90	37.1	47.6	27.9	27.9	28.6
Gold ND	Yellow	25	44	89	37.2	43.9	23.1	26.6	27.0
Omega	Yellow	22	46	87	37.4	42.2	19.7	20.1	23.0
Avian*	Fiber	35	48	92	--	40.7	15.2	--	--
Trial Mean		26	46	90	38.1	43.0	23.0	--	--
C.V. (%)		4	2	1	1.2	2.3	9.7	--	--
LSD (0.10)		1	2	1	0.6	1.3	3.0	--	--

Planting Date = May 29; Harvest Date = September 24; Previous Crop = Hay barley

*Excluded from statistics since different market class.

There was no notable lodging present in the trial.

Winter Rye									**Carrington**
								---------- Yield ---------	
Variety	Heading Date	Plant Height	Lodging	Protein	KWT	Seeds/ Pound	Test Weight	2025	3-yr. Avg.
		inch	1-9	%	g/1000		lb/bu	---------- bu/a ---------	
ND Dylan	5/31	47.7	5.8	11.6	26.3	18,671	53.4	74.3	65.7
ND Gardner	5/27	46.1	4.8	13.0	25.0	18,135	52.5	70.2	60.5
Hazlet	5/30	46.6	3.5	11.4	32.9	13,815	54.6	91.2	73.3
Danko	5/29	43.8	2.3	11.1	30.6	14,854	54.6	89.3	72.8
Aroostook	5/28	52.4	2.8	11.6	29.9	15,202	53.8	83.3	65.0
Rymin	5/30	46.4	4.0	11.9	28.3	16,038	53.2	79.2	65.0
Spooner	5/29	51.3	3.3	12.2	26.7	17,294	53.2	73.0	59.3
SU Cossani	5/30	44.8	1.8	9.4	29.0	15,678	54.5	105.6	85.6
SU Perspectiv	5/30	38.9	2.5	9.7	29.9	15,209	53.1	99.5	83.9
SU Performer	5/30	46.5	2.0	8.5	28.1	16,192	54.1	123.2	95.6
SU Bebop	5/30	46.8	3.0	10.2	29.1	15,634	54.1	107.9	83.4
SU Baresi	5/30	45.2	1.5	9.1	26.0	17,743	54.0	121.7	--
KWS Receptor	5/30	43.8	2.3	9.2	27.6	16,438	54.5	119.1	104.0
KWS Serafino	5/31	40.9	2.5	9.6	29.5	15,457	54.8	113.5	95.4
KWS Tayo	5/31	44.2	1.8	9.5	28.8	15,853	53.3	114.9	95.1
Exp KWS H247	5/30	42.3	1.8	9.2	29.2	15,588	54.4	125.3	--
Exp KWS H249	5/29	34.7	2.5	9.8	29.1	15,668	53.9	108.8	--
Wintergrazer	5/28	46.9	4.8	15.4	22.6	20,096	53.1	48.2	--
Wheeler	5/31	48.1	4.3	15.8	36.1	12,587	50.6	36.3	--
Wrenz Abruzzi	5/28	45.7	7.0	16.1	20.6	22,109	50.9	32.8	--
Elbon	5/28	45.5	3.8	14.7	21.7	20,989	53.3	53.9	--
Guardian	5/30	42.4	4.0	10.8	31.1	14,607	54.4	79.4	--
Trial Mean	5/29	45.0	3.3	11.4	28.1	16,539	53.6	88.7	--
C.V. (%)	0	13.5	22.8	3.2	8.1	11	1.0	10.1	--
LSD (0.10)	1	9.0	1.1	0.5	3.4	2,702	0.8	13.2	--

Planting Date = September 20, 2024; Harvest Date = August 1, 2025; Previous Crop = Forage Barley

Lodging: 1 = no lodging; 9 = plants lying flat.

Soybean, Dryland Conventional Varieties **Carrington**

Brand	Variety	Mat. Group	Time to Maturity	Plant Height	Oil	Protein	KWT	Seeds / Pound	Test Weight	Yield
			DAP	inch	%	%	g/1000		lb/bu	bu/a
NDSU	ND Stutsman	0.7	117	37	17.1	34.3	99.2	4,573	55.9	47.9
Richland IFC	MK009	0.9	111	35	16.0	34.9	51.4	8,842	55.5	35.1
Richland IFC	MK0249	2	111	34	16.9	33.7	67.9	6,692	55.2	36.6
Richland IFC	MK0603	0.6	118	33	14.6	36.1	61.8	7,365	56.4	37.4
NDSU	ND Benson	0.4	113	36	17.2	35.8	94.3	4,824	55.9	36.4
NDSU	ND Dickey	0.7	116	36	16.1	36.2	125.2	3,633	56.0	42.1
NDSU	ND Rolette	00.9	108	37	17.4	34.4	92.8	4,892	55.4	42.8
NDSU	ND21008GT20	00.8	108	33	17.2	35.1	113.9	4,012	55.9	37.5
NDSU	ND2108GT73	0.8	119	36	17.3	34.1	97.9	4,650	56.7	39.1
NDSU	ND17009GT	00.9	109	33	17.1	36.6	122.3	3,725	56.5	35.3
Trial Mean			114	36	17.1	34.9	103.0	4,670	55.6	40.1
C.V. (%)			1	4	1.7	1.4	7.8	7	0.7	9.3
LSD (0.10)			2	2	0.3	0.6	9.5	391	0.5	4.4

Planting Date = May 9; Harvest Date = October 9; Previous Crop = Durum

No significant lodging occurred.

Soybean - Dryland, Roundup Ready Varieties — Carrington (Page 1 of 2)

Brand	Variety	Mat. Group	Time to Maturity	Plant Height	Oil	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.*
			DAP	inch	%	%	g/1000		lb/bu	bu/a	bu/a
NDSU	ND21008GT20	0.08	110	35	16.8	34.2	120.3	3,784	54.6	45.1	47.0
NDSU	ND2108GT73	0.8	122	37	16.4	34.1	105.9	4,293	55.5	41.5	52.6
NDSU	ND17009GT	0.09	115	37	16.0	36.5	128.7	3,531	56.1	38.6	45.8
Syngenta/NK Seeds	NK02-W8E3	0.2	110	35	17.8	33.6	144.9	3,132	54.4	57.6	--
Syngenta/NK Seeds	NK02-Y2XF	0.2	113	38	17.2	33.3	126.8	3,598	53.9	55.1	--
Syngenta/NK Seeds	NK03-J1XF	0.3	116	38	16.6	34.4	138.0	3,291	54.3	58.7	64.9
Syngenta/NK Seeds	NK04-Q9XF	0.4	120	39	16.7	33.2	133.2	3,418	55.2	48.5	--
Syngenta/NK Seeds	NK06-C4XF	0.6	119	40	16.0	33.1	118.7	3,822	54.8	55.2	--
Bayer Channel	0325RXF	0.3	116	38	16.8	34.5	130.0	3,507	54.1	54.2	--
Bayer Channel	0525RXF	0.5	120	36	16.7	34.2	118.2	3,842	53.9	48.8	--
Bayer Channel	CT0126E	0.1	115	36	15.9	35.3	119.2	3,808	54.1	49.2	--
Bayer Channel	CT0626E	0.6	121	37	15.6	35.0	134.9	3,371	55.1	49.3	--
Wilbur Ellis Co/Integra	XF0212	0.2	115	34	16.5	35.4	126.9	3,578	54.4	55.6	62.3
Wilbur Ellis Co/Integra	XF0493	0.4	119	37	16.7	34.8	126.1	3,601	54.7	47.6	56.9
Wilbur Ellis Co/Integra	XF0674	0.6	119	38	16.3	34.5	112.8	4,030	54.9	47.1	59.0
Wilbur Ellis Co/Fortus	0324E	0.3	118	39	15.9	34.7	117.2	3,874	54.5	50.3	--
Thunder Seed	TE7405N	0.5	120	38	16.3	34.5	120.4	3,774	54.7	46.5	--
Thunder Seed	TX8605N	0.5	121	37	16.6	33.9	119.4	3,806	53.7	54.3	--
Thunder Seed	TX8307N	0.7	121	37	15.2	35.6	114.6	3,962	55.8	47.7	60.6
Trial Mean			118	37	16.4	34.5	123.0	3,718	54.6	50.2	--
C.V. (%)			1	6	1.8	1.2	4.7	5	0.6	9.8	--
LSD (0.10)			2	3	0.3	0.5	6.8	209	0.4	5.8	--

Planting Date = May 29; Harvest Date = October 2; Previous Crop = Durum

* 2-yr. Average is for 2023 and 2025. The 2024 trial was lost to hail.

Soybean - Dryland, Roundup Ready Varieties **Carrington (Page 2 of 2)**

Brand	Variety	Mat. Group	Time to Maturity	Plant Height	Oil	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.*
			DAP	inch	%	%	g/1000		lb/bu	bu/a	bu/a
Thunder Seed	TE7407N	0.7	120	37	15.4	36.2	128.2	3,547	55.6	50.9	59.6
Proseed	EL60-23N	0.2	118	37	16.1	34.4	116.7	3,887	54.4	53.7	--
Proseed	EL60-33N	0.3	120	35	15.9	35.9	109.4	4,152	55.1	49.3	--
Proseed	EL60-53N	0.5	118	40	16.5	35.0	113.4	4,028	54.1	49.5	--
Proseed	XF60-22N	0.2	117	35	16.5	33.4	126.8	3,589	53.9	51.5	--
Proseed	XF60-32N	0.3	116	36	16.3	33.8	109.3	4,154	54.3	46.6	--
Proseed	XF60-42N	0.4	115	37	16.8	34.3	132.6	3,445	53.9	56.3	--
Dyna-Gro	S03XF36	0.3	116	40	16.9	34.1	134.9	3,370	54.1	53.0	--
Dyna-Gro	S07XF86	0.7	120	38	16.7	33.9	125.5	3,619	53.8	54.9	--
BASF-Xitavo	XO 0436E	0.4	119	37	15.7	35.9	107.0	4,244	55.0	36.3	--
BASF-Xitavo	XO 0554E	0.5	119	38	16.9	34.1	122.8	3,704	54.2	49.1	--
BASF-Xitavo	XO 0602E	0.6	121	38	16.0	35.0	130.1	3,489	54.8	52.9	--
Trial Mean			118	37	16.4	34.5	123.0	3,718	54.6	50.2	--
C.V. (%)			1	6	1.8	1.2	4.7	5	0.6	9.8	--
LSD (0.10)			2	3	0.3	0.5	6.8	209	0.4	5.8	--

Planting Date = May 29; Harvest Date = October 2; Previous Crop = Durum

No significant differences in lodging were observed.

* 2-yr. Average is for 2023 and 2025. The 2024 trial was lost to hail.

Soybean - Irrigated, Conventional Varieties — Carrington

Brand	Variety	Mat. Group	Time to Maturity	Plant Height	Oil	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
			DAP	inch	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	0.7	119	36	16.6	34.9	118.8	3,825	56.2	53.8	60.9	66.0
Richland IFC	MK009	0.9	116	35	16.0	34.0	64.9	7,001	56.2	40.7	41.3	44.0
Richland IFC	MK0249	2.0	116	34	16.5	34.0	90.9	5,118	56.0	44.0	44.8	47.9
Richland IFC	MK0603	0.6	120	29	14.8	36.4	81.2	5,633	55.7	36.0	45.3	53.3
NDSU	ND Benson	0.4	120	38	17.0	36.4	125.3	3,627	56.0	42.1	47.5	52.3
NDSU	ND Dickey	0.7	121	40	15.8	36.3	144.6	3,143	55.9	49.9	57.8	60.3
NDSU	ND Rolette	00.9	114	38	17.2	34.8	115.3	3,945	55.5	49.9	53.4	57.2
NDSU	ND21008GT20 (Check)	00.8	115	31	16.8	34.6	134.9	3,374	55.7	47.8	--	--
NDSU	ND2108GT73 (Check)	0.8	123	39	16.9	34.9	120.4	3,778	56.6	48.8	--	--
NDSU	ND17009GT (Check)	00.9	117	34	16.9	36.1	139.1	3,264	57.2	41.0	--	--
Trial Mean			118	36	16.8	35.2	122.8	3,848	55.7	44.9	--	--
C.V. (%)			1	6	1.8	1.0	7.0	8	0.6	9.8	--	--
LSD (0.10)			1	3	0.4	0.4	10.1	362	0.4	5.2	--	--

Planting Date = May 29; Harvest Date = October 10; Previous Crop = Field Pea

No significant lodging occurred.

Soybean - Irrigated, Roundup Ready Varieties **Carrington**

Brand	Variety	Mat. Group	Time to Maturity	Plant Height	Oil	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
			DAP	inch	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	0.8	116	28	17.0	34.8	132.7	3,423	55.9	45.3	56.5	58.0
NDSU	ND2108GT73	0.8	123	39	17.5	34.4	125.1	3,636	56.4	48.8	74.8	70.8
NDSU	ND17009GT	0.9	115	32	17.4	35.8	135.0	3,360	57.1	46.3	55.4	55.7
Wilbur Ellis Co/Integra	XF0493	0.4	121	39	18.0	34.4	145.4	3,126	55.8	51.9	69.1	--
Wilbur Ellis Co/Integra	XF0674	0.6	121	38	17.5	34.2	137.6	3,307	55.5	43.2	--	--
Dyna-Gro	S03XF36	0.3	118	41	17.5	34.7	143.2	3,171	54.8	53.1	--	--
Dyna-Gro	S07XF86	0.7	121	33	18.2	33.1	143.3	3,174	54.6	59.2	--	--
Trial Mean			119	36	17.6	34.5	137.5	3,314	55.7	49.7	--	--
C.V. (%)			1	5	1.3	1.3	4.9	5	0.7	10.3	--	--
LSD (0.10)			2	2	0.3	0.6	8.3	201	0.5	6.2	--	--

Planting Date = May 29; Harvest Date = October 10; Previous Crop = Field Pea

No significant lodging occurred.

Soybean - Dryland, Conventional Varieties — Wishek

Brand	Variety	Mat. Group	Plant Height	Oil	Protein	Test Weight	Yield 2025	Yield 2-yr. Avg
			inch	%	%	lb/bu	bu/a	bu/a
NDSU	ND Benson	0.4	34.0	17.5	35.6	55.5	51.6	51.4
NDSU	ND Dickey	0.7	37.0	16.3	35.7	55.2	55.6	55.9
NDSU	ND Rolette	00.9	37.9	17.1	34.8	55.2	58.0	53.5
NDSU	ND21008GT20 (Check)	00.8	37.5	17.0	34.5	55.3	50.7	--
NDSU	ND2108GT73 (Check)	0.8	31.0	17.4	34.0	55.6	48.9	--
NDSU	ND17009GT (Check)	00.9	38.1	17.4	35.5	56.2	43.2	--
Trial Mean			35.1	17.2	35.1	55.2	51.3	--
C.V. (%)			10.0	2.0	1.9	0.7	6.1	--
LSD (0.10)			4.1	0.4	0.8	0.4	3.7	--

Planting Date = May 28; Harvest Date = October 7; Previous Crop = Wheat

No significant lodging occurred.

Site received frost on September 9 before all lines were mature.

Soybean - Dryland, Roundup Ready Varieties														Dickey County - Oakes
		Mat	Days	Pod	Plant	Plant	Seed		Seeds/	Test	Seed Yield		
Brand	Variety	Group[1]	to PM	Ht	Ht	Lodge[2]	Oil	Protein	Pound	Weight	2025	2-yr.	3-yr.
						1 to 9	%	%		lb/bu	-----bu/ac-----		
NDSU	ND21008GT20	0.8	120.0	4.0	31.0	7.0	18.2	36.7	2394	57.2	45.43	44.77	43.54
NDSU	ND2108GT73	0.7	129.8	5.8	35.5	5.0	17.9	36.8	2616	57.0	56.55	64.53	62.72
NDSU	ND17009GT	0.9	123.0	3.8	33.8	5.3	19.0	37.0	2172	57.8	45.53	44.71	44.57
Champion Seed	0985XL	0.9	131.0	5.8	36.0	3.3	17.3	38.3	2306	56.4	69.03	79.86	--
Paloma Brand	PL2E101	1.0	130.0	5.8	33.8	4.3	17.7	36.9	2501	55.9	70.45	--	--
Champion Seed	1134XL	1.2	131.3	6.0	36.3	2.3	17.5	37.6	2310	56.4	70.15	70.23	73.02
Champion Seed	1305EN	1.2	130.5	4.5	33.8	6.0	18.6	36.7	2462	55.4	59.6	--	--
BASF-Xitavo	XO 0806	0.8	130.5	4.8	35.3	2.8	18.2	36.3	2446	56.1	69.73	--	--
BASF-Xitavo	XO 1095E	1.0	131.3	6.0	35.3	2.8	18.2	37.0	2549	56.3	68.55	--	--
BASF-Xitavo	XO 1116E	1.1	131.0	5.5	38.0	4.8	17.3	37.3	2739	57.3	58.2	--	--
BASF-Xitavo	XO 1225E	1.2	130.5	4.8	36.0	4.5	17.2	37.7	2256	56.9	65.4	--	--
BASF-Xitavo	XO 0731E	0.7	129.8	5.5	33.0	4.8	18.1	37.5	2128	56.4	65.25	--	--
	Mean		129.1	5.2	34.8	4.4	17.9	37.2	2406	56.6	61.99	--	--
	C.V (%)		0.7	20.7	7.4	25.7	1.2	0.9	3	0.7	7.9		--
	LSD 0.10		1.0	1.3	3.1	1.3	0.3	0.4	72	0.4	5.9	--	--
	LSD 0.05		1.2	1.5	3.7	1.6	0.3	0.5	87	0.5	7.1	--	--

Planting Date = May 7; Harvest Date = October 1; Previous Crop = Corn

[1]Maturity group based on data provided by seed company.

[2]Plant lodge: 1 = no lodging; 9 = plants lying flat.

Soybean, Conventional - Irrigated **Dickey County, Oakes, ND**

Brand	Variety	Mat. Group	Days to Maturity	Pod Height	Plant Height	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	----------Yield-------- 2025	2-yr. Avg.
			DAP	inch	inch	1-9	%	%	g/1000		lb/bu	----------bu/a--------	
NDSU	ND Stutsman	0.7	128	2.8	42.0	2.3	19.0	35.9	184	2,463	56.7	68.9	73.2
Brushvale Seed	12S642	1.2	130	1.8	39.0	2.0	18.1	37.7	194	2,342	56.5	70.3	--
Brushvale Seed	14S301	1.4	131	1.8	38.0	4.0	18.0	37.9	193	2,357	56.0	72.7	--
Mean			129	2	40	3	18	37	190.2	2,388	56.4	70.6	--
C.V. (%)			0.9	39.2	2.9	20.1	0.6	0.6	2.5	2.4	0.5	7.7	--
LSD 0.10			1.2	0.8	1.2	0.6	0.1	0.2	4.8	58.9	0.3	5.5	--

Planting Date = May 9; Harvest Date = October 2; Previous Crop = Corn

Lodging: 1 = no lodging; 9 = plants lying flat.

Drone's eye-view of Oakes Field Day.

Soybean, Roundup Ready - Irrigated | **Dickey County, Oakes, ND**

Brand	Variety	Trait	Mat. Group	Days to Maturity	Pod Height	Plant Height	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inch	inch	1-9	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	122	0.5	33.0	4.8	18.9	36.2	185	2,462	55.8	48.2	--	--
NDSU	ND2108GT73	GT	0.8	134	2.0	35.5	2.8	18.9	36.7	181	2,529	55.7	66.7	66.8	71.3
NDSU	ND17009GT	GT	00.9	123	1.0	35.3	3.3	19.4	37.0	196	2,323	56.3	51.4	50.1	53.7
Champion Seed	0985XL	XtendFlex	0.9	134	4.0	38.0	2.3	18.2	37.3	203	2,239	55.7	87.9	84.2	--
Paloma	PL2E101	Enlist E3	1.0	134	3.0	34.5	2.5	18.6	36.3	184	2,472	55.3	84.7	--	--
Champion Seed	1134XL	XtendFlex	1.2	133	2.5	35.3	1.3	18.8	36.2	195	2,325	56.0	79.5	--	--
Champion Seed	1305EN	Enlist E3	1.3	135	1.8	36.8	3.5	19.7	35.8	189	2,398	54.8	73.4	75.9	--
Mean				131	2	35	3	19	36	190.2	2,392	55.7	70.3	--	--
C.V. (%)				0.4	31.2	2.9	19.4	1.8	0.6	4.6	4.6	1.5	6.7	--	--
LSD 0.10				0.5	0.6	1.0	0.5	0.3	0.2	8.2	104.2	0.8	4.4	--	--

Planting Date = May 9; Harvest Date = October 2; Previous Crop = Corn

Dry Edible Bean - Dryland — Carrington (Page 1 of 2)

Variety	Market Class	Days to Maturity	Plant Height[1]	Direct Harvest[2]	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.*	Yield 3-yr. Avg.*
			inch	%	%	g/100		lb/bu	lb/a	lb/a	lb/a
Ace	Black	103	19	98	19.6	16.6	2,737	58.1	2,097	2,249	2,266
Slate	Black	105	18	99	19.4	16.6	2,733	58.5	2,322	--	--
Butte	Black	103	20	99	20.7	18.1	2,526	59.2	2,084	--	--
Black Tails	Black	100	15	97	22.2	17.4	2,619	59.8	2,070	2,531	2,225
Eclipse	Black	103	18	99	20.5	17.1	2,652	59.0	2,062	2,356	2,260
ND Twilight	Black	104	16	98	19.5	18.4	2,468	59.9	2,313	2,550	2,408
ND Galaxy	Black	104	20	98	22.1	16.7	2,716	58.9	2,236	2,384	--
Blizzard	Navy	107	19	98	20.3	17.2	2,646	60.3	2,033	2,214	2,081
HMS Medalist	Navy	107	18	98	20.5	15.6	2,920	61.0	2,196	2,557	2,310
ND Polar	Navy	110	18	97	21.0	15.2	3,002	59.9	1,549	2,157	2,161
T9905	Navy	108	19	98	21.3	17.8	2,547	60.7	2,122	2,558	2,409
Merlot	Small Red	103	17	95	19.8	30.6	1,482	57.4	1,937	2,095	2,066
Viper	Small Red	104	17	97	19.9	22.8	1,986	57.9	2,059	--	--
Trial Mean		104	18	98	20.5	19.1	2,479	59.2	2,072	--	--
C.V. (%)		1	8	1	2.5	5.5	5	0.8	8	--	--
LSD (0.10)		2	2	2	0.6	1.3	133	0.5	194	--	--

Planting Date = June 2; Harvest Date = September 30; Previous Crop = Durum

White mold and low temperatures on September 3, 4, 6 and 7 (35° F, 34° F, 35° F, and 34° F) impacted yield.

[1] Plant height at harvest.

[2] Direct harvest is a relative score to estimate the % of beans that would be successfully harvested in a direct harvest system.

* 2-yr. Average is 2023 and 2025; 3-yr. Average is 2022, 2023, and 2025. Trial was lost to hail in 2024.

Variety	Market Class	Days to Maturity	Plant Height[1]	Direct Harvest[2]	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 2-yr. Avg.*	Yield 3-yr. Avg.*
			inch	%	%	g/100		lb/bu	lb/a	lb/a	lb/a
TVS21-4-6	Pinto	103	13	92	19.3	33.7	1,348	55.9	1,060	--	--
TVS21-6-10	Pinto	102	11	65	19.4	33.0	1,377	55.3	815	--	--
Cowboy	Pinto	99	18	96	19.7	32.1	1,413	57.5	2,007	2,597	2,392
La Paz	Pinto	104	16	96	19.4	29.1	1,559	57.6	1,855	2,093	2,105
Monterrey	Pinto	101	17	97	19.4	29.8	1,523	58.7	2,059	2,357	2,414
ND Falcon	Pinto	107	14	96	19.8	29.2	1,571	55.3	1,482	1,988	2,068
Torreon	Pinto	102	17	97	19.5	32.8	1,382	57.7	1,907	2,358	2,196
Vibrant	SD-Pinto	101	15	93	18.9	30.8	1,473	56.3	1,548	2,118	1,945
Windbreaker	Pinto	97	13	96	20.0	34.0	1,335	55.5	1,953	2,155	2,057
USDA Rattler	Pinto	108	16	97	19.5	32.2	1,411	58.1	2,087	2,499	--
TVS21-7-8	SD-Pinto	104	15	91	19.5	29.7	1,530	58.7	1,197	--	--
Gleam	SD-Pinto	104	16	97	19.2	30.8	1,475	59.6	1,849	--	--
ND Palomino	SD-Pinto	108	14	96	19.2	32.7	1,391	56.5	1,878	2,386	2,239
ND Rodeo	SD-Pinto	110	14	79	19.3	32.8	1,390	58.6	1,020	1,751	1,933
USDA Diamondback	SD-Pinto	106	15	95	19.6	30.3	1,506	58.5	1,738	2,219	--
Bronco	SD-Pinto	103	14	97	20.8	38.5	1,181	60.6	1,782	2,233	--
Coral	Pink	106	17	96	19.6	30.2	1,518	58.4	1,910	--	--
Magnolia	Pink	107	14	96	20.1	34.6	1,314	57.9	1,731	--	--
ND Rosalind	Pink	108	16	96	19.0	26.9	1,699	58.5	1,585	2,367	2,482
Eiger	Great Northern	111	18	97	20.3	27.9	1,629	58.8	2,293	--	--
ND Pegasus	Great Northern	110	17	96	20.8	32.0	1,420	58.4	2,103	2,706	2,682
Trial Mean		105	15	94	19.6	31.6	1,450	57.8	1,779	2,192	2,188
C.V. (%)		3	12	5	2.0	4.5	5	1.3	11	11	11
LSD (0.10)		4	2	6	0.5	1.7	83	0.9	238	301	314
KJ1	Adzuki	115	19	98	21.6	14.4	3,218	60.2	1,140	--	--
KJ2	Adzuki	115	17	98	22.5	17.5	2,603	60.4	906	--	--

Planting Date = June 2; Harvest Date = September 30; Previous Crop = Durum

White mold and low temperatures on September 3, 4, 6 and 7 (35° F, 34° F, 35° F, and 34° F) impacted yield.

[1] Plant height at harvest.

[2] Direct harvest is a relative score to estimate the % of beans that would be successfully harvested in a direct harvest system.

There was no notable lodging present in the trial.

* 2-yr. Average is 2023 and 2025; 3-yr. Average is 2022, 2023, and 2025. Trial was lost to hail in 2024.

Variety	Market Class	Days to Maturity	Plant Height[1]	Direct Harvest[2]	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 3-yr. Avg.
			inch	%	%	g/100		lb/bu	lb/a	lb/a
Ace	Black	100	17	98	20.4	18.7	2,427	57.2	2,111	--
Slate	Black	105	15	96	20.3	17.5	2,599	57.1	2,156	--
Butte	Black	100	20	97	22.4	18.6	2,448	59.9	2,318	--
Black Tails	Black	98	13	96	21.5	18.4	2,484	60.1	1,753	2,537
Eclipse	Black	104	19	97	20.9	17.6	2,585	58.4	1,849	2,530
ND Twilight	Black	103	14	96	19.1	19.3	2,365	58.4	2,370	2,622
ND Galaxy	Black	103	19	94	22.1	18.4	2,469	59.1	2,134	2,735
Blizzard	Navy	107	19	97	20.1	19.0	2,391	59.2	2,230	2,335
HMS Medalist	Navy	104	14	97	19.5	17.2	2,639	59.1	2,087	2,648
ND Polar	Navy	110	18	96	21.6	16.1	2,824	58.1	1,699	2,291
T9905	Navy	110	15	96	20.5	20.1	2,270	58.9	2,079	2,504
Merlot	Small Red	100	13	93	19.4	32.2	1,413	55.0	1,900	2,001
Viper	Small Red	104	14	96	19.5	24.3	1,890	55.9	2,003	--
Trial Mean		104	16	96	20.5	20.7	2,299	58.1	2,057	--
C.V. (%)		3	17	1	3.5	7.0	6	1.0	12	--
LSD (0.10)		4	3	2	0.8	1.7	172	0.7	283	--

Planting Date = June 3; Harvest Date = October 4; Previous Crop = Field Pea

White mold and low temperatures on September 3, 4, 6 and 7 (35° F, 34° F, 35° F, and 34° F) impacted yield.

Variety	Market Class	Days to Maturity	Plant Height[1]	Direct Harvest[2]	Protein	KWT	Seeds / Pound	Test Weight	Yield 2025	Yield 3-yr. Avg.
			inch	%	%	g/100		lb/bu	lb/a	lb/a
TVS21-4-6	Pinto	100	10	83	18.5	39.4	1,153	54.0	1,457	--
TVS21-6-10	Pinto	104	11	70	18.9	35.0	1,315	53.6	1,280	--
Cowboy	Pinto	97	16	95	19.2	33.1	1,375	55.9	2,028	2,508
La Paz	Pinto	102	12	93	19.0	32.8	1,397	56.0	1,858	2,306
Monterrey	Pinto	100	14	95	19.9	32.5	1,400	56.2	1,964	2,532
ND Falcon	Pinto	111	11	93	20.4	35.1	1,293	52.3	1,878	2,261
Torreon	Pinto	102	14	96	19.5	36.4	1,257	55.8	2,067	2,434
Vibrant	SD-Pinto	97	11	84	19.0	31.5	1,441	55.6	1,314	--
Windbreaker	Pinto	96	11	91	19.0	35.0	1,301	54.1	1,829	2,315
USDA Rattler	Pinto	109	13	95	19.0	33.4	1,378	56.4	2,145	2,685
TVS21-7-8	SD-Pinto	109	13	89	19.3	34.0	1,342	57.9	1,609	--
Gleam	SD-Pinto	97	12	95	18.9	31.4	1,449	57.4	1,520	--
ND Palomino	SD-Pinto	113	12	94	19.2	33.8	1,364	56.2	2,049	2,327
ND Rodeo	SD-Pinto	112	11	78	19.9	34.9	1,321	57.6	1,675	2,380
USDA Diamondback	SD-Pinto	106	13	94	18.7	30.3	1,513	56.8	1,587	2,393
Bronco	SD-Pinto	96	11	93	20.4	36.7	1,242	58.2	1,453	2,326
Coral	Pink	106	15	96	18.8	32.8	1,398	56.9	2,066	--
Magnolia	Pink	104	11	93	19.7	34.8	1,312	55.4	1,818	--
ND Rosalind	Pink	109	13	95	18.6	31.2	1,470	57.6	2,037	2,537
Eiger	Great Northern	111	12	93	20.9	30.9	1,474	56.7	1,766	--
ND Pegasus	Great Northern	112	12	92	19.4	32.0	1,422	56.8	2,111	2,859
Trial Mean		105	12	90	19.4	33.5	1,371	56.1	1,815	--
C.V. (%)		3	18	8	2.7	9.4	10	1.6	13	--
LSD (0.10)		4	3	8	0.6	3.7	157	1.1	272	--

Planting Date = June 3; Harvest Date = October 4; Previous Crop = Field Pea

White mold and low temperatures on September 3, 4, 6 and 7 (35° F, 34° F, 35° F, and 34° F) impacted yield.°

There was no notable lodging present in the trial.

Dry Bean						Wishek
Variety	Market Class	Protein	KWT	Seeds / Pound	Test Weight	Yield
		%	g/100		lb/bu	lb/a
ND Falcon	Pinto	20.0	34.3	1,322	53.0	2,701
ND Rodeo	SD-Pinto	19.2	40.4	1,124	58.1	3,590
USDA Rattler	Pinto	18.5	41.3	1,099	56.6	3,607
USDA Diamondback	SD-Pinto	18.1	37.9	1,199	57.5	3,419
ND Rosalind	Pink	18.5	33.0	1,374	58.6	3,088
ND Pegasus	Great Northern	18.7	39.7	1,144	56.6	3,857
ND Polar	Navy	20.7	17.1	2,658	58.8	2,771
T9905	Navy	19.2	23.3	1,951	59.0	3,636
Eclipse	Black	20.9	20.8	2,186	58.5	3,192
ND Galaxy	Black	22.9	21.2	2,146	60.8	3,249
Viper	Small Red	19.4	30.3	1,500	57.8	3,570
Trial Mean		19.7	30.8	1,609	57.7	3,334
C.V. (%)		3.9	3.0	3	0.8	8
LSD (0.10)		0.9	1.1	53	0.5	325

Planting Date = May 28; Harvest Date = October 2; Previous Crop = Barley

Site received frost on September 9 before all lines were mature.

There was no notable lodging present in the trial.

Harvest of organic dry bean trial.

Variety	Market Class	Moisture	Plant Height	Lodging	Direct Harvest[1]	Protein	KWT	Seeds/ Pound	Test Weight	Yield
		%	inch	1-9	%	%	g/1000		lb/bu	lb/a
Cowboy	Pinto	12.1	21.3	2	89.3	19.9	33.0	1,378	59.3	2,250
La Paz	Pinto	11.9	18.9	5	71.8	20.0	32.6	1,393	59.7	1,825
Monterrey	Pinto	12.2	21.3	4	80.5	20.0	33.7	1,348	60.2	1,946
ND Falcon	Pinto	11.4	20.3	3	83.8	21.2	32.3	1,408	56.6	1,739
Torreon	Pinto	12.3	18.3	4	79.5	20.2	35.7	1,273	58.8	1,691
Vibrant	SD-Pinto	12.1	20.9	5	75.8	20.2	32.9	1,377	59.1	1,735
Windbreaker	Pinto	11.9	17.7	6	67.0	20.2	35.8	1,270	58.1	1,578
USDA Rattler	Pinto	12.3	22.4	3	87.8	19.3	33.1	1,372	59.3	1,894
ND Palomino	SD-Pinto	11.8	19.5	4	82.3	20.1	34.1	1,331	58.6	2,096
ND Rodeo	SD-Pinto	11.3	20.7	5	71.3	20.5	35.8	1,267	60.6	1,791
WMM 556	SD-Pinto	12.8	20.5	5	77.5	20.1	31.4	1,444	61.7	2,111
WMM 750	SD-Pinto	11.8	21.3	5	73.8	20.4	30.4	1,495	61.2	1,997
Gleam	SD-Pinto	12.5	18.3	5	79.5	20.0	34.3	1,321	61.4	1,876
USDA Diamondback	SD-Pinto	12.3	20.7	4	80.5	20.3	32.6	1,393	60.2	1,677
Bronco	SD-Pinto	12.3	18.7	6	63.5	21.2	38.6	1,178	62.2	1,610
Coral	Pink	11.9	19.5	4	83.0	20.3	33.9	1,340	59.7	1,834
Magnolia	Pink	11.8	16.9	6	74.8	20.4	35.1	1,291	59.0	1,706
ND Rosalind	Pink	12.3	16.5	4	82.3	19.5	28.3	1,606	61.2	2,074
Eiger	Great Northern	10.9	19.7	3	88.0	22.3	28.5	1,592	61.1	2,123
ND Pegasus	Great Northern	11.0	19.7	5	76.8	21.2	31.8	1,429	60.1	2,013
Trial Mean		11.9	19.7	4.3	77.5	20.4	33.3	1,372	59.7	1,868
C.V. (%)		2.7	10.8	31.8	11.6	1.9	3.7	3.7	0.9	14.5
LSD (0.05)		0.5	3.0	1.9	12.7	0.6	1.7	71.1	0.8	385.3
LSD (0.10)		0.4	2.5	1.6	10.6	0.5	1.4	59.0	0.6	321.8

Planting Date = June 3; Harvest Date = October 2; Previous Crop = Oat

[1]Direct Harvest is a relative score to estimate the % of beans that would be successfully harvested in a direct harvest system.

Dry Bean Organic	**Carrington (Page 2 of 2)**

Variety	Market Class	Moisture	Plant Height	Lodging	Direct Harvest[1]	Protein	KWT	Seed/ Pound	Test Weight	Yield
		%	inch	1-9	%	%	g/100		lb/bu	lb/a
Blizzard	Navy	5.7	19.3	3.8	82.5	21.4	17.6	2,579	64.1	1,902
HMS Medalist	Navy	6.4	20.1	2.8	86.8	21.3	16.9	2,699	64.2	1,694
ND Polar	Navy	4.8	19.5	4.0	81.3	21.5	18.0	2,534	63.8	1,486
T9905	Navy	5.9	21.9	3.8	82.5	21.0	17.7	2,564	63.8	1,688
Blacktails	Black	9.7	19.7	4.8	75.0	23.2	16.7	2,737	62.7	1,648
Eclipse	Black	7.9	19.7	2.8	86.3	23.1	18.0	2,529	62.4	1,827
ND Twilight	Black	6.8	21.1	4.3	79.5	21.0	17.4	2,624	62.9	1,974
ND Galaxy	Black	11.7	21.9	2.0	89.5	22.8	17.5	2,598	61.2	2,157
Merlot	Small Red	7.5	19.3	7.0	62.5	20.2	16.8	2,722	59.0	1,514
Trial Mean		7.4	20.4	3.8	81.3	21.7	18.9	2,499	62.6	1,805
C. V. (%)		9.3	12.2	25.4	6.2	2.3	6.9	7.8	0.9	14.2
LSD (0.05)		1.0	3.6	1.4	7.3	0.7	1.9	281	0.8	374
LSD (0.10)		0.8	2.9	1.2	7.3	0.6	1.6	234	0.6	311

Planting Date = June 3; Harvest Date = October 3; Previous Crop = Spring Wheat

[1]Direct Harvest is a relative score to estimate the % of beans that would be successfully harvested in a direct harvest system.

Lodging: 1 = no lodging; 9 = plants lying flat.

Dry Bean, Misc. - Irrigated	**Dickey County, Oakes, ND**

Variety	Market Class	Days to Maturity	Plant Height	Seed Weight	Seeds/ Pound	Test Weight	----------Seed Yield---------- 2025	2-yr. Avg.	3-yr. Avg.
		DAP	inch	g/100		lb/bu	--------------- lb/a ---------------		
Eiger	Great Northern	106	17.3	39.1	1,164	63.6	3,796	--	--
ND Pegasus	Great Northern	98	18.0	39.2	1,159	61.0	3,679	3,130	3,398
Merlot	Small Red	98	17.8	40.2	1,133	60.0	3,464	3,103	3,391
Viper	Small Red	98	17.0	28.8	1,576	62.3	2,997	2,740	--
Coral	Pink	96	16.0	40.7	1,118	61.1	3,539	--	--
Magnolia	Pink	97	16.5	41.1	1,106	59.5	3,161	--	--
ND Rosalind	Pink	99	18.3	35.6	1,275	62.3	3,861	3,490	--
Trial Mean		98	17.3	37.9	1,215	61.4	3,441	--	--
C.V. (%)		2	6	5.1	5	1.5	12.5	--	--
LSD (0.10)		1.9	1	1.8	57.1	0.9	404	--	--

Planting Date = May 28; Harvest Date = September 11, 12 and 16; Previous Crop = Wheat

There was no notable lodging present in the trial.

Dry Bean, Navy and Black - Irrigated — Dickey County, Oakes

Variety	Market Class	Days to Maturity	Plant Height	Seed Weight	Seeds/ Pound	Test Weight	Seed Yield 2025	Seed Yield 2-yr. Avg.	Seed Yield 3-yr. Avg.
		DAP	inch	g/100		lb/bu	lb/a		
Blizzard	Navy	96	16.8	22.2	2041	63.2	2,951	2,670	3,162
HMS Medalist	Navy	97	15.0	20.0	2279	63.4	2,538	2,567	3,057
ND Polar	Navy	101	19.0	21.1	2153	64.3	2,711	2,265	2,807
T9905	Navy	92	15.5	24.0	1893	62.6	3,093	2,812	3,317
Black Tails	Black	103	14.8	20.2	2243	62.5	2,511	2,437	2,978
Eclipse	Black	95	14.8	20.7	2191	61.5	2,568	2,679	3,090
ND Twilight	Black	99	16.5	22.1	2059	64.2	3,240	3,198	3,506
ND Galaxy	Black	92	16.0	20.6	2200	62.7	3,509	--	--
Mean		97	16.0	21.4	2132	63.0	2,890	--	--
C.V. (%)		2.7	8.5	4	4.1	1.8	11.1	--	--
LSD (0.10)		2.5	1.3	0.8	82	1.1	299	--	--

Planting Date = May 28; Harvest Date = September 10 and 11; Previous Crop = Wheat

There was no notable lodging present in the trial.

Dry Bean, Pinto - Irrigated — Dickey County, Oakes

Variety	Days to Maturity	Plant Height	Seed Weight	Seeds/ Pound	Test Weight	Seed Yield 2025	Seed Yield 2-yr. Avg.	Seed Yield 3-yr. Avg.
	DAP	inch	g/100		lb/bu	(lb/a)		
Cowboy	85	18.5	38.1	1,194	58.8	2,619	2,432	3,023
La Paz	89	17.3	35.5	1,279	60.3	2,960	2,497	3,006
Monterrey	87	17.3	34.6	1,314	60.0	2,811	2,569	3,039
ND Falcon	95	21.8	37.9	1,199	56.9	2,660	2,395	2,834
Torreon	86	16.8	41.3	1,100	59.5	2,676	2,466	2,972
Vibrant	87	17.8	39.2	1,158	57.7	2,780	2,482	2,921
Windbreaker	85	15.3	41.4	1,099	55.9	3,030	2,699	3,198
Gleam	89	16.0	38.5	1,180	60.8	3,054	--	--
ND Palomino	92	16.3	40.2	1,130	57.8	3,149	2,959	3,310
ND Rodeo	96	17.0	44.4	1,021	62.0	3,905	3,419	3,746
Trial Mean	91	17.3	39.4	1,164	59.3	3,073	--	--
C.V. (%)	1.7	7.5	4.2	4.4	1.1	11.7	--	--
LSD (0.10)	1.5	1.2	1.5	47	0.6	332	--	--

Planting Date = May 28; Harvest Date = September 5, 10 and 11; Previous Crop = Wheat

There was no notable lodging present in the trial.

Field Pea | **Carrington (Page 1 of 2)**

Variety	Brand	Vine Length	Days to Flower	Days to Maturity	Canopy Height	-- Harvest Ease -- 2025	3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	--------- Yield --------- 2025	3-yr. Avg.
		inch	days	days	inch	-------- 1-9 --------		%	g		lb/bu	--------- bu/a ---------	
Yellow Cotyledon Type													
DS Admiral	Pulse USA	28	52	86	13	7	6.1	26.1	258	1,760	62.2	60.6	49.3
CDC Inca	Meridian Seeds	36	55	92	19	5	4.6	27.3	251	1,811	63.7	66.9	59.6
ND Dawn	NDSU	27	53	87	15	7	6.1	25.8	264	1,722	61.8	60.7	53.8
AAC Julius	Agriculture and Agri-Food Canada	28	53	87	17	7	5.0	27.8	235	1,931	63.1	64.8	58.8
CP5222Y	Croplan	25	52	91	20	5	--	28.1	303	1,498	62.5	63.7	--
CP5411Y	Croplan	27	54	89	16	6	--	25.8	255	1,780	62.5	62.7	--
MS Growpro	Meridian Seeds	30	53	92	22	5	4.4	29.1	338	1,344	63.0	66.3	57.4
MS Prostar	Meridian Seeds	29	54	92	14	7	6.0	26.8	262	1,735	63.0	62.4	54.6
AAC Beyond	Meridian Seeds	28	54	89	13	7	6.1	23.6	236	1,922	60.2	58.7	60.2
AAC Carver	Meridian Seeds	33	54	88	17	6	--	27.0	264	1,721	62.8	69.5	--
CDC Engage	Alliance Seed	32	56	95	22	5	--	26.3	254	1,789	64.1	77.8	--
21162	Peterson Farms Seed	33	55	94	23	3	--	30.1	251	1,808	63.4	63.9	--
21163	Peterson Farms Seed	36	57	94	15	7	--	28.3	244	1,899	62.4	66.1	--
GTPR004	GeneTech	31	55	94	20	6	--	27.8	243	1,869	63.7	67.6	--
GTPR005	GeneTech	29	55	92	21	6	--	27.3	254	1,789	63.4	66.3	--
GTPR007	GeneTech	29	56	92	23	3	--	26.2	264	1,717	64.2	67.3	--
Orchestra	Premier Genetics	26	52	88	14	7	--	28.8	308	1,473	62.4	62.7	--
PG Bank	Premier Genetics	31	54	92	19	5	--	26.6	265	1,714	63.9	59.6	--
PG Cash	Premier Genetics	29	53	86	17	7	5.2	26.2	280	1,621	62.4	62.1	57.3
Trial Mean		30	54	91	18	6	--	27.5	252	1,823	62.7	63.4	--
C.V. (%)		11	1	4	17	17	--	5.6	4	4	6.1	9.5	--
LSD (0.10)		4	1	4	3	1	--	1.8	12	89	4.5	7.1	--

Planting Date = May 6; Harvest Date = August 25; Previous Crop = Forage Barley

Variety	Brand	Vine Length	Days to Flower	Days to Maturity	Canopy Height	Harvest Ease 2025	Harvest Ease 3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	Yield 2025	Yield 3-yr. Avg.
		inch	days	days	inch	1-9	1-9	%	g		lb/bu	bu/a	bu/a
Yellow Cotyledon Type													
PG Prairie	Premier Genetics	29	54	86	22	4	--	27.7	261	1,744	63.5	77.5	--
BX26p932	Benson Hill	32	55	94	21	6	--	30.1	209	2,181	63.2	61.4	--
BX26p688	Benson Hill	32	53	96	24	4	--	29.7	250	1,817	64.1	62.6	--
BX26p177	Benson Hill	30	52	96	23	4	--	29.9	239	1,897	62.9	54.0	--
BX26p575	Benson Hill	31	53	95	15	7	--	29.2	245	1,857	63.6	58.3	--
Green Cotyledon Type													
PG Greenback	Premier Genetics	37	56	92	20	6	5.1	26.3	258	1,760	63.3	69.4	63.9
Aragorn	Pulse USA	28	51	89	11	8	7.6	26.8	245	1,856	62.6	47.9	43.8
Arcadia	Pulse USA	22	53	88	9	8	7.5	26.0	225	2,019	50.9	47.7	45.4
ND Victory	NDSU	36	56	96	23	5	3.8	27.2	211	2,161	63.5	65.3	52.3
Dun Marketclass Type													
CDC Dakota	Premier Genetics	31	57	94	20	5	--	29.8	206	2,208	62.6	64.2	--
Trial Mean		30	54	91	18	6	--	27.5	252	1,823	62.7	63.4	--
C.V. (%)		11	1	4	17	17	--	5.6	4	4	6.1	9.5	--
LSD (0.10)		4	1	4	3	1	--	1.8	12	89	4.5	7.1	--

Planting Date = May 6; Harvest Date = August 25; Previous Crop = Forage Barley

Field Pea - Organic — Carrington

Variety	Days to Flower	Days to Maturity	Plant Height	Lodging	Protein	KWT	Test Weight	Moisture	Yield
	days	days	inch	1 - 9	%	g/1000	lb/bu	%	bu/a
DS Admiral	51.5	85.3	31.7	7.0	22.6	214.5	62.8	12.8	32.2
CDC Inca	53.3	87.8	31.8	6.0	24.1	200.9	63.3	12.1	42.4
ND Dawn	52.3	85.3	29.0	7.5	22.7	208.9	61.8	12.8	43.6
PG Greenback	55.0	87.0	32.1	7.0	23.6	204.3	63.0	12.4	52.2
Aragorn	49.0	84.8	30.1	8.3	23.7	206.8	61.2	12.4	28.7
Arcadia	52.3	86.3	27.4	7.0	22.5	190.5	62.1	13.1	24.1
ND Victory	55.8	90.8	26.3	6.0	24.3	167.0	63.2	12.4	37.0
AAC Julius	54.0	85.3	31.5	7.0	24.9	193.1	62.4	12.4	53.4
Protecta	52.0	88.5	37.0	6.8	25.3	235.1	62.9	11.8	50.7
Shamrock	55.5	86.8	27.2	7.5	23.1	219.8	63.2	12.9	26.1
AAC Profit	55.0	89.0	27.6	7.0	25.0	208.2	62.3	12.5	51.5
Chrome	52.5	87.5	27.1	7.5	22.7	226.7	62.7	12.9	41.2
Cronos	50.3	86.5	30.5	6.5	25.4	255.1	62.5	12.1	23.7
Hyline	52.5	84.0	29.8	7.8	23.4	254.2	62.0	12.4	34.0
Flute	53.5	85.3	29.8	6.3	24.0	197.4	63.1	12.4	41.6
Trial Mean	53.0	86.7	29.9	7.0	23.8	212.1	62.6	12.5	38.8
C.V. (%)	1.6	2.0	13.4	9.7	3.0	8.7	0.7	4.3	14.9
LSD (0.10)	1.0	2.0	4.8	0.8	0.9	22.0	0.5	0.6	6.9

Planting Date = May 2; Harvest Date = August 12; Previous Crop = Oat

Lodging: 1 = no lodging; 9 = plants lying flat.

Corn - Dryland **Carrington**

Brand	Hybrid	Trait	RM	Days to Silk	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inch	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Channel	183-13VT2PRIB	RR2	83	77	88	16.9	9.3	71.7	3.8	56.1	170.9	189.2	--
Channel	186-56VT2PRIB	RR2	86	77	88	17.0	8.7	69.6	3.9	59.0	182.5	201.0	--
Channel	187-20VT2PRIB	RR2	87	78	94	17.3	9.0	71.1	3.7	56.2	212.5	223.3	--
Golden Harvest	G87U44-V	GT/LL	87	80	105	16.6	9.5	71.7	3.8	55.4	193.2	201.9	--
Golden Harvest	G90M06-D	GT/LL	90	80	110	19.6	9.9	72.6	4.1	55.2	198.7	--	--
Golden Harvest	G90B11-AA	GT/LL	90	84	105	20.7	10.6	71.1	4.3	57.1	200.4	--	--
Wilbur Ellis/Integra	3114 VT2P RIB	RR2	81	75	99	16.8	9.4	68.1	3.8	59.5	173.2	186.3	--
Wilbur Ellis/Integra	3431 VT2P RIB	RR2	84	77	103	17.8	8.9	69.8	3.8	58.3	182.9	196.7	191.6
Wilbur Ellis/Integra	3718 VT2P RIB	RR2	87	78	99	17.9	9.3	70.4	3.8	57.6	202.4	--	--
Wilbur Ellis/Integra	3884 VT2P RIB	RR2	88	76	99	18.9	9.1	70.7	3.7	56.4	189.4	207.0	200.7
Thunder Seed	T6588 AV	GT/LL	88	81	100	18.6	9.9	71.3	4.0	56.5	204.5	222.7	--
Thunder Seed	T6389 VT2P	RR2	89	80	99	18.0	8.8	71.6	3.8	57.4	189.1	216.5	212.0
Thunder Seed	T6490 VT2P	RR2	90	79	106	18.6	9.3	70.9	3.8	56.7	212.0	--	--
Thunder Seed	T6591 PC	Enlist	91	78	106	20.3	10.1	71.6	3.9	56.5	206.1	--	--
Dairyland Seed	DS-2541PCE	Enlist	85	79	93	17.9	9.2	71.5	3.8	56.3	196.3	--	--
Dairyland Seed	DS-3087PWE	Enlist	90	78	102	19.6	9.3	70.2	3.7	59.2	204.4	--	--
Proseed	2684 VT2P	RR2	84	74	98	15.8	8.4	70.6	3.9	57.1	195.8	--	--
Proseed	2686 VT2P	RR2	86	80	97	21.3	9.5	71.5	4.0	56.2	167.6	--	--
Proseed	2488 VT2P	RR2	88	81	105	21.5	10.0	71.4	4.0	57.3	201.7	--	--
Trial Mean				78	100	18.5	9.4	70.9	3.9	57.1	193.9	--	--
C.V. (%)				2	5	13.8	6.6	1.3	6.5	1.8	5.7	--	--
LSD (0.1)				2	5	3.0	0.7	1.1	0.3	1.2	13.2	--	--

Planting Date = May 13; Harvest Date = November 6; Previous Crop = Durum

Corn - Irrigated **Carrington**

Brand	Hybrid	Trait	RM	Days to Silk	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	Yield 2025	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inch	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Golden Harvest	G87U44-V	GT/LL	87	80	110	19.6	9.9	70.5	4.0	57.6	179.0	202.2	--
Golden Harvest	G90M06-D	GT/LL	90	77	116	19.4	9.6	70.0	4.0	58.2	173.3	--	--
Golden Harvest	G90B11-AA	GT/LL	90	82	111	22.6	11.3	69.6	3.9	59.2	170.8	--	--
Wilbur Ellis/Integra	3431 VT2P RIB	RR2	84	75	99	18.5	9.2	70.2	3.7	58.2	183.9	--	--
Wilbur Ellis/Integra	3884 VT2P RIB	RR2	88	74	98	20.5	9.7	69.2	3.7	58.1	177.9	202.6	219.5
Trial Mean				78	107	20.1	10.0	69.9	3.9	58.3	177.0	--	--
C.V. (%)				1	4	1.4	3.1	0.6	3.4	0.8	5.0	--	--
LSD (0.1)				1	6	0.3	0.4	0.5	0.2	0.6	11.2	--	--

Planting Date = May 13; Harvest Date = November 4; Previous Crop = Durum

Planting corn trials in Carrington.

Corn - Dryland | **Fingal**

Brand	Hybrid	Trait	RM	Days to Silk*	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	Yield 2025*	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inch	inch	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Thunder Seed	T6389 VT2P	RR2	89	82	31	77	16.1	8.6	71.9	3.7	58.2	156.1	198.1	--
Thunder Seed	T6490 VT2P	RR2	90	86	38	85	15.6	8.6	70.8	3.8	57.5	155.9	--	--
Thunder Seed	T6591 PC	Enlist	91	84	33	89	16.3	8.9	71.5	3.6	56.8	159.5	199.2	--
Thunder Seed	T6693 PC	Enlist	93	83	34	88	18.3	9.4	72.8	3.7	55.8	152.2	--	--
Proseed	2693D	RR2	93	86	33	93	18.6	9.2	70.8	3.6	56.0	141.7	--	--
Proseed	2594 VT2P	RR2	94	89	36	88	18.6	9.0	70.5	3.9	56.7	152.7	195.8	--
Champion Seed	4156 VT2P	RR2	91	82	37	95	17.0	8.8	70.7	3.7	57.5	171.0	--	--
Champion Seed	4466 VIP	GT/LL	94	83	35	91	18.6	10.0	71.8	3.9	58.7	154.4	--	--
Champion Seed	40A25 VT2P	RR2	90	84	37	86	15.6	8.3	70.6	3.7	57.6	164.0	--	--
Champion Seed	39A25 PWC	Enlist	89	83	39	95	15.7	8.7	70.8	3.6	57.7	158.2	--	--
Champion Seed	45A25 VT2P	RR2	95	86	38	92	17.6	8.8	71.1	4.0	56.1	168.6	--	--
Trial Mean				84	36	89	17.1	8.9	71.2	3.7	57.1	163.2	--	--
C.V. (%)				1	14	7	7.2	4.0	1.1	2.5	1.0	3.5	--	--
LSD (0.1)				1	6	7	1.5	0.4	0.9	0.1	0.7	5.0	--	--

Planting Date = May 12; Harvest Date = November 14; Previous Crop = Soybean

* Best Linear Unbiased Estimate

Corn - Dryland **Dickey County - Oakes**

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Grain Protein	Starch Content	Oil Content	Harvest Moisture	Test Weight	--Grain Yield-- 2025	--Grain Yield-- 2 yr. Avg.
					inch	inch	%	%	%	%	lb/bu	bu/ac	bu/ac
Golden Harvest	G94U63-V	94	GT/LL	70.5	43.5	93.0	9.4	72.2	3.5	18.2	58.1	250.5	259.4
Golden Harvest	G97B68-DV	97	GT/LL	73.0	46.5	90.1	8.8	73.2	3.3	19.2	56.1	249.9	264.1
Golden Harvest	G98U62-DV	98	GT/LL	71.0	43.3	88.4	8.3	72.9	3.6	17.7	55.8	240.4	254.8
Golden Harvest	G99M49-AA	99	GT/LL	69.5	42.3	83.9	9.9	71.6	3.6	17.7	54.4	221.6	--
Thunder Seed	T6294 VT2P	94	RR2	70.3	41.7	85.4	8.1	73.5	3.4	17.8	56.8	244.6	264.4
Thunder Seed	T6695 VT2P	95	RR2	71.0	41.1	85.1	7.8	73.0	3.7	17.3	55.3	238.1	253.2
Thunder Seed	T8696 SSP	96	RR2	71.0	41.9	87.7	9.0	72.8	3.4	19.6	53.4	246.6	--
Thunder Seed	T6498 PC	98	Enlist	71.5	41.5	91.5	9.1	73.1	2.8	19.0	54.7	250.7	260.2
Proseed	2594 VT2P	94	RR2	70.5	42.4	86.7	8.1	72.9	3.7	18.0	55.1	241.9	252.5
Proseed	2398 TRE	98	RR2	72.0	40.0	90.0	8.9	72.0	3.8	17.8	55.2	276.6	280.0
Proseed	2598 VT4	94	RR2	70.0	38.2	83.5	8.1	73.5	3.4	19.0	55.0	238.4	254.8
Trial Mean				70.9	42.0	87.7	8.7	72.8	3.5	18.3	55.4	245.4	--
C.V. (%)				1.1	5.6	2.3	3.6	0.5	5.0	3.4	0.8	6.7	--
LSD (0.10)				1.0	2.8	2.4	0.4	0.4	0.2	0.8	0.5	19.6	--
LSD (0.05)				1.2	3.4	3	0.5	0.5	0.3	0.9	0.7	23.6	--

Planting Date = May 7; Harvest Date = October 24; Previous Crop = Soybean

[1] Hybrid traits as reported by seed company when hybrids submitted for evaluation.

Corn Silage - Dryland **Carrington (Page 1 of 2)**

Company	Hybrid	RM	Traits	Days to Silk	Plant Height	Harvest Moisture	DM %	---------- Yield ---------- 2025*	2-yr. Avg.	3-yr. Avg.
				DAP	inch	%	%	---------- ton/a ----------		
Integra	STP5191	101	RR2	86	114	62	38	29.8	28.2	28.5
Integra	STP5203	102	GSS Rib	84	111	59	41	27.5	28.4	--
Proseed	LFY 101	101	RR	86	106	61	39	28.9	28.1	28.2
Proseed	STS 105 GT	105	GT	81	115	59	41	27.8	--	--
Golden Harvest	G99M49-AA	99	Agrisure Above	79	101	57	43	23.9	--	--
Golden Harvest	G01U74-AA	101	Agrisure Above	79	103	60	40	27.0	25.1	--
Golden Harvest	G03U08-D	103	Agrisure Duracade	79	100	59	41	26.0	25.9	--
Trial Mean				82	107	60	40	27.3	--	--
C.V. (%)				2	5	4	6	4.9	--	--
LSD (0.10)				2	8	NS	NS	1.6	--	--

Planting Date = May 13; Harvest Date = October 9; Previous Crop = Field Pea

*Best Linear Unbiased Estimate

		60 days after ensiling												
Company	Hybrid	pH	Crude Protein	ADF	aNDF	Starch	EE	Ca	P	Mg	K	TDN (OARDC)	Neg (OARDC)	RFV
			% DM										Mcal/cwt	
Integra	STP5191	3.9	9.3	27.1	44.1	24.4	2.9	0.3	0.2	0.2	1.2	69.5	45.1	146.1
Integra	STP5203	3.9	8.3	26.3	43.6	26.9	2.9	0.3	0.2	0.2	1.2	70.0	45.4	149.4
Proseed	LFY 101	3.9	8.4	28.4	47.1	24.1	2.7	0.3	0.2	0.2	1.3	68.6	43.7	132.7
Proseed	STS 105 GT	3.9	8.3	22.9	37.7	35.8	3.2	0.2	0.2	0.2	1.1	73.2	49.2	177.4
Golden Harvest	G99M49-AA	3.9	8.6	22.0	36.4	36.4	3.4	0.3	0.2	0.2	1.1	73.3	49.5	186.5
Golden Harvest	G01U74-AA	3.8	8.6	21.5	35.4	35.9	3.2	0.2	0.2	0.2	1.1	73.9	50.2	190.5
Golden Harvest	G03U08-D	3.9	8.3	19.3	32.7	39.1	3.5	0.2	0.2	0.2	1.0	75.8	52.4	212.2
Trial Mean		3.9	8.6	23.9	39.6	31.8	3.1	0.3	0.2	0.2	1.1	72.0	47.9	170.7
C.V. (%)		2.2	6.7	14.3	13.4	20.9	7.3	18.9	7.5	16.8	12.7	4.0	7.3	16.5
LSD (0.10)		NS	NS	5.0	7.7	9.7	0.3	NS	NS	NS	NS	4.2	5.1	41.0

Planting Date = May 13; Harvest Date = October 9; Previous Crop = Field Pea

Corn Silage - Irrigated **Carrington (Page 1 of 2)**

								---------- Yield ----------		
Company	Hybrid	RM	Traits	Days to Silk	Plant Height	Harvest Moisture	DM %	Yield*	2-yr. Avg.	3-yr. Avg.
				DAP	inch	%	%	---------- ton/a ----------		
Integra	STP4723	97	RR2	83	120	56.7	43.4	23.6	--	--
Integra	STP5191	101	RR2	88	116	65.3	34.7	25.4	23.6	29.5
Integra	STP5203	102	GSS Rib	83	111	60.7	39.4	24.3	27.6	--
Trial Mean				85	116	60.9	39.1	25.4	--	--
C.V. (%)				2	2	5.2	8.1	2.8	--	--
LSD (0.10)				3	4	5.5	5.5	NS	--	--

Planting Date = May 13; Harvest Date = October 10; Previous Crop = Field Pea

*Best Linear Unbiased Estimate

Corn Silage - Irrigated **Carrington (Page 2 of 2)**

		60 days after ensiling												
Company	Hybrid	pH	Crude Protein	ADF	aNDF	Starch	EE	Ca	P	Mg	K	TDN (OARDC)	Neg (OARDC)	RFV
			% DM										Mcal/cwt	
Integra	STP4723	4.0	8.0	30.4	49.3	21.3	2.4	0.3	0.2	0.2	1.3	67.5	42.1	123.6
Integra	STP5191	3.9	8.1	27.2	45.4	24.0	2.6	0.3	0.2	0.2	1.2	69.6	44.8	139.6
Integra	STP5203	3.9	7.5	21.3	36.6	37.1	3.1	0.2	0.2	0.1	0.9	74.7	50.8	186.9
Trial Mean		4.0	7.9	26.3	43.8	27.5	2.7	0.2	0.2	0.2	1.1	70.6	45.9	150.1
C.V. (%)		1.5	5.2	11.6	10.7	19.7	7.0	13.2	4.4	12.6	9.4	3.6	6.7	15.3
LSD (0.10)		NS	NS	5.3	8.2	9.4	0.3	0.1	NS	NS	0.2	4.4	5.4	39.9

Planting Date = May 13; Harvest Date = October 10; Previous Crop = Field Pea

Corn silage under irrigation.

Winter Rye Forage **Carrington**

Variety	Harvest Date*	Harvest Moisture	Yield Dry Matter**	CP	ADF	aNDF	ASH	Lignin	Ca	K	Mg	P	S	TDN ADF	RFV	RFQ
		%	ton/a						% DM							
ND Dylan	2-Jun	74	2.50	16.0	33.5	56.4	8.43	3.16	0.37	3.01	0.21	0.34	0.30	62.8	103.8	154.8
ND Gardner	30-May	54	4.17	14.3	31.1	53.9	7.33	3.17	0.35	2.66	0.18	0.35	0.25	64.7	111.7	173.9
Hazlet	2-Jun	72	3.16	14.5	33.8	57.6	7.99	3.26	0.30	2.94	0.19	0.31	0.28	62.6	101.1	157.6
Danko	2-Jun	74	2.23	16.4	33.7	55.9	9.44	3.39	0.41	3.13	0.22	0.35	0.31	62.6	105.1	146.9
Aroostook	30-May	64	3.18	13.9	29.1	52.9	6.86	2.74	0.36	2.56	0.17	0.34	0.24	66.3	117.6	193.0
Rymin	2-Jun	73	2.57	16.2	34.1	55.7	9.09	3.29	0.41	3.12	0.21	0.35	0.29	62.3	104.7	154.7
Spooner	2-Jun	70	2.86	11.8	37.8	62.2	6.84	4.22	0.27	2.54	0.17	0.28	0.23	59.4	89.6	144.1
SU Cossani	2-Jun	73	2.40	15.8	32.6	55.5	8.49	3.12	0.38	3.01	0.22	0.33	0.30	63.6	106.6	159.2
SU Perspectiv	2-Jun	76	2.24	15.7	33.7	57.6	8.34	3.36	0.34	3.00	0.20	0.33	0.29	62.6	101.1	150.1
SU Performer	2-Jun	75	2.14	13.8	35.9	59.7	7.89	3.80	0.31	2.87	0.20	0.30	0.27	60.9	95.1	144.8
SU Bebop	2-Jun	76	2.21	15.6	33.2	55.6	8.60	3.17	0.37	3.00	0.21	0.34	0.29	63.1	105.6	156.3
SU Baresi	2-Jun	72	2.76	15.4	34.4	58.0	8.69	3.35	0.35	2.99	0.21	0.32	0.31	62.1	100.1	145.7
KWS Aviator	2-Jun	63	3.30	13.2	36.4	60.0	7.07	3.89	0.27	2.69	0.17	0.30	0.25	60.5	93.9	153.1
KWS Progas	2-Jun	72	2.25	12.9	36.7	60.6	7.48	3.87	0.28	2.69	0.18	0.28	0.26	60.3	92.6	143.5
Wintergrazer	30-May	49	2.92	--	--	--	--	--	--	--	--	--	--	--	--	--
Wheeler	2-Jun	73	1.99	--	--	--	--	--	--	--	--	--	--	--	--	--
Wrenz Abruzzi	30-May	53	1.71	--	--	--	--	--	--	--	--	--	--	--	--	--
Elbon	30-May	62	2.87	--	--	--	--	--	--	--	--	--	--	--	--	--
Guardian	2-Jun	74	2.19	--	--	--	--	--	--	--	--	--	--	--	--	--
Trial Mean		69	2.61	14.7	34.0	57.2	8.04	3.41	0.34	2.87	0.20	0.32	0.28	62.4	102.0	155.6
C.V. (%)		10	14.3	11.6	6.0	5.0	9.23	13.05	14.66	6.06	9.32	8.03	8.55	2.6	7.9	6.0
LSD 0.10		8	0.31	2.4	2.8	4.0	1.03	0.62	0.07	0.24	0.03	0.04	0.03	2.2	11.2	13.1

Planting Date = September 20, 2024; Harvest Date = Various; Previous Crop = Forage Barley

*Harvest occurred no later than 2 days after head emergence.

** Best Linear Unbiased Estimates

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Pat Copenhaver
Fetch Farms
Charnell Haak
Langemo Farms
Edwin Linderman
James and Larry Quesenberry
S & J Central Properties

NDSU Carrington Research Extension Center Staff

Agriculture Experiment Station

Mike Ostlie	Director/Agronomist
Kristin Simons	Agronomist
Michael Wunsch	Plant Pathologist
Open	Soil Scientist
Open	Animal Scientist
Rupak Karn	Precision Ag Specialist
Qasim Khan	Organic/Forage Systems Spec.
Dave Copenhaver	Research Specialist/Seedstocks
Ezra Aberle	Research Specialist/Agronomy
Szilvia Yuja	Research Specialist/Soils
Suanne Kallis	Research Specialist/Pathology
Jesse Hafner	Research Specialist/Pathology
Agustin San Pedro	Research Specialist/Agronomy
Rick Richter	Research Technician/Seedstocks
Tim Schroeder	Research Technician/Livestock
Steve Schaubert	Research Technician/Agronomy
Scott Fetch	Research Technician/Seedstocks
Chad Richter	Research Technician/Seedstocks
Billy Kraft	Research Technician/Agronomy
Aaron Fauss	Research Technician/Pathology
Victor Nava	Research Technician/Agronomy
Madison Bierman	Research Technician/Livestock
Open	Research Technician/Seedstocks
Open	Research Technician/Agronomy
Open	Fruit Project Manager
Melissa Hafner	Laboratory Manager
Steve Zwinger	Seasonal Research Assistant
Sam Richter	Seasonal Research Assistant
Myrna Friedt	Administrative Assistant
Lynne Voglewede	Part-time Administrative
Kalie Anderson	Part-time Program Assist.
Vern Anderson	Animal Scientist - Emeritus
Billie Jo Caulfield	Part-time Custodian

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Jeff Stachler	Cropping Systems Specialist
Karl Hoppe	Livestock Systems Specialist
Mary Keena	Livestock Environ. Mgmt. Spec.
Rupak Karn	Precision Ag Specialist
Linda Schuster	Administrative Assistant
Greg Endres	Cropping Specialist - Emeritus

North Dakota Farm Management Education

Jason Fewell	Instructor/Coordinator

Oakes Irrigation Research Site

Thomas Miorini	Site Manager
Heidi Eslinger	Research Technician
Spencer Eslinger	Research Technician
Kelly Cooper	Part-time Project Manager

Throughout the year, the Center hires individuals on a part-time basis to help in the research effort. Many of these are students and local residents. We would like to acknowledge the following who helped at some time during the year: Emma Aberle, Justin Adkins, Jocelyn Biel, Maxim Ciubotareanu, Rowdy Freeman, Savanna Friedt, Sage Friedt, Khendra Garcia, Jerome Gibson, Brett Harmon, Jared Hartl, Tessa Hartl, Morgan Hatch, Jennifer Heller, Gabriela Henson, Bagas Indwisari, Mykola Kuchenko, Marlys Lange, Lilly Larson, Abigail Lee, Kambry Linderman, Jaedyn Lura, Jason Lura, McKenna Melaas, Raymond Moll, Betty Montgomery, Rebecca Morstad, Sarah Nava, Brandon Nichols, Emery Patzer, Morgan Pedersen, Richard Ray Jr., Jaxsyn Remmick, Tyson Scanson, Trisa Schroeder, Stephen Sogge, Kaitlyn Tjelta, Maximus Whitman and Ninmakwa Wilkie-Larson.

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