Carrington
Research Extension Center

A Report of Agricultural Research and Extension in Central North Dakota

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Volume 65
December 2024

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Carrington Research Extension Center Mission

- **Research programs** in Agronomy, Horticulture, Livestock, Organic Agriculture, Plant Pathology, Precision Agriculture, and Soil Science serving needs of local communities with priorities identified by our 13-county Advisory Board.
- **Extension programs** in Agronomy, Livestock, Precision Agriculture, Livestock Environmental Management serving statewide to promote unbiased best management practices suited to our region.
- **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 buckwheat to increase seed availability of the best varieties.
- **Providing local data** and best management practices since 1960.

Carrington Research Extension Center Impacts

Developing Profitable Cattle Feeding Strategies in Producer Feedout Studies.

- In 2024, producers averaged $200 per head additional profit from feeding cattle to finish in CREC research projects.
- If North Dakota fed 25% of its cow herds to finish, that would translate to $30 million net economic return to North Dakota cattle producers.
- In the Dakota Feeder Calf Show Feedout project, the average profitability difference between the top five herds and bottom five herds was $205.89 per head.

Twenty Different Foundation Seed Varieties were Produced in 2024.

- Crops produced included one barley, seven field peas, four spring wheats, three durums, two flaxes, and three soybeans.
- In total, 51,000 bushels of clean seed were produced in 2024 for distribution in 2025.
- ND Stampede is a new NDSU spring wheat variety with very high yields. Seed with very high quality will be available and released to the counties in 2025 through North Dakota Crop Improvement and Seed Association (NDCISA) allocations.

Train the trainer workshops were a success in 2024.

- CREC has provided leadership for the Advanced Crop Advisers workshop since 1993. In 2024, 150 participants attended and 97% of respondents agreed or strongly agreed their production recommendations would change as a result.
- The Getting-it-Right webinar series was organized by CREC and attended by over 500 people covering topics in soybean, dry bean, sunflower, and canola production. Participant evaluations indicated 81% of attendees increased knowledge and 83% would change practices due to the information received.

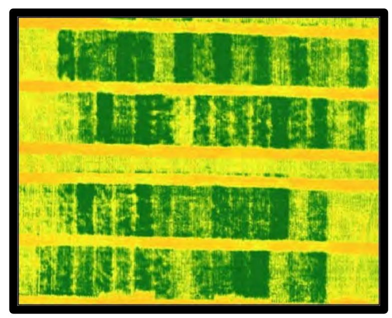
Fifty-seven people attended the reduced-tillage strategies session at Central Dakota Ag Day. Ninety percent of the respondents indicated they agree or strongly agree the session increased their knowledge and 77% of the respondents indicated they agree or strongly agree that they plan to act on what they learned.

Carrington Research Extension Center Impacts (cont.)

In 2024, the Northern Hardy Fruit Evaluation Project provided educational information to over 1,240 people with video conference programs, tours, meetings and personal phone calls. Field Day was attended by 55 people who learned about black rot fungus in apples. Horticultural expertise was also provided to other regions of the country including Alaska, Colorado, Minnesota and South Dakota.

Pathology researchers delivered disease management recommendations for field peas, chickpeas, dry beans, soybeans, and sunflowers to crop advisers, commercial agronomists, producers, and other stakeholders at winter production meetings and summer field tours, with a total direct audience of over 2,250 people across 15 events spanning five states and provinces (North Dakota, Minnesota, Manitoba, New York, Ontario).

NDSU Extension trained 65 professionals on how to safely respond to an animal disease outbreak or mass livestock mortality. One hundred percent of participants increased their confidence and ability to respond to an animal disease or mass livestock mortality event such as Highly Pathogenic Avian Influenza (HPAI) or livestock deaths due to natural disasters. Additionally, 96% of participants planned to make changes to be better prepared and better able to respond to animal diseases or mass livestock mortalities as a result of their participation in the training.

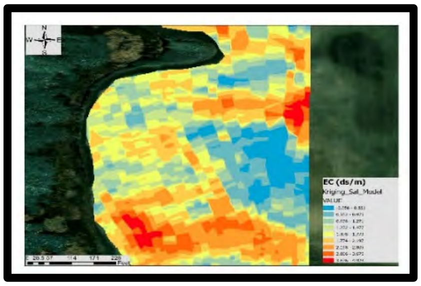


Split nitrogen (N) and sulfur (S) applications boost spring wheat yields and improve nitrogen use efficiency (NUE). Applying 10-20 lbs. of sulfur per acre increased wheat yields by 30.5%, even at the same nitrogen levels. Using split applications, with 25% less nitrogen, wheat yields were comparable to full nitrogen rates, saving on fertilizer costs. This approach not only increases wheat yield but also reduces environmental impact. Minnesota and North Dakota farmers can use this strategy to increase yields, reduce fertilizer use and expense, and promote sustainable farming practices.

The NDSU Extension Horse Management Webinar Series was held in spring 2024. Four webinars were presented to 309 individuals who joined live. Of 160 webinar poll respondents, 78% found the information shared either very or extremely useful. Recordings were viewed 679 times as of October 2024. Contacts for the webinar series increased by 930 individuals as compared to last year.

The CREC grew 22 different crops across seven locations, conducting extensive variety testing on 540 varieties. This included testing a diverse range of crops: 20 winter rye lines, 24 hard red winter wheat lines, 25 barley lines, 76 hard red spring wheat lines, 13 durum lines, 21 oat lines, 38 field pea lines, seven buckwheat lines, 17 flax lines, 37 canola lines, 19 corn silage lines, 65 corn lines, 35 edible bean lines, 76 soybean lines, and 67 sunflower lines. This testing provides local, non-biased data to make the best decision during variety selection.

Research demonstrated that field pea varieties differ in their tolerance to Aphanomyces and Fusarium root rot pressure, with some varieties capable of producing sharply higher yields without reductions in root rot severity. In studies conducted across 11 fields differing in Aphanomyces root rot pressure, the yield gains conferred by selecting a tolerant variety ranged from 3 to 20 bu/ac and averaged 14 bu/ac, with yield gains correlating closely to root rot pressure.



Salinity affects more than 1.9 million acres in North Dakota. Planting winter barley, winter rye, or winter camelina as spring cover crops one month before soybeans shows potential to improve soybean yields in saline soils. These cover crops can help to reduce salinity stress and support better soybean growth. While the yield increases (5-8%) are not yet statistically significant, these results offer practical steps toward managing salinity and improving sustainable soybean production.

The use of concrete surfaced pens did not impact finishing steers throughout the summer. Concrete surfaced pens can help improve footing during times of high moisture and mud, but comes at a higher cost than traditional dirt-surfaced pens. We found similar daily surface temperatures and similar activity levels of cattle fed on concrete and dirt-surface lots. During cattle finishing, concrete lots were not a detriment to cattle well-being or performance and could further benefit producers during cold, muddy times of the year.

One of the CREC's key ongoing projects is the development of an adapted sweet white lupin variety suited for the Northern Great Plains. Three promising lupin lines have been selected for seed increase, with plans for future variety release. Lupin, a highly nutritious legume, holds great potential as a plant-based protein source for food processing and can also serve as a beneficial alternative in crop rotation systems. CREC is currently engaged in discussions with potential producers, buyers, and processors of lupins in an effort to introduce this crop with commercial viability.

Variability in cattle feeding returns is discussed at the annual NDSU Feedlot School and at online backgrounding seminars. Producer knowledge of cattle feeding was increased by 33% from attending the Feedlot School. The backgrounding cattle seminars reached over 1,405 viewers.

Cover crop demonstration plots with 51 species were established and showcased at our annual Field Day and at the Cover Crops Field Training event in a vibrant display of the variety of available plant species that can be used for cover cropping. Constituents witnessed strengths and weaknesses of each species and the types of cropping systems that would best fit depending on factors such as desired planting date, available moisture, relay or intercropping, herbicide management considerations and cost.

A three-year study to evaluate winter pea adaptability in North Dakota was completed by testing fall planting dates and varieties. Year-to-year variability was substantial with winter kill ranging from 0-100% over the course of the study. Recommendations were updated to indicate fall-planted winter peas have potential in North Dakota, but are very risky, with ideal planting dates occurring between late September and early October to minimize winter kill potential.

Silphium and Kernza are possible new perennial crop alternatives for North Dakota. At the CREC, we are committed to exploring sustainable crop alternatives that enhance soil health and profitability. Our long-term research includes studying Kernza's fertility and variety trials and studying herbicide options for Silphium. These perennial crops provide year-round soil cover, reduce erosion, and offer alternatives for forage, seed, and oil production.

Split In-Season Nitrogen and Sulfur Applications Increase Spring Wheat Yield and Quality in Conventional and No-Till Systems

Sergio Cabello-Leiva, Szilvia Yuja, and Mike Ostlie

Introduction

Effective management of nitrogen (N) and sulfur (S) fertilizers is crucial for wheat production, as both nutrients are key to photosynthesis due to their role in chlorophyll production (Andrews et al., 2013). In North Dakota, many farmers over-apply N to increase yields, which is neither cost-effective nor sustainable (Tenorio et al., 2020). Although soil analysis helps guide proper N and S application, factors like temperature, rainfall, soil properties, and plant genetics can affect efficiency.

Active (GreenSeeker) and passive (drone and multispectral camera) optical sensors offer an affordable way to monitor plant N and S status in real-time. This allows for precise, mid-season recommendations that improve yield and protein content. Franzen et al. (2016) highlighted how seasonal weather changes complicate sulfur predictions in soil analysis, while active sensors can accurately detect N and S deficiencies. Their research also found that high nitrogen rates can worsen sulfur deficiency, especially in no-till systems.

Ullah et al. (2022) demonstrated that the optimal interaction between N and S significantly enhances wheat yield, emphasizing the need for updated fertilizer recommendations in Minnesota and North Dakota. Their research supports split applications of N and S for better results. Given that traditional spring soil tests may not fully reflect nutrient availability due to factors like organic matter and weather, we hypothesized that using split applications of nitrogen and sulfur would significantly increase wheat yields under conventional and no-till cropping systems.

Methodology

This research was conducted at two locations: Carrington, ND, where plots were established on dryland, no-till loamy soils, and at the Central Minnesota Demonstration and Research Irrigation Farm in Staples, MN, where plots were placed on irrigated sandy soils managed with conventional tillage. The experimental unit size was 25 ft x 10 ft.

Spring wheat (MN Rothsay) was seeded at a rate of 2.3 bu per acre in late April using a randomized complete block design (RCBD) with four replicates. Sixteen treatments were applied using urea and ammonium sulfate, with nitrogen (N) and sulfur (S) rates (lb acre^{-1}) as follows: 0N-0S, 0N-10S, 0N-20S, 50N-0S, 50N-10S, 50N-20S, 75N-0S, 75N-10S, 75N-20S, 100N-0S, 100N-10S, 100N-20S, 150N-0S, 150N-10S, and 150N-20S. Additionally, one treatment of 100N-20S was applied at planting as a control. Nitrogen and sulfur were applied in a split application, with 60% as a starter and 40% at the wheat Feekes 5 stage.

Composite soil samples were collected in early spring from 0-6 inches and 6-24 inches depths to analyze for NO3-N, soil pH, phosphorus (P), potassium (K), sulfate-S, zinc (Zn), and organic matter.

The 6–24-inch samples were tested for NO3-N and sulfate-S, providing the basis for N and S recommendations. In-season soil sampling at Feekes 5 stage also tested for NO3-N and sulfate-S, and after harvest, soil samples were collected from 0-24 inches to test for NO3-N and sulfate-S.

The GreenSeeker hand-held sensor was used to collect NDVI data from each plot at Feekes stages 3, 5, and 10.5 of the wheat growth stages. Additionally, a drone equipped with a DJI Phantom 4 MicaSense Red-Edge multispectral camera captured canopy reflectance images at 550, 670, 715, and 840 nm (green, red, red-edge, and near-infrared) at the same wheat growth stages (3, 5, and 10.5).

Results

Rainfall Impact

In 2024, rainfall significantly impacted wheat production in our trial locations. From April to August, Carrington received 15.01 inches of rainfall, 32% above the average, while Staples recorded 23.3 inches, a 57% increase. This excessive rainfall increased the risk of nitrogen (N) and sulfur (S) leaching, reducing nutrient use efficiency. Treatment effects were visible, as shown in the aerial green index and NDVI images in Figure 1, especially at the wheat Feekes 5 growth stage.

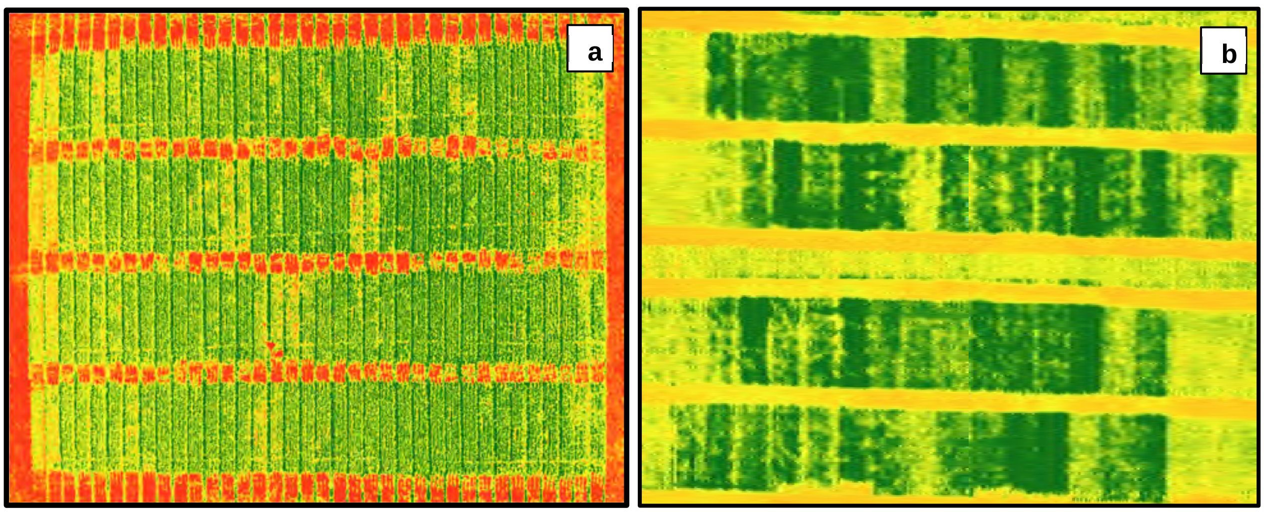


Figure 1. (a) Carrington, ND, wheat green index at Feekes 5, (b) Staples, MN, wheat NDVI index at Feekes 5.

The GreenSeeker sensor provided NDVI readings, which strongly correlated with green ground cover, as seen in Figure 2. Using this data, multiple regression models were developed to predict optimal N and S application rates at Feekes 5 for target yields. These models showed high accuracy (R^2 of 0.78 for Carrington and 0.81 for Staples), providing robust seasonal predictions for N and S applications.

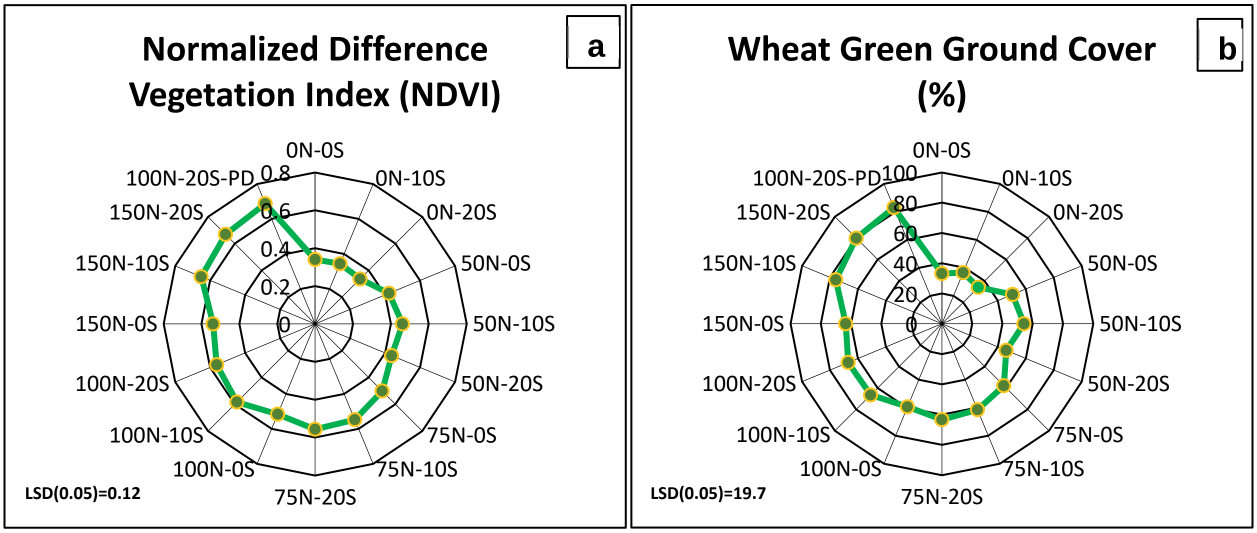


Figure 2. (a) Wheat normalized difference vegetation index (NDVI measured with GreenSeeker) at Feekes 5. (b) Wheat green ground cover (RGB smartphone photo) at Feekes 5. Both graph values were averaged across Carrington, ND, and Staples, MN, 2024.

Yield Results

Yield was a significant factor across treatments (Figure 3). Sulfur application increased wheat yield by 30.5% at the same nitrogen levels. Specifically, treatments with 150N-20S (55.7 bu/a) and 150N-10S (56.1 bu/a) outperformed the 150N-0S treatment (40 bu/a). These findings align with Franzen et al. (2016), who noted that high nitrogen rates (in this case, 150 lbs/a) can worsen sulfur deficiency, presenting challenges, particularly in no-till systems. No significant difference was observed between the treatment where 100 lbs N and 20 lbs S was applied at planting (47.6 bu/a) versus the one with a split application of 75 lbs N and 20 lbs S (46.8 bu/a). This indicates that a split application with 25% less nitrogen can be as effective as a full-rate single application at planting.

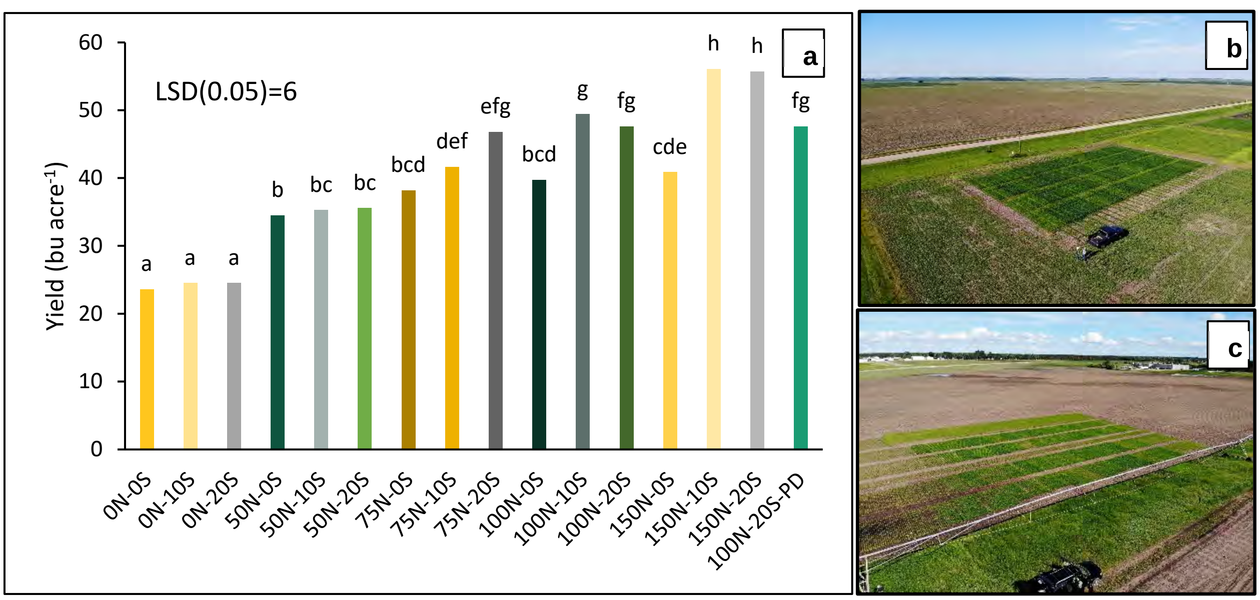


Figure 3. (a) Wheat grain yield combined across Carrington, ND, and Staples, MN ,2024. (b) Carrington aerial picture of spring wheat field trial at Feekes 5, June 2024. (c) Staples aerial picture of spring wheat field trial at Feekes 5, June 2024. Different lowercase letters above each graph bar indicate significant differences at 95% confidence.

Protein content varied between locations. In Carrington, protein levels remained above 13% across all treatments due to fertile, loamy soil under no-till conditions. In contrast, Staples exhibited protein levels below 12% in most treatments, likely due to sandy soil conditions. However, lower yields with higher N rates did show some increase in protein content. Total grain nitrogen was highest in treatments with sulfur, especially when nitrogen was reduced by 25% compared to the full rate.

Nitrogen Use Efficiency (NUE) Gains with Sulfur

Sulfur applications significantly improved nitrogen use efficiency (NUE). In Carrington, NUE increased by 7% with sulfur, and in Staples, by 10%. A split application with 75N-20S (25% less N) further boosted NUE by 13% in Carrington and 21% in Staples. This demonstrates that split applications improve yield and enhance nitrogen use efficiency (Figure 4a).

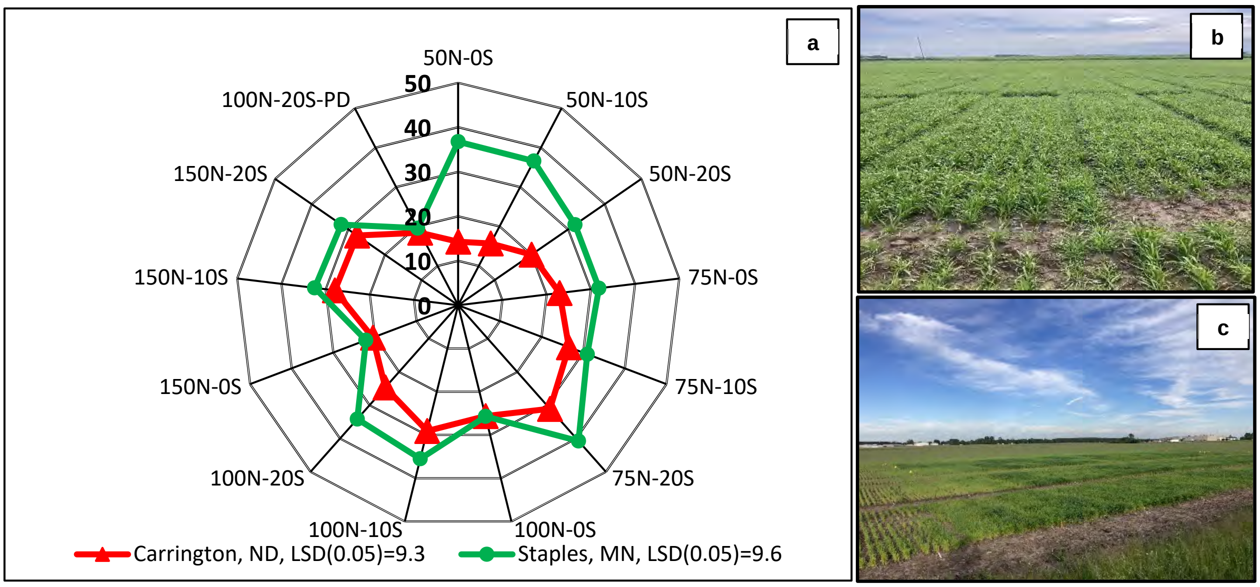


Figure 4. (a) Wheat nitrogen use efficiency (NUE) at Carrington, ND (red line), and Staples, MN (green line). (b) Wheat field trial Carrington, ND, June 2024. (c). Wheat field trial Staples, MN, June 2024.

Conclusions

Adopting sulfur and split nitrogen (N) applications offers multiple benefits for wheat production. Sulfur rates of 10 and 20 lbs per acre increased wheat yield by 30.5% at the same nitrogen levels. Additionally, split applications with 25% less nitrogen proved as effective as full-rate applications at planting. Nitrogen use efficiency (NUE) was also significantly improved with sulfur, with 7-12% improvements at the same N rate, boosting wheat yield potential in Minnesota and North Dakota.

Split N and S applications have shown the potential for higher yields with less fertilizer, providing a promising strategy for sustainable wheat production. While these results are promising, further testing will help refine N and S recommendations for varying conditions in North Dakota and Minnesota. This trial represents a positive first step toward more efficient, profitable, sustainable wheat production.

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Acknowledgment
Partial funding for this project was provided by the Minnesota Wheat Research and Promotion Council, https://mnwheat.org/council/. We want to thank Central Minnesota Demonstration and Research Irrigation Farm in Staples, MN, for all their research support.

Finishing Calves on North Dakota Protein Coproducts: The Effects of Canola Meal, Dried Distillers Grains, and Soybean Meal on Growth Performance and Carcass Characteristics

Madison Bierman and Colin Tobin

In 2020, North Dakota was the #1 producer of canola (80% of U.S.), # 9 of soybean (4.6% of U.S.), and #13 of corn (1.75% of U.S.) (USDA-NASS). With the current development of additional oilseed crushing plants across North Dakota, demonstrating the usage of coproducts produced as a result of alternative energy production will benefit livestock producers and grain farmers. North Dakota currently sits as one of the few states having ethanol, soy oil, and other vegetable oil production, which creates a local market for area livestock producers to lower feed input costs. The utilization of coproducts locally may help reduce seasonal demand variability, ensuring a more stable market.

To optimize growth, growing and finishing steers require supplemental protein when fed diets containing corn or barley (McKinnon et al., 1993; Cecava and Hancook, 1994). Protein coproducts produced in North Dakota predominantly used in beef cattle diets include canola meal, distillers' grains (dry, modified, and wet), and soybean meal. Average crude protein levels are 40%, 30%, and 46% for canola meal (CM), dried distillers' grains (DDGS), and soybean meal (SBM), respectively (NASEM, 2016). Additionally, the ruminally undegradable protein levels in CM, DDGS, and SBM are approximately 42%, 68%, and 44%, respectively.

The focus of this project was to determine the effectiveness of incorporating three different North Dakota-produced protein coproducts (CM, DDGS, and SBM) in finishing steer diets on growth performance and carcass characteristics. We hypothesize that steers fed distillers' grains would have improved performance over the oilseed treatments.

Materials and Methods
North Dakota State University Institutional Animal Care and Use Committee approved all procedures involving the use of animals in this experiment. The experiment was conducted at the North Dakota State University Carrington Research Extension Center (CREC) located near Carrington, ND. Coproducts were sourced from around North Dakota with CM, DDGS, and SBM coming from Velva, Spiritwood, and Spiritwood, respectively.

Experimental Design and Treatments
Three treatments were used in a generalized randomized block design to evaluate animal performance and carcass characteristics. The three finishing diets were balanced for net energy and crude protein. The final diets fed are presented in Table 1.

Table 1. Diet formulations.

Item	Dietary Treatment		
	DDGS	CM	SBM
Ingredient composition, %			
Dry rolled corn	57.8	63.4	64.9
Barley	9.4	10.2	11.3
Dried distillers' grains (DDGS)	20		
Canola meal (CM)		13.5	
Soybean meal (SBM)			10.7
Barley hay	6.8	6.9	7
Corn silage	3	3	3
Limestone and mineral supplement	3	3	3.1
Nutrient Composition			
NEm, Mcal/lb	1.00	1.01	0.99
Neg, Mcal/lb	0.60	0.59	0.60
CP, %	13.5	13.5	13.5

Animals, Initial Processing, Study Initiation

Two hundred and fifty-one cross bred steer calves (758 ± 19 lbs, initial body weight [BW]) from various ranches were used in the experiment. Steers were blocked by source from various producers across North Dakota (95 cross-bred steers from the Dakota Feeder Calf Show [block 1], 96 red-angus steers from producer 2 [block 2], 30 red angus home-raised steers from CREC [block 3], and 30 black angus steers from producer 4 [block 4]).

Upon arrival, cattle were processed for backgrounding. They were given a unique identification tag and vaccinated with Pyramid 5 + Presponse SQ, Inforce 3, Bar-Vac 7/Somnus, pour-on Cydectin, given a broad-spectrum antibiotic, and implanted with Synovex S. The steers were fed a high forage backgrounding ration for approximately 80 days.

Steers were individually weighed on two consecutive days prior to initiation day of the study. The initial body weight was used for pen allotment on the second weigh day. Steers were randomly assigned to one of 24 pens, then randomly assigned to one of three rations incorporating different coproducts - dried distillers grains with solubles (DDGS), soybean meal (SBM), or canola meal (CM) (Table 1). Steers were fed in 24 pens (*n* = 24; 10-11 steers/pen), resulting in eight replications per treatment with approximately 83 steers per treatment. Each pen had 3.25 ft concrete bunk space, 11.5 ft concrete feed apron, and 420 ft^2 of pen space per steer.

The experiment was initiated for blocks 1-3 on December 29, 2023, with a 23-d step-up adaptation period and 133-d finishing period (harvested May 31, 2024). Due to late arrival and low BW, steers within block 4 were delayed until January 16, 2024 (harvested July 5, 2024). Block 4 steers were fed a similar step-up adaptation ration for 23 days and 147-d finishing period. Synovex Choice was administered to cattle in blocks 1-3 and block 4 on February 15 and March 12, 2024, respectively. Steers consumed their respective coproducts on day one of the adaptation diet.

Diets and Intake Management

Feed analysis was performed on all feed ingredients by Dairyland Laboratories, Inc. (Arcadia, WI) prior to and throughout the study to balance the rations. Dairyland Laboratories conducted wet chemistry analysis of ash, ether extract, neutral and acid detergent fiber, and crude protein.

Steers were fed once daily in the morning around 0800. Bunks were managed to be devoid of feed at 0700 the following day.

Animal performance was calculated on a pen basis for dry-matter intake, average daily gain, and the ratio of feed:gain for each interim weigh period. All cattle were marketed and harvested at a commercial abattoir when treatment backfat reached approximately 0.5 in. Carcass data including hot carcass weight, ribeye area, 12th rib fat, USDA marbling scores, USDA Quality Grade and USDA Yield Grade were obtained. Data were analyzed using pen as the experimental unit (n = 24) using a generalized randomized block design model. Tukey's studentized range test was used to separate means.

Results

There was a difference in the bodyweight gain between coproduct treatments ($P < 0.05$). Steers assigned to DDGS, CM, and SBM treatments had an overall body weight gain of 588 lbs, 605 lbs, and 569 lbs, respectively. Steers that consumed canola meal had increased bodyweight gain ($P < 0.05$) of approximately 35 lbs compared to steers that consumed soybean meal (Table 2).

Table 2. Effects of canola meal, dried distillers grains, and soybean meal on growth performance and carcass characteristics.

	Dietary Treatment					Mean Separation (P-value)		
	DDGS	CM	SBM	SEM	*P*-value	DDGS to CM	DDGS to SBM	CM to SBM
Bodyweight gain, lbs	589	605	570	8.1	**0.0156***	0.3	0.2	**0.01***
Average Daily Gain, lbs	3.7	3.8	3.6	0.023	**0.0162***	0.3	0.2	**0.01***
Dry Matter Intake, lbs	25.8	25.8	24.5	0.35	0.4	0.9	0.5	0.4
Gain:Feed, lbs	0.14	0.15	0.15	0.0036	0.7	0.8	0.8	0.9
Hot Carcass Weight, lbs	850	867	832	7.4	**0.0006***	**0.08**	**0.05**	**0.004***
Yield Grade	3.7	3.81	3.53	0.069	**0.0274***	0.4	0.2	**0.02***
Rib Eye Area, in^2	12.7	12.9	12.8	0.1	0.3	0.3	0.9	0.5
Marbling	550	546	525	17.2	0.5	0.9	0.5	0.6
Rib fat, in	0.66	0.71	0.63	0.02	**0.0058***	**0.06**	0.5	**0.005***
Dressing Percentage, %	63.07	63.78	62.59	0.002	**0.007***	0.1	0.3	**0.005***

There was a difference in the overall average daily gain (ADG) between treatments ($P < 0.05$). Calves in the DDGS, CM, and SBM had an ADG of 3.6 lbs., 3.7 lbs, and 3.5 lbs, respectively. Steers that consumed canola meal had increased ADG ($P < 0.05$) of approximately 0.2 lbs more than steers that consumed soybean meal (Table 2).

No differences in overall dry matter intake (DMI) were detected when feeding DDGS, CM, or SBM ($P > 0.05$). The calves consumed 25.8 lbs, 25.8 lbs, and 24.5 lbs, respectively (Table 2). No differences in overall G:F were detected due to different coproduct feeds ($P > 0.1$). Steers fed DDGS, CM, and SBM gained 0.14 lbs, 0.15 lbs, and 0.15 lbs, respectively (Table 2).

Differences in hot carcass weights of calves were detected ($P < 0.05$). Carcass weights for DDGS, CM, and SBM were 850 lbs., 867 lbs., and 832 lbs. Steers fed CM averaged 35 lb heavier carcasses than SBM ($P < 0.05$) and tended to have heavier carcasses than those fed DDGS ($P < 0.10$). Additionally, those fed DDGS tended to have heavier carcasses than SBM ($P < 0.10$).

No differences in ribeye area (REA) or marbling were detected due to feeding different coproducts in the rations (*P* > 0.1). Animals fed DDGS, CM, and SBM had ribeye areas of 12.7 in^2, 12.9 in^2, and 12.8 in^2, respectively. Marbling scores were 550, 546, and 525.

Rib fat (RF) thickness differed between groups (*P* = 0.006). Steers fed DDGS, CM, and SBM had rib fat measuring 0.66 in., 0.71 in., and 0.63 in., respectively. Steers fed CM had deposited more rib fat than steers fed SBM (*P* < 0.05) and tended to have thicker rib fat than steers fed DDGS (*P* < 0.10).

Differences in dressing percent (DP) were detected in the study (*P* = 0.007). The dressing percentages of steers fed DDGS, CM, and SBM were 63.07%, 63.78%, and 62.59%. Steers fed CM dressed approximately 1.19% higher than those fed SBM (*P* < 0.05).

Steers being loaded for market, May, 2024.

Durum Intensive Management Study: Impact of Postemergence Nitrogen on Seed Quality

Greg Endres, Leo Bortolon, Blaine Schatz, Mike Ostlie, Melissa Hafner and Kristin Simons

Durum growers and the pasta industry need consistent seed yield and excellent quality for profitability. A significant production strategy of interest by durum growers is the use of postemergence-applied nitrogen (N) fertilizer to potentially increase seed yield and achieve hard amber durum milling quality.

A field study consisting of five trials was conducted during 2021-23 at NDSU Research Extension Centers in Carrington and Minot with financial support from the North Dakota Wheat Commission. The primary study objective was to examine durum seed yield and quality response, specifically seed protein and vitreous kernels (hard count), to 30 lbs per acre of supplemental N applied at tillering or post-anthesis (flowering) growth stages. Soil nitrate-N levels (125-175 lbs N per acre) present at seeding time were based on NDSU Extension recommendations. Research was conducted using the durum variety ‘ND-Riveland’ planted at 1.2-1.7 million pure live seeds per acre under center-pivot irrigation at Carrington and dryland at Minot.

Summary of study results:
<u>Seed yield</u> across five site-years, averaged 76.0 bu per acre with N applied at tillering stage, while yield was less (LSD [0.05] = 2.5 bu per acre) with post-anthesis applied N (72.2 bu per acre) and the standard management check (71.5 bu per acre).

Averaged across two site-years (Carrington 2022-23) in trials with soil N not sufficient for achieving the milling durum threshold level for <u>vitreous kernels</u> (85% or greater), the standard management check averaged 84% compared to 96% with application of post-anthesis N and 90% with tillering N (Table). In addition, <u>seed protein</u> improved to 13.6% with post-anthesis N and to 12.8% with tillering N, compared to standard management check at 11.9% (threshold for milling durum at 13%).

Durum Intensive Management trial during mid-season in 2022 at Carrington.

Table. Durum seed response to post-N application, Carrington 2022-23.

	Seed			
	Vitreous (Hard count)		Protein	
Timing of N treatment[1]	%	% improvement compared to check	%	% improvement compared to check
Standard management check	84	x	11.9	x
Tillering	90	7	12.8	8
Post-anthesis	96	14	13.6	14
LSD (0.05)	3	x	0.5	x

[1]N applied at 30 lb per acre.

In summary, study data confirmed previous research where soil N levels limit yield potential, an early season postemergence N application (before the jointing stage) can increase wheat seed yield. Especially in environments with high seed yield potential and soil N levels inadequate for high quality seed, N application immediately after durum flowering will optimize the potential for a substantial increase in seed protein and hard seed count. The challenge is predicting durum seed yield, and deficient protein and hard seed count triggering market discounts, to make the decision to post-apply N to improve return on investment of N fertilizer and application costs.

NDSU Extension publications that may aid in making decisions to post-apply N in durum include:

- Ransom, J.K., et al. (2017) Field Guide to Sustainable Production of Quality Durum Wheat in North Dakota, A1825. North Dakota State University Extension Service, Fargo.
- Tools for determining need in spring wheat for immediate post-anthesis N application to enhance grain protein, https://www.ndsu.edu/agriculture/extension/publications/site-specific-farming-active-optical-ground-based-sensor-algorithms-tools-0.

The study also examined durum response to seeding rates and late-season application of fungicide. Plant stand targeted at 1 and 1.4 million plants per acre was investigated at Carrington in 2021, with no yield increase with the greater plant density. Foliar disease and Fusarium head blight (scab) were at minimal incidence levels in the trials causing no positive yield or quality response to fungicide application at early flower (Miravis Ace or Prosaro Pro) or sequential-application at early flower plus 4-7 days later (tebuconazole, Prosaro or Prosaro Pro).

Inoculants Improve Pea Yield when Peas are Grown in Areas of Low Pulse History

Kristin Simons and Barney Geddes

Pulse crops, like peas and lentils, form symbiotic relationships with rhizobium bacteria, which allow producers to grow these crops without the need for synthetic fertilizers. Rhizobium can be applied directly to seeds as a liquid suspension or powdered peat, or it can be incorporated with the seed during planting in a granular formula. Liquid inoculants typically induce less nodulation compared to granular or peat-based formulas.

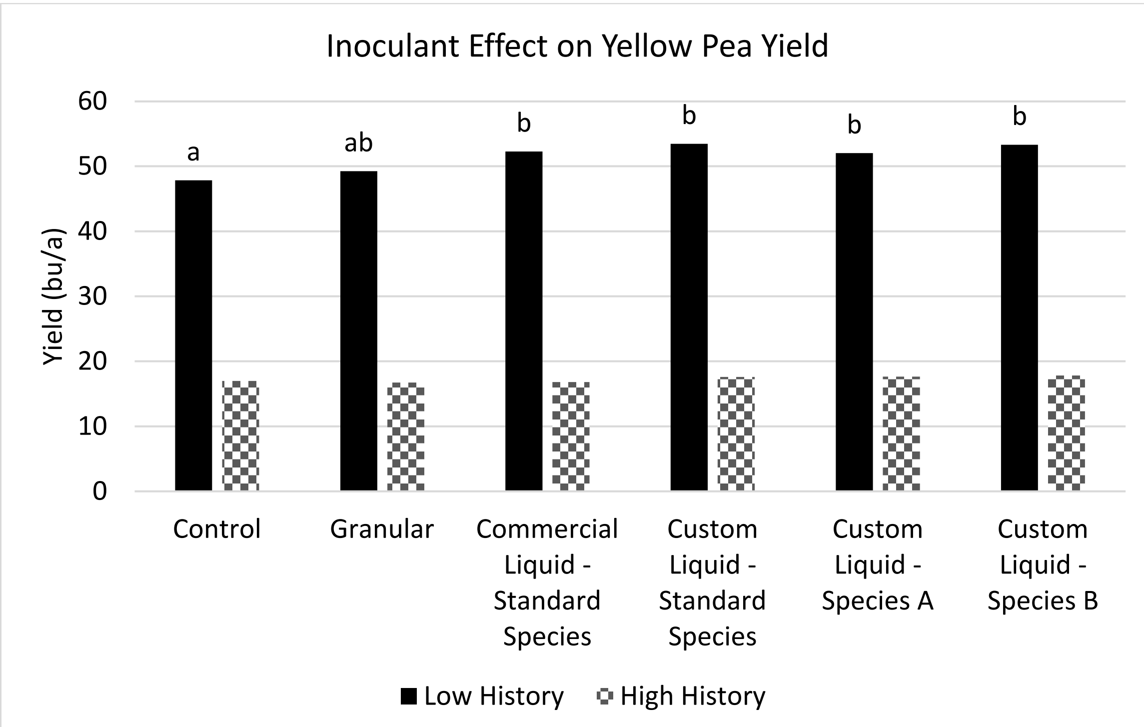
The Carrington REC participated in a broader study that compared the effects of commercial and custom inoculants on field pea and lentil yields. This research was conducted on sites with both low and high pulse cropping histories. The study included two main types of peas grown in North Dakota: green peas (ND Victory) and yellow peas (ND Dawn). North Dakota has considerable variation in pulse cropping history, so the study incorporated two distinct cropping histories: a low pulse history, where no pulse crops were grown for more than seven years, and a high pulse history, where peas were grown two seasons prior.

The study examined six different treatments (Table 1). The control treatment had no inoculant and served as the baseline for yield comparisons. Granular inoculants, which are popular due to their ease of application, were tested alongside liquid inoculants, as custom inoculants are often easier to produce in liquid form. The pea portion of the study was divided into four distinct trials - one for each pea color (green and yellow) and one for each type of pulse cropping history. Planting occurred in mid- to late-May due to a cool, wet spring. Seeds were inoculated just before planting, with liquid inoculant applied or granular inoculant placed in the furrow during planting.

Table 1. Inoculant effect on pea yield using various types of rhizobium species.

	Yellow Pea		Green Pea	
	Low History	High History	Low History	High History
Control	0	0	0	0
Granular	3%	-1%	19%	0%
Commercial Liquid - Standard Species	9%	-1%	32%	-4%
Custom Liquid - Standard Species	12%	4%	28%	25%
Custom Liquid - Species A	9%	4%	39%	-11%
Custom Liquid - Species B	11%	5%	34%	-17%

No significant differences were observed in flowering time or duration within each trial site. The trials were desiccated after physiological maturity was reached and harvested in mid to late August, as weather permitted. Yields were significantly different at alpha = 0.10 only in the trials with low pulse cropping history (Figure 1). To facilitate comparison, yields were adjusted as a percentage of the control treatment (Table 1). In the high pulse history trial, yields for both green and yellow peas were significantly lower. Several factors contributed to this yield reduction, including slower soil drainage at the high history site, which led to more saturated soils and slightly delayed planting. Root rot was also observed at the high history site.



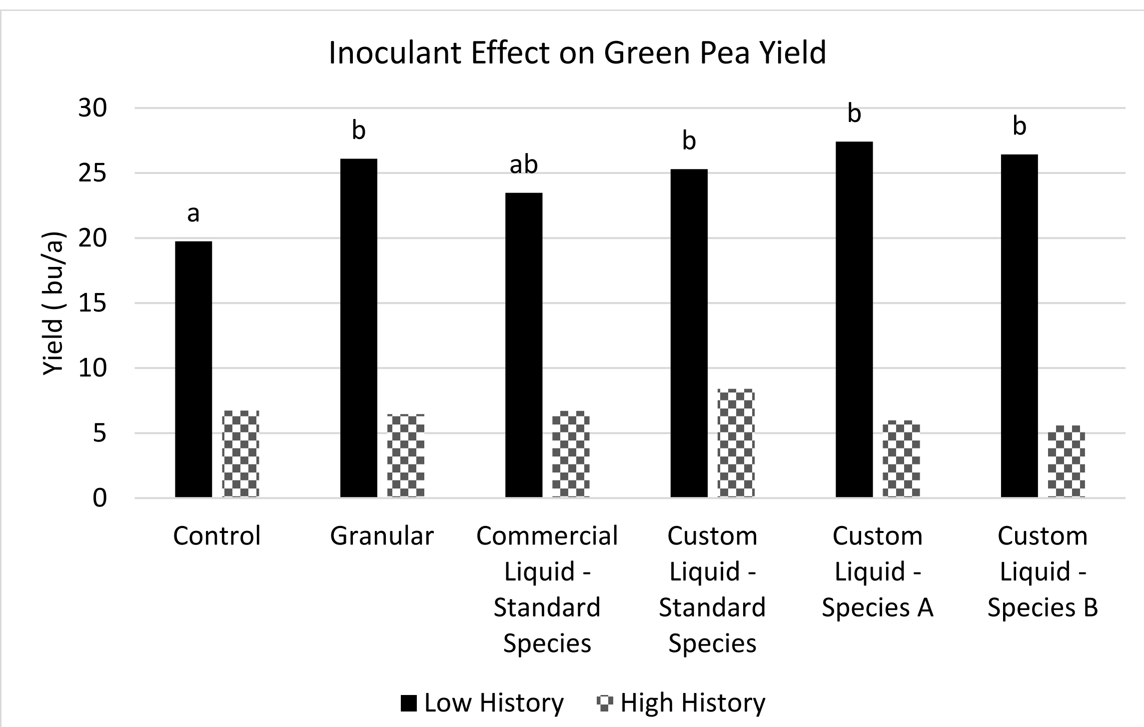


Figure 1. Inoculant significantly affected the yield of both green and yellow peas with a low pulse cropping history. Letters above the bars indicant significant groupings.

In the low pulse cropping history trials, all liquid inoculants had a positive effect on yellow pea yields, while both custom-produced liquid inoculants and granular inoculants significantly improved green pea yields. Table 1 shows the percentage effect of inoculants on yield. Notably, the range of yield change was smaller for yellow peas compared to green peas, though whether this is due to pea color, variety, or environmental factors remains unclear.

In conclusion, pulse inoculants can increase yields for both green and yellow peas. Further research is needed to confirm these findings and to determine whether the observed effects are specific to pea color or genotype.

Funding for inoculant testing was made possible by the U.S. Department of Agriculture (USDA) Agricultural Marketing Service through grant 23SCBPND1203. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

Mitigating Salinity Impact: Spring-Planted Winter Barley, Winter Rye, and Winter Camelina Cover Crops Boost Soybean Yield

Sergio Cabello-Leiva, Larry Cihacek, Szilvia Yuja, and Naeem Kalwar

Introduction

Soil salinity is a significant challenge in North Dakota, affecting over 1.9 million acres and reducing crop yields. Often marked by a white crust, saline soils have high soluble salts like sulfates, carbonates, and chlorides. Soils with electrical conductivity (EC) over 4 mmhos/cm are considered saline (Franzen et al., 2019; Seelig, 2000), but soybean yields can drop by 20-25% with EC levels above 1.1 mmhos/cm, reaching 50% loss at 2 mmhos/cm (Butcher et al., 2015).

Mitigating salinity in North Dakota relies on water management, reducing evaporation, and improving drainage. Cover crops can be used as a green cover to decrease soil surface evaporation and improve drainage through root channels. Additionally, cover crops can offer multiple benefits, such as crop diversity, reducing erosion, and improving soil health (Blanco-Canqui et al., 2015).

Winter cover crops need vernalization for anthesis, and because of that, spring-planted winter rye, winter camelina, winter barley, etc., remain in the vegetative stage, acting as green mulch in between the soybean rows, decreasing surface evaporation and adding root channels that increase soil water drainage. Adding a cover crop in the system also improves microbial communities' biodiversity. In North Dakota, winter rye has been used to mitigate the unfavorable impact of saline conditions in soybeans, where a significant increase in beneficial soil microbes was reported (Dasgupta et al., 2023). We hypothesized that winter cover crops, planted in early spring, would act as green mulch during the growing season, alleviating salinity problems and obtaining significantly higher soybean yields.

Methodology

This research was conducted in Carrington, ND, under dryland conditions in a saline area with an electrical conductivity (EC 1:1) gradient ranging from 0.6 to 3 mmhos/cm. The trial followed a randomized complete block design (RCBD) with treatments including soybean (check), soybean with winter rye, winter barley, winter camelina, or a cover crop mix. Each cover crop was planted at 66% and 33% of the recommended seeding rate. The cover crop was either terminated at the R2 stage of soybeans or left in the field without termination. The experimental plot size was 10 ft by 25 ft. Cover crops were planted on May 5 and soybeans were planted by June 21, 2024. By June 25, the soil green cover was measured using the Canopeo App.

Before planting, the soil in the research area was mapped using an EM38 device to measure apparent electrical conductivity. This data was used to create an EC map in ArcGIS (Figure 1a), helping select areas with low variability and target specific EC levels for the study. Soil samples were then collected and analyzed for EC 1:1 and saturation paste to characterize the soil (Figure 1b).

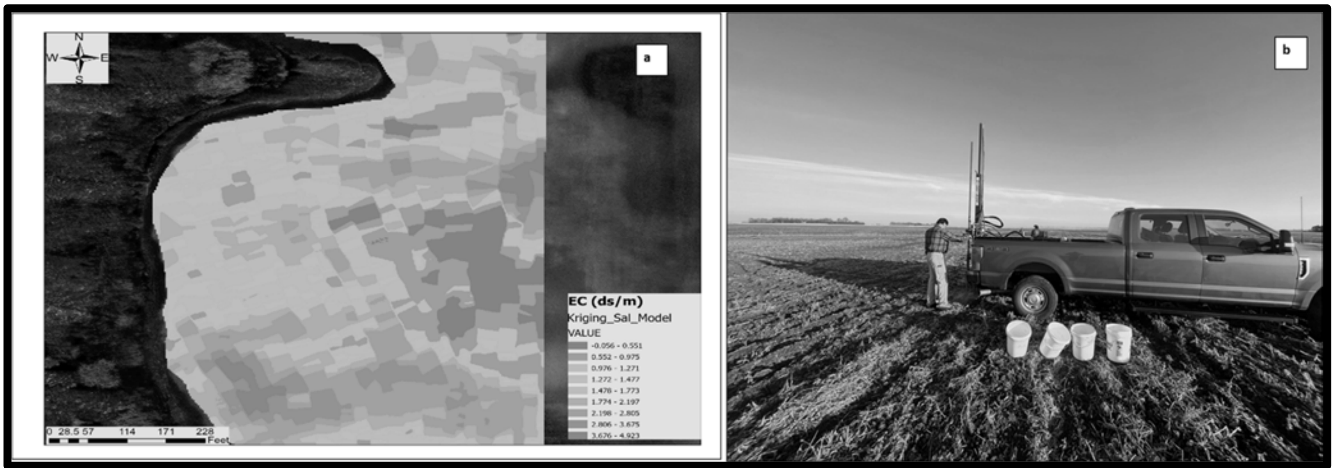


Figure 1. (a) Soil electrical conductivity map from EM38, Carrington, ND, 2024. (b) Soil sampling for soil electrical conductivity characterization, Carrington, ND, 2024.

Soil composite samples were collected at 0–6 inches and 6–24 inches depths in early spring. Topsoil samples (0–6 inches) were analyzed for nitrate-N (NO3-N), pH, phosphorus (P), potassium (K), sulfate-S, zinc (Zn), EC, and organic matter, while deeper samples (6–24 inches) were tested for nitrate-N. Additional soil sampling for EC and pH was performed at the R2 soybean stage at the 0–6-inch depth per plot.

Cover crop biomass samples were taken mid-season from a 3.3-foot section of an internal row at the soybean R2 stage. These samples were dried and weighed to calculate biomass production. Above-ground soybean biomass was also sampled at this time. Before soybean harvest, biomass samples were collected again from plots where glyphosate was not sprayed.

Grain yield, test weight, protein, and oil content were measured at soybean harvest to evaluate treatment effects.

Results

Spring temperatures were cool, and rainfall was 15% above average, ensuring good moisture throughout the growing season. However, frequent rains made it challenging to plant cover crops and soybeans on time.

Winter barley, winter rye, and the cover crop mix achieved the highest green cover values, exceeding 30%, and provided effective mulch during the early stages of soybean growth (Figure 2a). Soybean plants reached the R2 stage by July 25, when cover crop biomass was sampled. Winter camelina and the cover crop mix, seeded at 66% of the recommended rate, produced significantly higher biomass, averaging over 2,000 pounds per acre (Figure 2b).

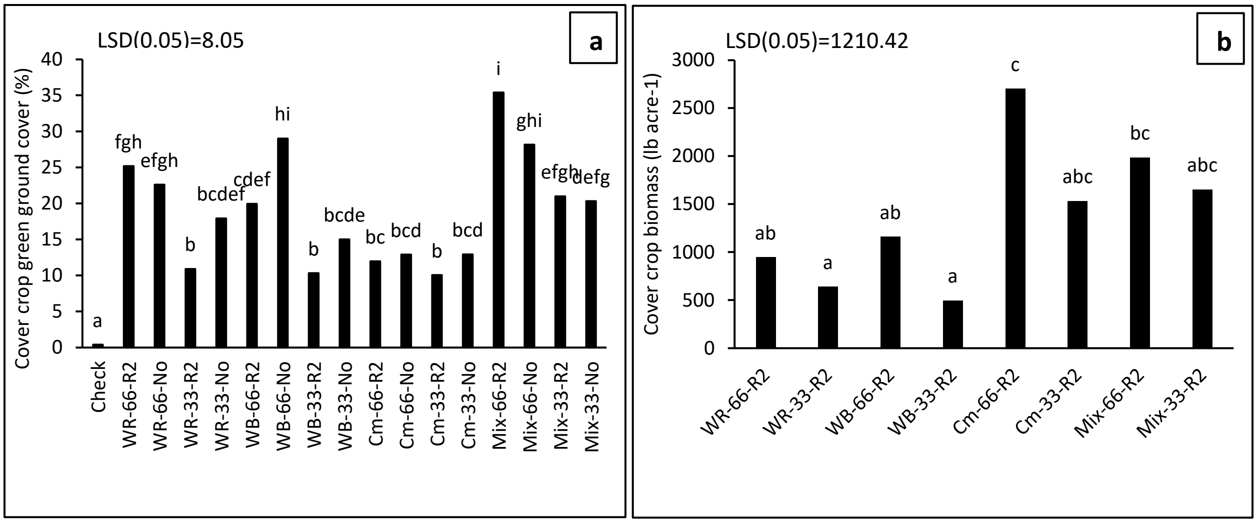


Figure 2. (a) Cover crop green ground cover on June 27, 2024, Carrington, ND. (b) Cover crop biomass at soybean R2 stage, July 25, 2024, Carrington, ND. Abbreviations: WR = winter rye; WB = winter barley; Cm = winter camelina; Mix = WR+WB+Cm; Check = no cover crop; 66 = 66% of recommended cover crop seeding rate; 33 = 33% of recommended cover crop seeding rate; R2 = cover crop termination date at soybean R2 stage; No = no termination for cover crops. Bars with different letters are statistically different at alpha = 0.05.

Soil salinity had a severe impact on soybeans. When EC (1:1) was above 1.8 mmhos/cm, soybean yields dropped by more than 50% compared to fields with EC levels of 0.63 mmhos/cm. Figure 3b illustrates soybean yield responses to different salinity levels, with each level represented as a block in the RCBD field design. Figure 3a shows an aerial photo of the Soybean Green Index, highlighting each replication's average EC (1:1) values. Soybean biomass was notably higher in areas with low soil salinity, as expected, while higher salinity levels resulted in poor plant stands and reduced biomass.

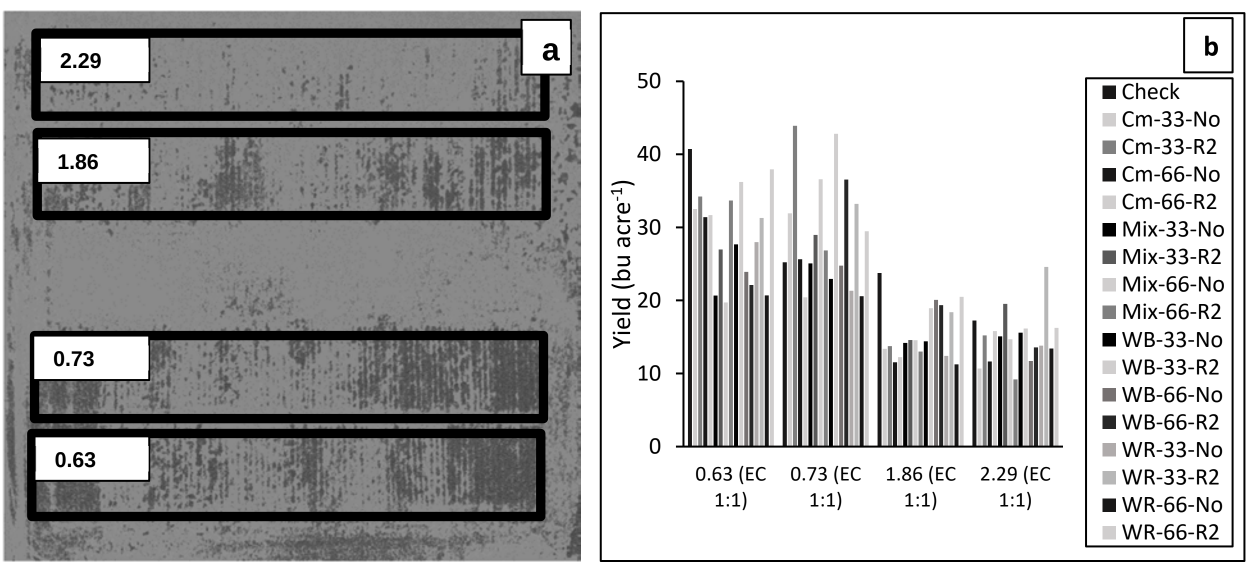


Figure 3. (a) Soybean Green Index aerial photo with average EC (1:1) per replication, Carrington, ND, 2024. (b) Soybean grain yield across four soil EC (1:1) levels, each level represents a replication on the field, Carrington, ND, 2024. Abbreviations: WR = winter rye; WB = winter barley; Cm = winter camelina; Mix = WR+WB+Cm; Check: = no cover crop; 66 = 66% of recommended cover crop seeding rate; 33 = 33% of recommended cover crop seeding rate; R2 = cover crop termination date at soybean R2 stage; No = no termination for cover crops.

Soybean grain yield varied across treatments with spring-planted cover crops. Winter camelina, barley, and rye outperformed the check plot (no cover crop) by 2-3 bushels per acre, representing a 5-8%

increase (Figure 4). However, these differences were not statistically significant. Nonetheless, these results provide a promising foundation for refining cover crop seeding rates and termination timing. In Figure 4, we can see that soybean yield was 33% higher in treatments where cover crops were seeded at 33% of the recommended rate and terminated at the soybean R2 stage, compared to treatments where the cover crop seeding rate was 66% with no termination date.

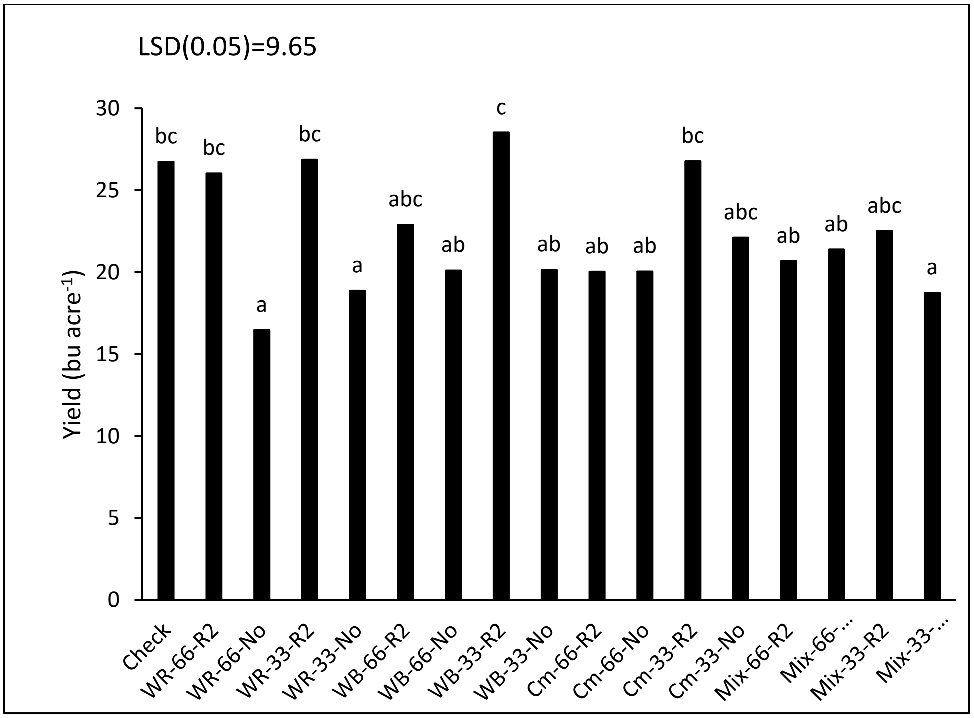


Figure 4. Soybean grain yield under different cover crop treatments, Carrington, ND, 2024. Abbreviations: WR = winter rye; WB = winter barley; Cm = winter camelina; Mix = WR+WB+Cm; Check = no cover crop; 66 = 66% of recommended cover crop seeding rate; 33 = 33% of recommended cover crop seeding rate; R2 = cover crop termination date at soybean R2 stage; No = no termination for cover crops. Bars with different letters are statistically different at alpha = 0.05.

Conclusions

The 2024 Carrington study found that planting winter barley, winter rye, and winter camelina one month before soybeans increased yields by 5–8%. While the yield differences were not statistically significant, the results suggest a potential benefit for mitigating salinity and enhancing soybean yields.

In saline soils, soybean yields may decline further if the cover crop seeding rate exceeds 33% of the recommended rate and/or if cover crops are terminated after the soybean R2 growth stage. These findings are a valuable starting point for optimizing cover crop seeding rates and termination timing for soybean production, but further research is needed to draw reliable conclusions.

Acknowledgments

Partial funding for this project was provided by the North Dakota Soybean Council, https://ndsoybean.org/

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Fungicide Treatment Increases Wheat Yield and Test Weight

Kristin Simons, Sam Richter, and Andrew Friskop

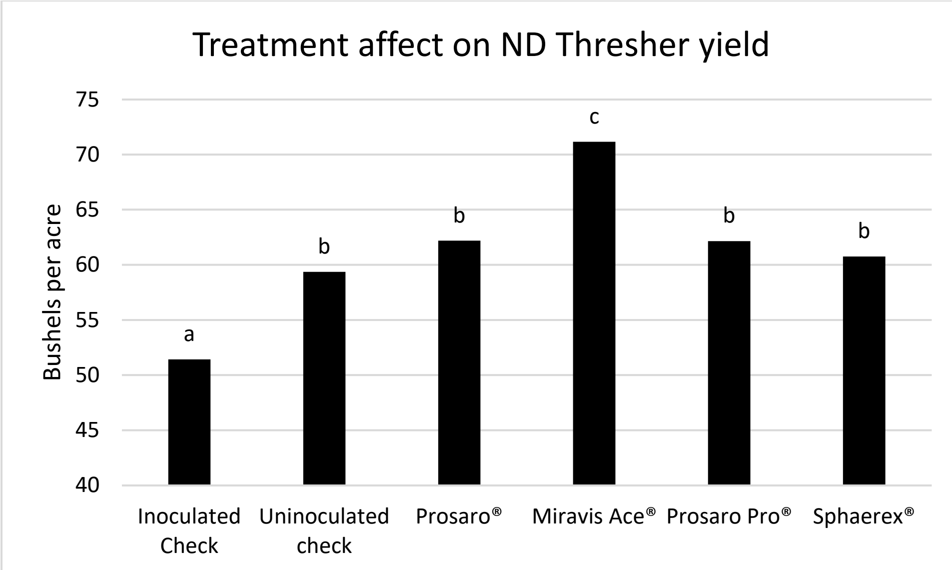
Fusarium Head Blight (Scab) continues to be a persistent problem for small grains in the United States, particularly in regions with frequent rainfall and warm temperatures. In 2024, these conditions were especially conducive to scab development in North Dakota. As part of a grant through the US Wheat & Barley Scab Initiative, the CREC conducted a wheat fungicide control trial under irrigation to assess potential solutions.

The trial aimed to evaluate two wheat varieties - one susceptible and one moderately resistant - and four different commercial fungicide products for scab control (Table 1). The experiment was planted on May 16, and corn spawn inoculum was spread across the plots twice: first on June 25 and again on July 2. Fungicides were applied at early anthesis (Feekes 10.51) on July 12. The trial was rated three weeks after inoculation, shortly before the ripening color change. After harvest on September 6, test weight and protein data were collected. Disease ratings, including incidence (0-9 scale) and severity (percentage spread within a spike), were generated and samples were submitted for DON testing. These results will be included in future presentations and reports.

Table 1. Trial tested both variety effect and fungicide effect on wheat yield.

Factor Category	Specific Factor
Wheat Varieties	ND Thresher (moderately resistant)
	WB9479 (susceptible)
Fungicide Treatments	No fungicide
	No inoculant, No fungicide
	Prosaro® (prothioconazole + tebuconazole) at 6.5 oz/a
	Miravis Ace® (propiconazole + pydiflumetofen) at 13.7 oz/a
	Prosaro Pro® (prothioconazole + tebuconazole + fluopyram) at 10.3 oz/a
	Sphaerex® (metconazole + prothioconazole) at 7.3 oz/a

The environmental conditions in 2024 were highly favorable for scab development, with mean incidences of 2.65 for ND Thresher and 2.4 for WB9479 in the inoculated untreated controls. Scab significantly impacted both yield (Figure 1) and test weight (Figure 2) in both varieties. In ND Thresher, fungicide treatments led to a significant increase in yield compared to the inoculated check, though no significant difference was observed when compared to the uninoculated check. Among the fungicides, Miravis Ace® was the most effective in improving yield. In the susceptible variety WB9479, no significant differences were observed between the inoculated or uninoculated checks, although fungicide treatment did result in increased yield, with Miravis Ace® being the only fungicide to show a significant improvement.



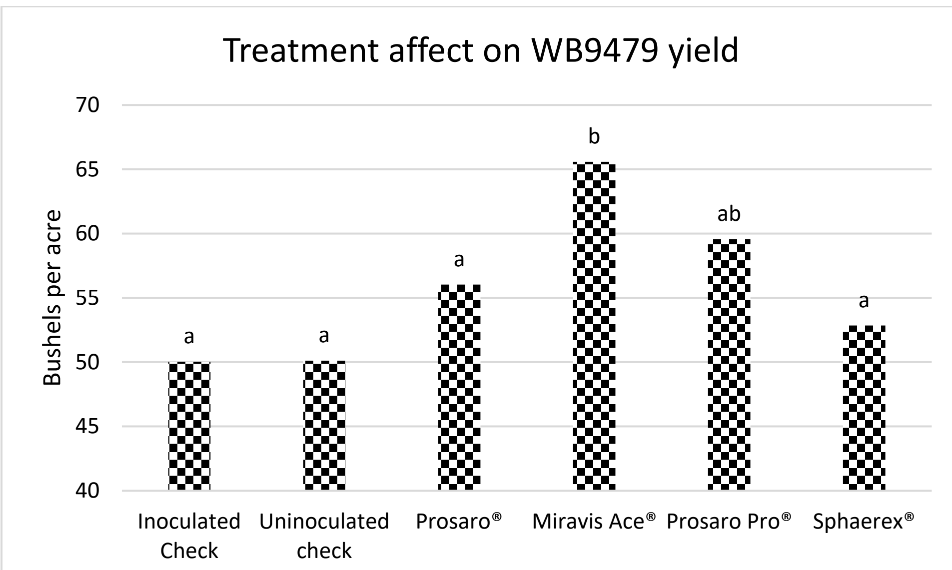
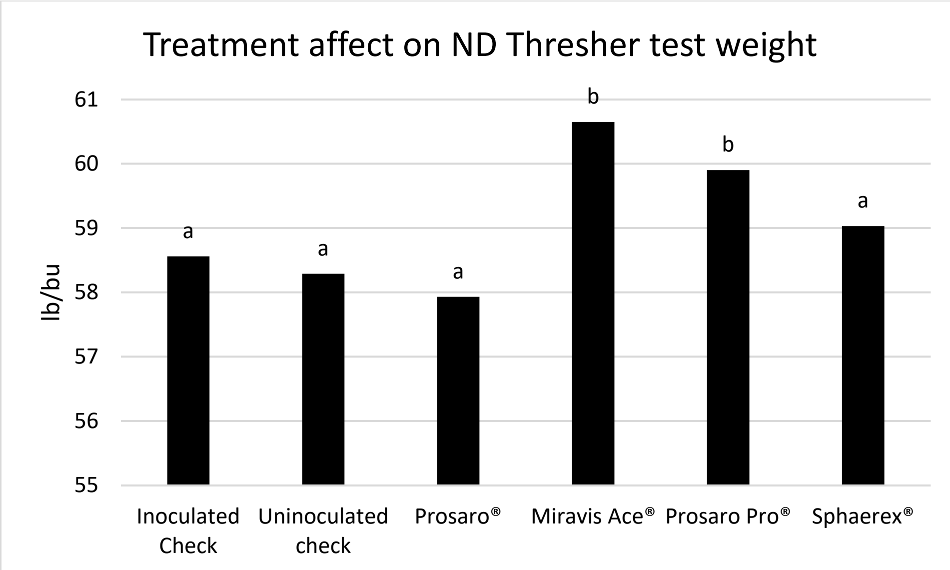


Figure 1. Fungicide treatment improves yield under high scab disease pressure. Different letters on each indicates statistically different at alpha = 0.10.



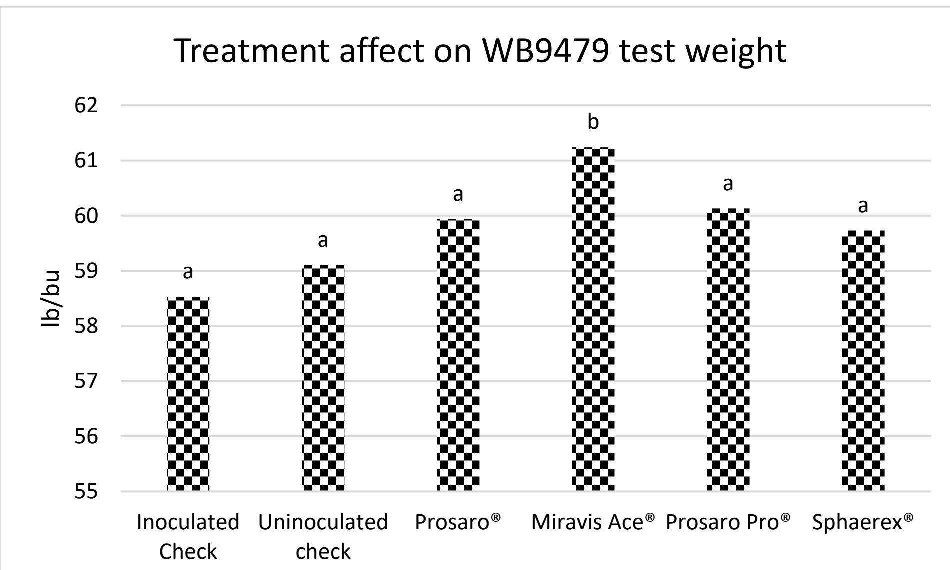


Figure 2. Fungicide treatment improves test weight under high scab disease pressure. Different letters on each indicates statistically different at alpha = 0.10.

Test weight was also affected by scab infection (Figure 2). In ND Thresher, only two treatments - Miravis Ace® and Prosaro Pro® - resulted in significantly higher test weights than the other treatments. In WB9479, only Miravis Ace® significantly increased test weight.

In conclusion, Miravis Ace® proved to be the most effective fungicide, significantly improving both yield and test weight in both the resistant and susceptible lines. Notably, planting a resistant variety offers some protection in years with low disease pressure, as evidenced by the yield differences in ND Thresher. Future analyses will focus on additional seed characteristics, which will be generated and reported later.

This material is based upon work supported in part by the U.S. Department of Agriculture, under Agreement No. 59-0206-2-124. This is a cooperative project with the U.S. Wheat and Barley Scab Initiative. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Interseeding Legumes with Hard Red Spring Wheat

Ezra Aberle

Interest in reducing fertilizer inputs has increased recently in North Dakota. Seeding legumes with Hard Red Spring Wheat (HRSW) is not new. Our ancestors seeded sweet clover, or alfalfa, with HRSW prior to the widespread adoption of commercial fertilizer. However, numerous fertility options are available. Through literature review and local knowledge inquiries, interseeding potential for thirteen species was evaluated as well as sweet clover as the legume check.

For the duration of the study (Table 1), no nitrogen fertilizer was added to limit confounding treatment differences. During the first year, legumes were interseeded with HRSW at no more than ½" seeding depth. Traditionally, HRSW is seeded deeper than this study depth. In general, legumes are seeded shallower than in this study. These trials were conducted with conventional tillage until 2021 and then no-till starting in 2022.

Table 1. Comparison of interseeded legume species performance on spring wheat and the effects on the subsequent crop the next season.

First year HRSW seeded with legumes					Test crop the following year			
Treatment	Test Weight	Protein	Grain Yield	Legume Stand	Treatment	Test Weight	Protein	Grain Yield
	lb/bu	%	bu/a	plants/sqft		lb/bu	%	bu/a
Check (no legume)	60.5	15.1	28.5	0.0	Check (no legume)	54.1	12.0	25.9
Indian Head black lentil	60.1	15.3	27.5	7.5	Indian Head black lentil	54.9	11.3	24.0
Alsike clover	60.3	15.1	28.0	11.3	Alsike clover	54.3	11.1	19.0
Balansa clover	60.2	15.2	28.9	6.1	Balansa clover	56.1	11.5	25.0
Berseem clover	60.2	15.3	30.4	12.1	Berseem clover	57.3	11.3	24.3
Crimson clover	58.4	15.2	27.7	25.4	Crimson clover	56.3	11.1	22.2
Hubam clover	59.5	15.4	28.6	18.2	Hubam clover	55.2	12.2	30.0
Persian clover	59.6	15.2	26.3	4.9	Persian clover	56.3	10.8	24.5
Red clover	60.0	15.1	27.9	26.3	Red clover	56.3	11.3	23.8
Subterranean clover	59.9	15.3	28.0	16.3	Subterranean clover	54.8	11.2	24.6
Sweet clover	60.0	15.3	28.9	14.3	Sweet clover	56.7	12.0	20.1
Barrel medic	60.7	15.0	27.7	19.0	Barrel medic	55.5	11.5	26.1
Burr medic	59.9	15.3	27.9	18.6	Burr medic	54.5	11.2	30.0
Snail medic	60.0	15.0	26.9	19.7	Snail medic	55.7	11.4	26.5
Birdsfoot trefoil	60.3	15.3	29.9	4.4	Birdsfoot trefoil	55.3	11.7	27.1
Trial Mean	60.0	15.2	28.2	13.6	Trial Mean	55.6	11.4	24.9
C.V. (%)	5.4	4.2	18.8	57.8	C.V. (%)	5.0	11.2	31.9
LSD (0.05)	NS	NS	NS	4.3	LSD (0.05)	NS	NS	NS

Below are observations from additional years at the CREC with HRSW as the cereal crop.

- 2018 started out dry in April, followed by below average precipitation in May, above average precipitation in June and below normal precipitation the remainder of the growing season but with timely rains.

- 2019 also had below average precipitation in April and May, which was followed by above average precipitation in June and July.
- 2020 rainfall was well below average for the entire season with the exception of July.
- 2021 also had little significant rainfall after seeding. This lack of rain impacted grain yield and cover crop establishment with no treatments being significantly higher than others.
- 2022 April and May had rainfall amounts that were well above average, followed by well below normal precipitation the remainder of the growing season.
- 2023 the precipitation was near normal throughout the growing season.

We will also grow a test crop without fertilizer the following year to determine if there is any impact based on the residual effects of these treatments.

To bolster a successful herbicide program, these practices should be utilized in cleaner, more weed-free fields, if possible. None of these treatments had a negative impact on the first-year HRSW production. Also, no treatments had a positive or negative detectable impact on the following year's HRSW test crop.

Crimson clover and red clover had the highest stand establishment, followed by the medic spp., hubam clover, and subterranean clover, which were significantly higher than sweet clover and the remainder of the treatments. Treatments with successful establishment had green ground coverage immediately after harvest and maintained this coverage throughout the fall, reducing potential effects of wind erosion, providing a larger window for living roots during the year, and potentially reducing new weed seed emergence.

An Overview of the Nitrogen Response of Corn and Wheat at the Carrington Research Extension Center from 2013 to 2024

Szilvia Yuja

The Soils Program at the Carrington Research Extension Center (CREC) has been heavily involved in fertility research since its inception. Almost every year since 2013, wheat or corn trials have included a nitrogen curve with plain urea as a comparison to test other treatments. Yield response to nitrogen varies widely year to year even on the same field, mostly due to climatic factors such as rainfall, temperature, and length of season. As the studies are conducted, we have the opportunity to address the objectives of each individual trial and to continue learning about the nitrogen response we can expect to see on fields. Even though the data presented only applies to the fields immediately surrounding the CREC, it provides a real-world example of the variability of nitrogen response that any farmer may experience.

The tables presented show the yield and nitrogen rate at which the highest yield was achieved, as well as the starting soil nitrogen levels. As a reference, the table also displays the nitrogen rate and corresponding yield, at which nitrogen fertilizer had the highest return on investment (ROI). The ROI was calculated using the recent local prices of $0.4 per lb of N ($368/ton of urea), $3.57 per bushel of corn and $5.92 per bushel of wheat. Each row represents an individual trial. In some years there were multiple nitrogen fertility trials. Each one has its own entry.

Dryland corn (Table 1)
Under dryland conditions, the average nitrogen rate producing the highest yield was 110 lbs. However, the individual values vary greatly between trials and years and range from 0 to 200 lbs of N. The average of the nitrogen rates for each trial at which return on N investment was the highest was only 57 lbs. The lowest value was 0. This was the case for 5 out of 12 trials in which the most profitable scenario would have been to forego nitrogen application altogether. The highest most profitable nitrogen rate was 200 lbs of N in a trial in 2020.

Table 1. Dryland corn nitrogen yield response from 2013 to 2024.

Year	Spring Residual Soil N	Highest Yield N Rate	Highest Yield Yield	Highest ROI N Rate	Highest ROI Yield	Rainfall May 1 - Aug 31
	lb/a	lb/a	bu/a	lb/a	bu/a	inches
2013	57	143	105	61	96	6.82
2013	60	100	120	0	113	6.82
2014	52	79	114	0	99	9.26
2014	58	70	130	70	130	9.26
2015	54	150	137	0	131	12.74
2016	65	0	147	0	147	11.09
2017	22	50	147	50	147	9.15
2017	22	180	152	60	143	9.15
2020	14	142	104	120	102	8.46
2020	45	200	121	200	121	8.46
2021	56	100	73	0	70	5.87
2022	38	100	73	120	172	12.21
Average		110	118	57	123	--
Median		100	121	55	125	--
Minimum		0	73	0	70	--
Maximum		200	152	200	172	--

Irrigated corn (Table 2)
Under irrigation, the highest yield was achieved at 157 lbs N on average. The average nitrogen rate for highest return on nitrogen investment was at 107 lbs N. Unlike on dryland, there were no trial sites or years in which the highest yield was achieved with no nitrogen, neither was foregoing nitrogen the most profitable option. Both the high yields and the nitrogen rates to achieve them tended to be higher for irrigated corn than dryland corn. Notably, there was less variability in optimum nitrogen rates.

Table 2. Irrigated corn nitrogen yield response from 2013 to 2024.					
		Highest Yield		Highest ROI	
Year	Spring Residual Soil N	N Rate	Yield	N Rate	Yield
	lb/a	lb/a	bu/a	lb/a	bu/a
2014	53	196	152	153	150
2014	53	146	160	124	159
2014	53	177	155	141	153
2015	47	180	163	180	163
2016	36	157	132	121	130
2020	44	80	169	80	169
2020	15	240	163	60	153
2020	58	129	177	83	175
2021	43	98	228	72	225
2022	14	160	195	160	195
Average		157	170	107	164
Median		159	163	123	161
Minimum		80	132	60	130
Maximum		240	228	180	225

Dryland wheat (Table 3)
Dryland wheat nitrogen response was more consistent than the response seen in dryland corn. Out of 15 trials only one had its highest yield associated with no nitrogen application. Furthermore, there were only three trials in which no nitrogen application would have been the most economic option. The average nitrogen rate at which yield was maximized was 91 lbs. The range for this value was 0 to 200 lbs of N. The average nitrogen rate at which profit was maximized was 47 lbs with a range of 0 to 105 lbs of N.

Unfertilized passes of wheat next to fertilized passes.

Table 3. Dryland wheat nitrogen yield response from 2013 to 2024.

Year	Spring Residual Soil N	Highest Yield N Rate	Highest Yield Yield	Highest ROI N Rate	Highest ROI Yield	Rainfall May 1 - Aug 31
	lb/a	lb/a	bu/a	lb/a	bu/a	inches
2013	71	60	44	0	41	6.82
2014	32	70	71	70	71	9.26
2015	35	105	50	105	50	12.74
2015	52	200	61	50	56	12.74
2016	23	50	33	50	33	11.09
2016	20	77	34	77	34	11.09
2016	26	102	34	5	30	11.09
2017	81	50	54	50	54	9.15
2017	14	0	59	0	59	9.15
2018	84	100	51	0	47	8.80
2018	17	136	55	16	49	8.80
2019	19	138	52	83	51	11.19
2020	18	60	33	60	33	8.46
2023	28	120	50	30	48	11.44
2024	15	90	42	90	42	16.02
Average		91	48	46	47	--
Median		90	50	50	48	--
Minimum		0	33	0	30	--
Maximum		200	71	105	71	--

Irrigated wheat (Table 4)
Under irrigation there was no trial in which yield was maximized without nitrogen application and there was only one trial in which foregoing nitrogen would have been the most economic option. The average nitrogen rate at which yield was maximized was 119 lbs with a range of 70 to 200 lbs of N. The average of the most economic nitrogen rate was 75 lbs with a range of 0 to 120 lbs. The differences between dryland and irrigated wheat nitrogen response were less noticeable than in a similar comparison in corn. Maximum yield was 71 bushels in both dryland and irrigated wheat. However, irrigation produced good yields more consistently.

Table 4. Irrigated wheat nitrogen yield response from 2013 to 2024.					
		Highest Yield		Highest ROI	
Year	Spring Residual Soil N	N Rate	Yield	N Rate	Yield
	lb/a	lb/a	bu/a	lb/a	bu/a
2014	35	70	72	70	72
2014	35	100	71	90	71
2015	35	100	51	100	51
2015	81	140	61	70	57
2018	84	150	46	0	44
2018	76	200	68	80	67
2019	35	120	56	90	54
2019	35	120	56	120	56
2020	13	80	57	80	57
2020	13	150	59	50	57
2020	13	80	71	80	71
Average		119	61	75	60
Median		120	59	80	57
Minimum		70	46	0	44
Maximum		200	72	120	72

Discussion

Spring residual nitrate levels in the top two feet of soil for all the trials ranged from 14 to 84 pounds (Tables 1 through 4). Residual nitrogen seems to have had no predictive value on nitrogen response in any of the scenarios. At our site, which has a loam soil and an average annual precipitation of 18.79 inches, the availability of moisture likely affected the profitability of nitrogen application as evidenced by the fact that under irrigation some amount of nitrogen application was necessary to maximize profit in almost every case, but the same was not true for dryland. This could be due to the fact that under dryland, yield potential was limited by the availability of moisture. Rainfall amounts had some correlation with highest yields in dryland corn (Figure 1) and with economic N rates in dryland wheat (Figure 2). Still, the fact that these correlations are not stronger and more consistent, suggest that the timeliness of the rainfall was a major factor determining yield and nitrogen response. Irrigation likely had a stronger impact because of the consistency with which water was supplied throughout the season.

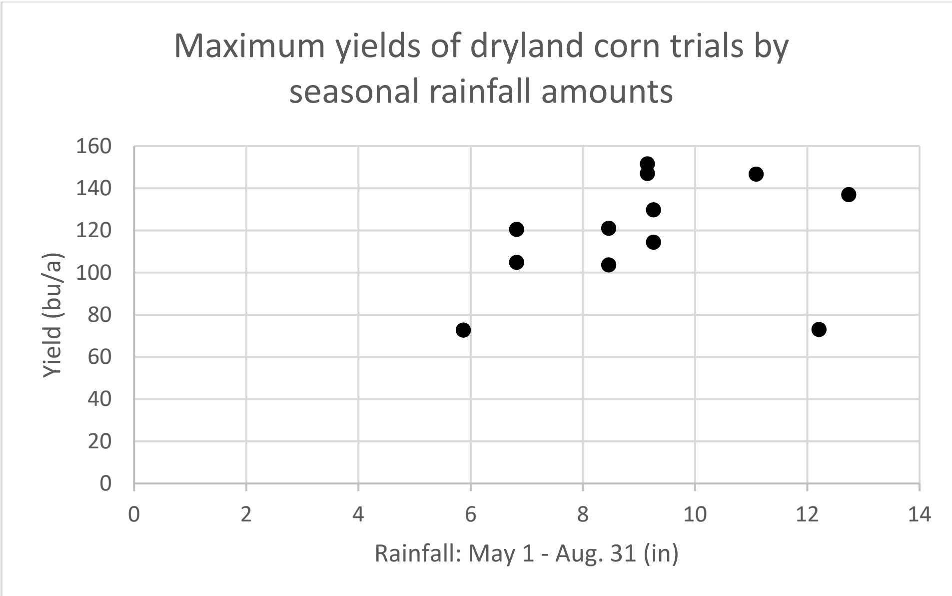


Figure 1. Maximum yields of dryland corn trials by seasonal rainfall amounts.

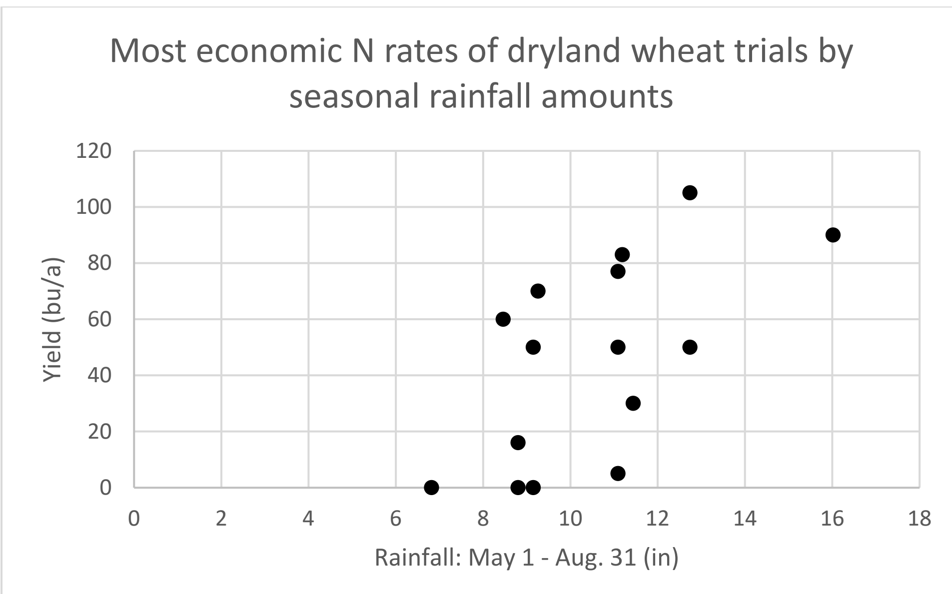


Figure 2. Most economic nitrogen rates of dryland wheat by seasonal rainfall amounts.

The data displayed is specific to our site, and the prices used for calculating economic return are subject to change. Therefore, this data is not meant as a fertilizer recommendation for corn or spring wheat. However, it shows that it might be worthwhile for farmers to consider their farmlands' own unique characteristics and climate to consistently get the most value out of their nitrogen application.

Optimizing Planting Dates and Variety Selection for Winter Pea Establishment in the Northern Environment

Qasim A. Khan, Mike Ostlie, and Steve Zwinger

Interest in growing winter peas in the Northern Plains is increasing, driven by the availability of new cold-hardy varieties. However, determining the optimal planting time remains a significant challenge due to the region's short growing season and harsh winter conditions. Planting too early can lead to excessive vegetative growth, depleting the carbohydrate reserves needed for overwintering and increasing the risk of winterkill. On the other hand, planting too late may not allow sufficient time for root establishment, compromising the crop's ability to survive the winter. The ideal planting window is typically 4–6 weeks before the first hard frost. Optimal soil temperatures for germination range from 40–50°F, but dry or wet fall conditions can complicate planting schedules. Selecting a cold-hardy variety is critical for improving winter survival and ensuring successful growth.

This study evaluates the performance of winter peas planted on four different dates over three years (2022–2024) to assess the impact of planting date and variety on winter survival, biomass production, and grain yield. Field trials were conducted on Certified Organic land at the Carrington Research Extension Center (CREC). Four winter pea varieties, Blaze, Icicle, Windham, and WyoWinter, were sown on four planting dates: mid-September (PD1), late-September (PD2), early October (PD3), and mid-October (PD4). The experimental design was a randomized complete block with four replications. Data collected included fall and spring stand percentages, flowering days, aboveground biomass yield in 2022, and grain yield in 2023. Due to extreme winter conditions, all plant stands were lost in 2024, preventing data collection for that year.

The study highlights the complex interaction between planting date, variety selection, and winter conditions in determining winter pea performance in the Northern Plains (Table 1). Under extreme winter conditions, all varieties experienced winterkill, as evidenced by the total crop failure in the open winter of 2024, regardless of planting date. However, in milder winters, winter survival varied with planting date and variety. Late-September (PD2) and early October (PD3) planting dates generally resulted in better fall establishment and winter survival, with WyoWinter and Blaze showing better overall adaptability. Late planting (PD4) demonstrated potential when seeds emerged in the spring, as observed in 2022, where spring-emerged Blaze and WyoWinter varieties produced measurable biomass, indicating resilience to delayed emergence. However, when peas at PD4 emerged in the fall, as in 2023, they experienced lower survival rates and greater yield variability compared to earlier planting dates.

September-planted winter peas in November of 2023.

Table 1. Planting date and variety effect on pea winter survival, biomass and grain yield.

		2022				2023		
Planting Date	Variety	Fall Stand	Spring Stand	Flowering	Biomass	Flowering	Maturity	Grain Yield
		%	%	date	lb/a	days	days	bu/a
1	Blaze	91.3	1.3	--	0	6/5	202.8	24.51
2	Blaze	94.3	56.3	6/14	732	6/6	203.5	27.48
3	Blaze	88.8	25.0	6/16	272	6/10	205.8	33.15
4	Blaze	--	56.3	6/17	1005	6/10	206.0	8.80
1	Icicle	2.0	0.0	--	0	6/8	205.8	34.43
2	Icicle	13.5	0.0	--	0	6/6	204.0	17.04
3	Icicle	10.0	0.0	--	0	6/7	206.0	30.69
4	Icicle	--	1.5	--	0	6/11	204.3	17.98
1	Windham	3.8	0.0	--	0	6/5	204.3	18.72
2	Windham	50.0	7.5	6/13	348	6/8	205.3	33.88
3	Windham	40.0	0.5	--	0	6/8	203.3	29.83
4	Windham	--	10.0	--	0	6/11	208.5	26.90
1	WyoWinter	88.8	0.0	--	0	6/5	204.5	25.45
2	WyoWinter	97.3	6.8	6/15	495	6/5	205.3	27.82
3	WyoWinter	94.5	0.0	--	0	6/8	204.5	19.28
4	WyoWinter	--	34.3	6/17	761	6/10	208.3	27.64
Mean		42.1	12.5	6/15	255.8	6/8	205.1	25.2
C.V. (%)		22.5	99.1	1.1	168.7	0.7	0.8	25.3
Planting Date (PD)		<.0001	<.0001	0.2924	0.0025	<.0001	0.002	0.0069
Variety (V)		<.0001	<.0001	0.7389	0.0022	0.0063	0.24	0.407
PD x V		<.0001	<.0004	0.911	0.1384	<.0001	0.0015	<.0001

In favorable years, such as 2023, PD3 proved to be the most productive planting date, with Blaze and Icicle achieving the highest grain yields. However, Icicle demonstrated poor winter survival followed by Windham. Overall, PD2 and PD3 were the most reliable planting dates for winter peas, with Blaze and WyoWinter emerging as the relatively consistent variety across all planting dates. These findings emphasize the importance of optimizing planting time and variety selection while exploring strategies to maximize the potential of spring-emerging systems. Further research is needed to develop even more winter-hardy cultivars to mitigate the risk of winterkill and improve the resilience of winter peas in extreme weather conditions.

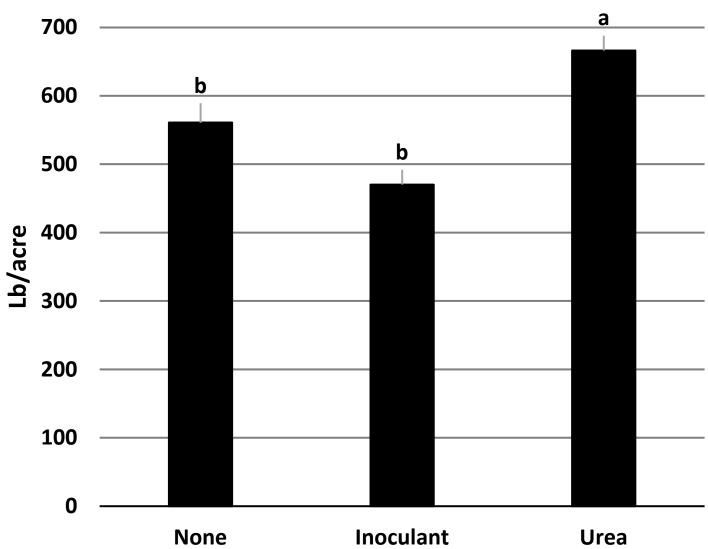
Profitability Impact of Urea Application or Inoculant on Dry Bean Yield at Wishek, ND

Agustin San Pedro Sanchez and Kristin Simons

Dry beans are a significant crop in North Dakota, contributing to both the state's agricultural economy and food production. As one of the top producers of dry beans in the United States, North Dakota's farmers face constant challenges to improve yield and profitability while managing production costs. Fertilization, particularly nitrogen application, plays a crucial role in optimizing crop growth, but the appropriate nitrogen rate for dry beans remains a subject of ongoing research and is producer dependent (Franzen, 2023). Additionally, the use of rhizobium inoculants has been shown to help dry beans fix nitrogen from the atmosphere, potentially reducing the need for synthetic fertilizers.

A demonstration was conducted in Wishek, North Dakota, where the effects of supplemental N and inoculation on dry bean yield were shown using ND Palomino. The demonstration aimed to show crop performance differences under each treatment and their effect on profitability. Three treatments were included in the demonstration: no inoculant or supplemental N (control), inoculant only, and supplemental N (urea at 73 lbs/acre). The demonstration was planted on June 5, 2024, in strips and each treatment was present twice. Urea was hand applied to the treatment area just prior to planting. Seed was inoculated with *Rhizobium leguminosarum biovar phaseoli* the day of planting. Nineteen feet of each treatment strip were hand harvested when the plants were physiologically mature at the end of September to eliminate seed loss due to shattering. After drying, seed was threshed and weighed.

The results from the demonstration trial showed the urea application treatment resulted in the highest yield of 666 lbs/acre (Figure 1) and was significantly higher than either the control or the inoculated yields. No significant differences were observed between the control and inoculated treatment yields. Profitability changes are determined by the urea price and grain market price.



Dry bean yield response to fertilization. Bars with different letters are statistically different at alpha = 0.10.

Dry beans grown under no-till management near Wishek, ND.

A simplified look at change in profitability was calculated based on treatment cost and yield differences. Urea was purchased at $510/ton and inoculant was $14/75 oz bag. Harvested seed was sold at $31/cwt. Based on these input costs and market price, the application of supplemental N would have increased dry bean profitability by $10 per acre (Table 1).

Table 1. Profitability impact of urea application or inoculant on dry bean.

Treatment	Treatment Cost	Gross Income Change	Treatment Profitability Change
	$/a	$/a	$/a
Control	$ -	$ -	$ -
Inoculant: Rhizobium leguminosarum biovar phaseoli	$ 2.00	$ (28.10)	$ (30.10)
Supplemental N: 73 lb/a urea	$ 22.30	$ 32.66	$ 10.36

In conclusion, the supplemental N application treatment proved to offer the highest return on investment during the 2024 environmental conditions at Wishek, ND. For this demonstration, only a limited amount of the trial was harvested. Thus, testing again at Wishek is needed to make recommendations on inoculants and supplemental N. Future studies could explore the long-term effects of these treatments on soil health, investigate optimal nitrogen rates for dry beans in similar soil conditions, and evaluate the potential benefits of combining urea with rhizobium inoculants to further improve both yield and sustainability.

Franzen, D. W. (2023). *Fertilizing Pinto, Navy and Other Dry Edible Bean (SF720).* NDSU Extension.

Summary: Timing of Cover Crop Establishment in Spring Cereals

Ezra Aberle

Interest in planting cover crops has recently increased in North Dakota. The traditional method for seeding is to do so after a cereal grain crop. However, with our short growing season, the window to successfully establish a fall cover crop is limited. Most years, adequate moisture for germination is available for only 1 to 2 days after harvesting the small grain crop. If seeding later than this, germination of the cover crop is determined by the next adequate rainfall event, which may be days or weeks after harvest. Delayed germination drastically reduces the amount of biomass produced by the cover crop. Because labor is likely in short supply for most farms, combining and seeding at the same time can be challenging. This led us to ask the question: Where are the opportunities within the growing season to successfully establish a cover crop without impacting grain yield of the cash crop and not significantly increase production costs?

A small trial was conducted at the CREC as well as the Langdon, North Central (Minot), and Hettinger RECs, and at the Oakes Irrigation Site from 2015-2018 using barley as the cereal. The trial was continued at the CREC for an additional five years using HRSW as the cereal with the additional treatment of drilling at the 4-5 leaf stage.

The cover crop treatments were all one mixture of turnips, radishes, lentils, and flax planted into or after barley (2015-2017) or HRSW (2018-2022) as follows:

- Check (no cover crop seeded)
- At seeding with the drill (down the same seed tubes as the cereal)
- 4-5 leaf barley (herbicide application timing, broadcast applied)
- 4-5 leaf barley with the drill (only at the CREC)
- Anthesis (fungicide application timing)
- After harvest with a drill (traditional timing and method)

Table 1 shows the combined results from the three locations that were not severely impacted by drought and produced a harvestable grain crop: Carrington, Langdon, and North Central (Minot).

- In 2015, sufficient timely rains occurred after each cover crop seeding timing therefore all of the before harvest seeding timings produced significantly more biomass than the check and after harvest treatments.
- In 2016, there was an early dry spring with little significant rainfall after barley seeding. Despite that, a good barley crop was raised due to adequate subsoil moisture. However, the lack of rain impacted cover crop establishment and growth of all timings with none being significantly better than others.
- In 2017, again there was little significant rainfall after seeding, but there was adequate moisture close to the surface at the time of seeding to successfully establish the cover crop and then raise a respectable grain crop.

Table 1. Barley performance and cover crop production across locations from 2015 to 2017 based on various cover crop establishment timings.

Year	Treatment	Test Weight	Protein	Grain Yield	Biomass Total
		lb/b	%	bu/a	lb/a
2015	Check (no covercrop)	50.9	12.4	82.4	1797
2015	At seeding	50.7	12.2	87.8	2606
2015	4-5 leaf (broadcast)	51.4	12.2	81.4	3431
2015	Anthesis (fungicide timing)	51.4	12.4	81.6	2499
2015	After harvest	51.1	12.3	84.3	1871
2016	Check (no covercrop)	49.6	11.5	109.4	944
2016	At seeding	49.8	12.9	115.8	1061
2016	4-5 leaf (broadcast)	49.7	12.5	116.8	833
2016	Anthesis (fungicide timing)	49.8	12	111.7	982
2016	After harvest	49.9	12.4	107.5	1258
2017	Check (no covercrop)	47.4	11.5	92.4	868
2017	At seeding	46.4	11.9	86.1	1816
2017	4-5 leaf (broadcast)	47.2	11.7	87.6	1308
2017	Anthesis (fungicide timing)	47.2	11.5	90.2	1398
2017	After harvest	46.6	11.6	85.7	1188
Trial Mean		49.3	12.1	94.7	1591
C.V. (%)		1.8	3.2	10.6	40
LSD (0.05)		NS	NS	NS	660

Table 2 shows the combined results from additional years at the CREC with HRSW as the cereal crop.

- The year 2018 started out dry in April, followed by below-average precipitation in May, above-average precipitation in June, and below normal, but timely, precipitation the remainder of the growing season. A good grain crop and biomass were produced on adequate subsoil moisture. The two drilled treatments produced significantly more biomass than the check and other treatments.

- 2019 also had below-average precipitation in April and May, which was followed by above-average precipitation in June and July. The three early-season treatments produced significantly more biomass than the check, anthesis, and harvest treatments.
- 2020 rainfall was well below average for the entire season with the exception of July. Again, two drilled treatments produced significantly more biomass than the check and other treatments.
- 2021 also had little significant rainfall after seeding. This lack of rain impacted grain yield and cover crop establishment with no treatments being significantly higher than others.
- In 2022, April and May had rainfall amounts that were well above average, followed by well below normal precipitation the remainder of the growing season. The 'at seeding' treatment produced significantly more biomass than the check and after harvest planting.

Cover crop mix seeded with the cereal crop.

Table 2. Spring wheat performance and cover crop production at CREC from 2018 to 2022 based on various cover crop establishment timings.

Year		Test Weight	Protein	Grain Yield	Biomass Total
		lb/bu	%	bu/a	lb/a
2018	Check (no covercrop)	64.9	13.0	50.7	1963
2018	At seeding	65.1	13.2	51.1	2346
2018	4-5 leaf (broadcast)	64.7	13.6	50.3	1925
2018	4-5 leaf (drilled)	64.4	13.1	50.6	2315
2018	Anthesis (fungicide timing)	64.0	13.2	50.7	2113
2018	After harvest	65.4	13.4	50.2	1968
2019	Check (no covercrop)	58.4	15.3	20.4	752
2019	At seeding	58.6	15.7	15.2	1177
2019	4-5 leaf (broadcast)	58.3	16.3	21.8	1019
2019	4-5 leaf (drilled)	58.5	15.6	19.9	1195
2018	Anthesis (fungicide timing)	59.1	15.5	20.5	928
2019	After harvest	58.3	15.3	20.7	909
2020	Check (no covercrop)	58.3	15.7	22.1	726
2020	At seeding	58.7	16.1	22.1	1167
2020	4-5 leaf (broadcast)	59.6	16.1	21.9	1009
2020	4-5 leaf (drilled)	57.4	15.8	22.8	1279
2020	Anthesis (fungicide timing)	58.1	15.6	22.1	932
2020	After harvest	59.2	16.0	24.1	942
2021	Check (no covercrop)	64.6	15.8	15.2	211
2021	At seeding	64.9	15.7	15.2	247
2021	4-5 leaf (broadcast)	64.6	15.6	15.3	231
2021	4-5 leaf (drilled)	64.8	15.8	13.3	305
2021	Anthesis (fungicide timing)	64.6	15.6	13.9	249
2021	After harvest	64.7	15.7	12.5	222
2022	Check (no covercrop)	62.3	13.8	23.3	390
2022	At seeding	65.8	13.5	27.5	613
2022	4-5 leaf (broadcast)	65.4	13.5	25.8	494
2022	4-5 leaf (drilled)	66.0	13.6	24.5	480
2022	Anthesis (fungicide timing)	66.1	13.4	27.6	464
2022	After harvest	64.8	13.5	25.2	396
Trial Mean		62.3	14.8	26.6	965
C.V. (%)		2.0	3.2	9.7	19
LSD (0.05)		NS	NS	NS	212

In summary, these practices should be utilized in relatively weed-free fields to be successful, as the herbicide program may be limited by most of these treatments. It is important to note that none of the treatments had a negative impact on the first-year cereal production. Also, none of these treatments had a statistically significant positive or negative impact on the following years HRSW crop. Research conducted on campus has shown that in conventionally-tilled soil the nitrogen benefits of these cover crops haven't been seen in season or the following season. Ideally, this experiment would have been paired with no-till sites to determine if these treatments behave differently in no-till environments.

Hard Red Spring Wheat Variety Performance, Griggs County, 2024

Jeff Stachler

A large-plot hard red spring wheat (HRSW) variety trial was established about 9 miles northeast of Cooperstown in Griggs County to evaluate five varieties. TCG Wildcat, as a long-term trial entry and WB9590, as a widely grown variety in the county, were included to compare to three new varieties. A limited number of varieties were chosen for this trial due to the large-plot size of 30 feet wide by 300 feet in length and to encourage farmers to conduct their own variety trials. The goal of this research trial was to learn how selected HRSW varieties perform locally. In addition, a field day was conducted for area farmers and crop advisers to learn about the varieties and provide information on maximizing HRSW production.

The trial was established as a randomized complete block design with each variety replicated three times. The trial was planted May 11, 2024, with a John Deere 750 drill at a seeding rate of 114 pounds per acre.

Huskie Complete (13.7 fluid ounces per acre) plus Pixxaro EC (6 fluid ounces per acre) plus Lamcap II (2.0 fluid ounces per acre) plus Priaxor (2.0 fluid ounces per acre) plus Interlock (4 fluid ounces per acre) were applied as a tank mixture June 17. Miravis Ace (13.7 fluid ounces per acre) plus Lamcap II (2 fluid ounces per acre) plus Masterlock (6.4 fluid ounces per acre) was applied July 9. Plant development notes taken July 7 showed ND Stampede, WB9590 and TCG Zelda having over 93% of plants fully headed with WB9590 starting to flower and TCG Wildcat and Ascend-SD having about 60% and 25%, respectively, of plants fully headed. Plant lodging was determined by looking at each plot and determining the percentage of plants having fallen over. The trial was harvested September 3 with a John Deere S790 combine with a draper header. Wheat samples from each plot were analyzed at Central Plains Ag Services (Hannaford) for dockage, test weight, moisture, protein, and falling numbers. Additional samples were submitted to North Dakota Grain Inspection to measure vomitoxin level and seed damage.

Profit was calculated by using the cash price for milling quality HRSW at Central Plains Ag Services in Hannaford at harvest and multiplying by the yield. Since protein content was above 14% for all plots, a premium of $0.12 per 0.2% was added to the profit. Discounts for falling numbers were subtracted from the profit based upon a $0.05 per bushel discount for falling numbers below 300 seconds making it terminal wheat plus additional discounts for falling numbers in ranges below 300. Discount was applied for kernel damage at $0.04 per bushel between 0.9 and 5% kernel damage.

TCG Zelda and ND Stampede had the greatest yield (Table). TCG Wildcat and TCG Zelda had similar profit. TCG Wildcat had a three-year (2021 and 2023-24) average yield of 78.9 bu/a compared to the trial average among the three years of 75.8 bu/a.

Hard Red Spring Wheat									Griggs County
Variety	Stand Count	Stem Count	Plant Height	Plants Lodged	Reduced Plant Height	Root Rot	Ergot	FHB	Vomitoxin
	June 1	----August 3 ----		--September 3 --		----August 3 ----			
	plants/a	plants/a	inches	%	%	%	%	%	ppm
Ascend-SD	1,340,680	3,591,280	38.1	82	33	7.5	0.11	8.3	0.5
ND Stampede	1,181,930	4,359,870	35.9	98	77	6	0	11.1	0.5
TCG Wildcat	1,273,890	4,071,410	35.8	95	50	6.3	0.43	14.9	0.5
TCG Zelda	1,226,460	4,505,070	32.8	95	58	8.5	0.88	20.8	0.5
WB 9590	1,033,820	3,771,330	30.7	92	62	10.1	0.81	17.4	0.5
C.V. (%)	6.5	8.3	1.1	7.7	14.4	48.9	105.8	33.2	0.0
LSD (0.10)	120,040	508,500	0.6	NS	12	NS	NS	7.3	NS

Planting Date = May 11; Harvest = September 3; Previous Crop = Soybean

Hard Red Spring Wheat								Griggs County
Variety	Protein	Falling Numbers	Test Weight	Dockage	Damage	Moisture	Yield	Profit
	%	seconds	lb/bu	%	%	%	bu/a	$/a
Ascend-SD	15.3	279	61.2	1.2	0.97	13.3	91	512
ND Stampede	14.6	231	61.4	1	2.83	13.5	105	517
TCG Wildcat	15	345	61	1.3	0.83	13.6	102	609
TCG Zelda	14.5	307	61.7	1.2	1.9	13.6	106	588
WB 9590	15	293	60.3	1.1	1.6	13.4	92	534
C.V. (%)	1.5	6.7	0.6	12.1	65.9	0.7	2.0	6.7
LSD (0.10)	0.3	30	0.5	NS	NS	0.1	3	57

Planting Date = May 11; Harvest = September 3; Previous Crop = Soybean

Prior to harvest, percentage of reduced plant height due to lodging was evaluated and compared to August 3 plant height, with Ascend-SD having the least reduced plant height. WB9590 had the shortest plants and Ascend-SD had the tallest plants. Ascend-SD had the highest protein content. TCG Zelda and ND Stampede had the highest and similar test weight. Also prior to harvest, kernel shatter was very minimal and similar among varieties (data not shown).

TCG Zelda had the greatest percentage of plants (20.8%) having at least one spikelet with FHB and Ascend-SD had the lowest percentage of plants (8.3%) having at least one spikelet with FHB. Despite the presence of plants having FHB, the Miravis Ace application was timely since all samples of every variety only had 0.5 ppm of vomitoxin.

Only TCG Wildcat and TCG Zelda had falling numbers greater than 300 seconds with ND-Stampede having the lowest falling numbers.

The implications of this trial are the new HRS wheat varieties TCG Zelda and ND Stampede produced similar seed yield above the standard TCG Wildcat variety. However, in years when falling numbers become an issue, Ascend-SD, ND Stampede, and WB9590 can cause a reduction in profit. Timely fungicide applications at flowering can reduce the quantity of vomitoxin despite the presence of FHB. Farmers have the opportunity to conduct their own large-plot, replicated variety trials to compare newer varieties to previously planted varieties on their own farm to determine those potentially most profitable.

Soybean Response to Mid-Row Deep Banded Phosphorus at Planting

Jeff Stachler

NDSU Extension soybean fertility recommendations indicate phosphorus (P) fertilizer should be applied to low- or very low-P testing soils (Olsen P soil test at 7 ppm or less). This trial was conducted to measure response of soybean seed yield to a mid-row deep band application of monoammonium phosphate (MAP; 11-52-0) at planting in a low-P testing soil.

Peterson Farms Seed variety 24XF04 was planted May 22, 2024, with a John Deere 1895 dual placement drill in 20-inch rows following soybean. MAP fertilizer was applied as a mid-row deep band (4- to 5-inch depth) at 30.2 pounds P per acre.

Plot size was 80 feet wide (two planter swaths) by 300 feet in length with randomized complete block design having three replications.

The average Olsen P soil test values at planting for the untreated check was 6.0 ppm, and P treatment was 6.7 ppm. At harvest, soil P test value for the untreated check was 4.3 ppm, and P treatment was 5.0 ppm. These soil test values are statistically similar at each sampling time.

Soybeans were harvested October 29.

Soybean profit was calculated by multiplying yield by $8.85 per bushel cash price on October 29 in Cooperstown and subtracted $23.20 for cost of the MAP in the P treatment.

Mid-row deep band application of MAP at planting did not influence soybean stand and height (Table 1). Despite the low soil P levels at planting plus early season cold and wet soils, soybean seed yield, test weight, moisture and dockage were similar among treatments. In addition, soybean profit was similar.

Table 1. Soybean response to mid-row deep banded phosphorus at planting.

Treatment	Stand Count	Plant Height	Moisture	Dockage	Test Weight	Yield	Profit[1]
	-----July 4 -----						
	plants/a	inches	%	%	lb/bu	bu/a	$/a
Untreated check	178,240	4.7	11.3	0.6	56.7	43.7	387
11-52-0[2]	182,590	4.9	11.3	0.6	56.4	46.1	384
C.V. (%)	4.8	3	0.7	12.6	0.5	3.1	3.2
LSD 0.1	NS	NS	NS	NS	NS	NS	NS

Planting Date = May 22; Harvest Date = October 29; Previous Crop = Soybean

[1]Profit = $8.85/bu X yield - $23.20/a for MAP

[2]MAP applied as mid-row deep band at planting

Concrete vs. Dirt Feedlot Pens: The Effects in Temperature and Evening Animal Behavior on Finishing Yearlings

Colin Tobin and Madison Bierman

Feedlot cattle that are fed in open yard lots during the summer are subject to a variety of environments which include periods of hot climatic conditions (Hahn and Mader, 1997; Mader et al., 1999b). North Dakota has a continental climate which brings average summer temperatures up to 85°F. Periods consisting of high temperature, relative humidity, and solar radiation with low wind speeds can increase heat load placed on the animal. Reduced performance, decreased comfort, and death can result due to extreme heat load (Mader et al., 1997, 1999a.; Hubbard et al., 1999).

The objective of this study was to determine if temperature differences in pen types (concrete vs. dirt) influenced cattle behavior, growth performance, and carcass characteristics. Data was collected using temperature loggers placed in pen surfaces and accelerometers fixed to ear tags. Our hypothesis was cattle fed in a concrete-surface lot would be subject to greater evening heat loads compared to those on dirt surfaces.

Materials and Methods

All procedures involving the use of animals in this experiment were approved by the North Dakota State University Institutional Animal Care and Use Committee. The experiment was conducted at the North Dakota State University Carrington Research Extension Center (CREC) located near Carrington, ND.

Experimental Design and Treatments

Three treatments were used in this completely randomized design study to evaluate animals' times of activity/inactivity, growth performance, and carcass characteristics relative to pen temperature. The treatments were dirt pens (DIRT) and concrete (CONC). All pens were fed a basal diet consisting of 49% dry-rolled corn, 24% dry-rolled barley, 14% modified distillers grains plus solubles, 6% corn silage, 4% small grain straw, and 3% dry supplement.

Animals, Initial Processing, Study Initiation

Fifty-four black angus steers (920 ± 96 lbs, initial body weight [BW]) were delivered to the CREC, weighed, randomly assigned to treatment (concrete or dirt surface lot), and assigned to one of three treatment lots (n = 6 [9 steers/pen]). Twenty-four Axivity AX-3 tri-axial accelerometers (Axivity Ltd, Newcastle, UK), fitted to Allflex ear tags, were placed on four randomly selected steers. The axes corresponded to z - front-to-back, y - side-to-side and x - vertical. The accelerometers were configured to a sample rate of 12.5 Hz.

Temperature loggers (IButton DS1925-F5; IButtonLink, LLC, Whitewater, WI) were placed within the pen surface material. Pen surface temperatures were logged every 15 minutes from June 27 to October 10, 2023. Temperatures were aggregated to 1-hour epochs and further averaged into eight 3-hour periods throughout the day. Time period 6 (6:00 p.m. - 9:00 p.m.) was analyzed using the mixed procedure of SAS 9.4 (SAS Institute Inc., NC, USA).

A training and validation dataset were created from accelerometer data and observed animal behaviors. These datasets were used in a Random Forest machine learning prediction model. The calculated metrics used to create the training and validation datasets include movement intensity (MI), signal magnitude area (SMA), energy, entropy, and movement variation (MV). Of the 59,595 recorded behavior observations, 47,676 random observations (80%) were used as the training dataset and all datapoints were utilized as the validation dataset. The Random Forest model was then applied to the total 4,147,200 1-minute epochs to create inactive/active behavior predictions for all 24 animals fitted with accelerometers. Minutes of active behavior were averaged by pen. To coincide with any potential changes in pen temperature, minutes of activity were analyzed during time period 6.

The initial Random Forest model utilized three observed behaviors (laying, standing, and feeding) for prediction. Standing was usually predicted as laying. We merged the two inactive observed behaviors (laying and standing) into inactive to create a binary classification model of active or inactive. The training dataset predicted the active and inactive behavior 87.3% and 95.9% correctly, respectively. The Random Forest model predicted 93.7% of the overall observed dataset.

The monthly average of growth performance (weight, average daily gain (ADG), dry matter intake (DMI), and gain to feed (G:F)) were analyzed using the repeated measures procedure of PROC MIXED in SAS 9.4 (SAS Inst Inc., Cary, NC; Littell et al., 2006) with pen serving as the experimental unit.

Results

There were no detectable differences in minutes of activity due to lot surface type ($P > 0.05$; Table 1) throughout the study. There were no detectable differences in pen surface temperature at time period 6 (6:00 p.m. - 9:00 p.m.) ($P > 0.05$; Table 1) throughout the study. There were no detectable differences in animal growth performance or carcass characteristics ($P > 0.05$; Table 1).

Table 1. Main treatment effects of surface temperature and minutes of activity due to surface type treatments.

	Pen Surface Treatment			
	DIRT	CONC	SEM	*P* - value
Pen Surface Temperature, °C	16.7	16.8	0.275	0.88
Minutes of Activity, min	19.9	17.5	1.05	0.19
Weight gain, lbs	504	539	18.56	0.26
Average daily gain, lbs	4.1	4.4	0.15	0.21
Hot carcass weight, lbs	906	918	15.01	0.61
Dressing Percentage, %	63	63.7	0.1	0.37
Yield Grade	3.77	3.8	0.14	0.85
Back Fat, in	0.71	0.72	0.05	0.86
REA, in^2	13.6	13.7	0.21	0.7
Marbling Score	604	612	29.6	0.85

The use of concrete did not increase surface temperatures during the late afternoon/early evening period of the day. Having no detectable differences, both lot surfaces allow accumulated heat to be dissipated through the ground similarly, helping animals tolerate warmer and more humid afternoon temperatures.

The research was partially funded by the North Dakota State Board of Agriculture Research and Education (SBARE) Animal Agriculture Committee.

Performance in Feedlot Calves is Influenced by Cow Herd – 2024 ND Angus University Feedout

Karl Hoppe and Colin Tobin

The North Dakota Angus University Feedout program is a summer, retained-ownership project where cattle producers raising spring-born Black Angus cattle can learn more about the feeding performance, carcass characteristics and profitability of their yearling steers.

Through involvement in this calf value discovery program, cow-calf producers raising Black Angus calves can benchmark performance and identify superior genetics when fed with common feedlot management.

Calves (97 head) were received in groups ranging from 2 to 39 head from seven owners prior to June 13, 2024. Upon delivery to the Carrington Research Extension Center Livestock Unit, calves were weighed, tagged, and veterinary-processed.

Calves were penned by owner and later comingled. Calves were provided a corn-based receiving diet. After a 10-day ration adaption, 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 implanted with Synovex-Choice.

Cattle were harvested in two groups. The first group of cattle was harvested on October 16, 2024 (47 head) and the second group was harvested on November 1, 2024, (48 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.

Consigned cattle averaged 899.7 pounds upon delivery to the Carrington Research Extension Center Livestock Unit on June 13, 2024. After an average 133-day feeding period, cattle averaged 1,472.0 pounds (at plant, shrunk weight). Death loss was 2.06 percent (2 head) during the feeding period.

Calves were priced at $273.00 per hundred weight upon delivery to the feedlot.

Overall, the carcasses contained U.S. Department of Agriculture Quality Grades at 18.9 percent Prime, 77.9 percent Choice (including 50.5 percent Certified Angus Beef), 2.1 percent Select, 0 percent no roll and 1.1 percent 'other'. USDA Yield Grades for the carcasses were 9.4 percent YG2, 68.1 percent YG3, 21.0 percent YG4 and 2.1 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 October 16, 2024 was $295.97 base with premiums: Prime $25, CAB $6, Choice $6.751, YG2 $3, and discounts: Select $8.25 YG4 $8.00, YG5 $20 and carcasses greater than 1075 pounds $20. The grid price received for November 1, 2024 was $298.89 base with similar premiums and discounts except for Choice $10.35, Select $12.65, YG4 $12.65/cwt and other at $55.

Feeding results from the calves by owner are listed in Table 1.

Table 1. Feeding results for ND Angus University feedout calves, 2024.

Herd	Average In Weight	Average Out Weight	Average Daily Gain	Average Backfat	Average Ribeye Area	Average Marbling Score	Quality Grade Prime Carcass	Quality Grade CAB Carcass	Average Carcass Value
	lbs	lbs	lbs	inches	$inch^2$		%	%	per head
1	892.2	1488.6	4.69	0.67	13.4	608.2	23.1%	56.4%	$ 2,866.82
2	953.5	1531.8	4.49	0.59	14.6	584.2	11.1%	77.7%	$ 2,858.20
3	934.0	1462.4	4.30	0.60	13.5	488.0	0.0%	40.0%	$ 2,774.62
4	976.1	1512.1	4.32	0.63	13.7	637.4	43.7%	37.5%	$ 2,980.66
5	848.1	1448.1	4.89	0.65	13.4	543.1	4.7%	42.8%	$ 2,809.68
6	878.0	1469.5	4.61	0.51	13.7	422.0	0.0%	0.0%	$ 2,873.81
7	816.0	1391.8	4.44	0.55	13.6	566.0	0.0%	66.6%	$ 2,758.92
overall	899.7	1472.0	4.5	0.60	13.7	549.8	11.8%	45.9%	$ 2,846.10

The top dollar grossing pen of calves returned $2980.66 per head, while the bottom pen returned $2758.92 per head including death loss. The spread between the top profit pen and the lowest profit pen was $221.74 per head. This spread was mostly attributed to higher percent prime quality grade in the higher grossing herd.

Yearling Angus steer performance varied between owners. Average daily gain (pounds per head) was 4.53 with a range between owners of 4.30 to 4.89.

Feedout projects provide cattle producers an opportunity to learn about feedlot performance, individual carcass differences, and discover cattle value.

Black Angus-influenced cattle fed to finish at the CREC Livestock Unit.

Producers Find Value in Feeding Calves to Finish: Dakota Feeder Calf Show Feedout 2023-2024

Karl Hoppe and Colin Tobin

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 to consign steer calves to a show and feedout project. The calves were received in groups of three or four on October 21, 2023, at the Turtle Lake Weighing Station, Turtle Lake, N.D., for weighing, tagging, veterinary processing, and display. The number of cattle consigned was 95, of which 82 competed in the pen-of-three contest.

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

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 reimplanted with Synovex-Choice on February 15, 2024.

The cattle were harvested on May 31, 2024 (95 head). The cattle were sold to Tyson Fresh Meats, Dakota City, Neb., 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 597.9 pounds upon delivery to the Carrington Research Extension Center Livestock Unit on October 21, 2023. After an average 222-day feeding period, cattle averaged 1,342.3 pounds (at plant, shrunk weight). No deaths occurred during the feeding period.

Average daily feed intake per head was 29.4 pounds on an as-fed basis and 21.8 pounds on a dry-matter basis. Pounds of feed required per pound of gain were 8.77 on an as-fed basis and 6.51 pounds on a dry-matter basis.

The overall feed cost per pound of gain was $0.712. The overall yardage cost per pound of gain was $0.119. The combined cost per pound of gain, including feed, yardage, veterinary, trucking and other expenses except interest, was $1.020.

Overall, the carcasses contained U.S. Department of Agriculture Quality Grades at 4.2% Prime, 85.2% Choice (including 25.3% Certified Angus Beef), and 9.4% Select and 1.1% ungraded, and USDA Yield Grades at 6.3% YG1, 30.5% YG2, 51.6% YG3, and 11.6% YG4.

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 May 31, 2024, was $305.91 Choice YG3 base with premiums: Prime $25, CAB $6, YG1 $6.50 and YG2 $3, and discounts: Select minus $12, Standard (ungraded - no roll) minus $15, YG4 minus $8, and carcasses heavier than 1075 pounds or lighter than 650 pounds minus $20.

The top-profit pen-of-three calves with superior genetics returned $338.15 per head, while the bottom pen-of-three calves returned $14.30 per head. The average of the five top-scoring pens of steers averaged $310.76 per head, while the average of the bottom five scoring pens of steers was $104.87 per head.

For the pen-of-three competition, average profit was $228.66 per head. The spread in profitability between the top and bottom five herds was $205.89 per head.

Table 1. Feeding performance - 2023-2024 Dakota Feeder Calf Show Feedout.								
Pen of three	Best Three Score Total	Average Birth Date	Average Weight per Day of Age	Average Harvest Weight	Average Daily Gain	Average Marbling Score (1)	Avg. Calculated Yield Grade	Avg. Feeding Profit or Loss
			lbs.	lbs.	lbs.			$/head
1	2.6693	24-Feb-23	3.04	1392.8	3.59	657.7	3.12	307.52
2	2.5229	2-Apr-23	3.46	1464.4	3.84	536.7	3.09	315.74
3	2.4768	27-Mar-23	3.36	1438.9	3.65	599.0	3.25	276.09
4	2.4753	18-Mar-23	3.11	1364.1	3.60	689.7	4.17	338.15
5	2.4740	27-Mar-23	3.20	1370.5	3.43	610.0	3.34	316.28
Average Top 5 Herds	2.52	20-Mar-23	3.2	1406	3.6	619	3.39	$ 310.76
6	2.2560	8-Mar-23	3.45	1545.6	3.86	511.3	3.93	332.24
7	2.2499	27-Mar-23	3.02	1295.7	3.37	468.0	2.40	199.00
8	2.1691	31-Mar-23	3.42	1451.7	3.67	506.7	3.68	278.19
9	2.1152	4-Mar-23	3.06	1381.6	3.42	544.3	3.83	271.86
10	2.0682	5-Apr-23	3.30	1386.4	3.54	497.0	3.72	259.89
11	2.0625	28-Apr-23	3.25	1287.7	3.40	451.7	2.73	161.72
12	2.0472	11-Mar-23	3.07	1364.1	3.52	508.0	3.49	199.76
13	2.0255	23-Mar-23	3.44	1488.3	3.53	470.3	4.05	324.48
14	2.0104	28-Mar-23	3.39	1450.1	3.53	471.0	3.61	239.37
15	1.9268	16-Apr-23	3.20	1308.4	3.36	416.0	2.91	162.98
16	1.9223	7-May-23	3.28	1271.8	3.38	493.3	3.22	121.61
17	1.8142	19-Mar-23	2.94	1284.5	3.17	419.7	2.75	99.56
18	1.6814	3-Apr-23	2.97	1249.5	3.16	386.3	2.46	14.30
19	1.6555	21-Apr-23	3.20	1289.3	3.39	483.0	4.07	125.88
Average Bottom 5 herds	1.80	13-Apr-23	3.1	1281	3.3	440	3.08	$ 104.87
Overall Average Pens of Three	2.14	29-Mar-23	3.22	1,372.92	3.49	511.56	3.36	$ 228.66
Standard deviation		18.4	0.2	83.8	0.2	80.1	0.5	93.2
number		19	19	19	19	19	19	19

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

Favorable average daily gains, weight per day of age, harvest weight and marbling score can be found in North Dakota beef herds. 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.

Dakota Feeder Calf Show calves enjoying a nice winter.

From Waste to Worth; Creating an Opportunity Out of a Disaster

Mary Keena and Miranda Meehan

North Dakota poultry owners, both backyard and commercial, have been impacted by the ongoing 2022 Highly Pathogenic Avian Influenza (HPAI) outbreak. Avian Influenza is caused by influenza type A virus which can infect poultry such as chickens, turkeys, quail, domestic ducks, geese, guinea fowl and wild birds. There are two types of this virus: 1) Highly Pathogenic Avian Influenza (HPAI), where virus strains are extremely infectious, often fatal to domestic poultry and can spread rapidly from flock to flock and 2) Low Pathogenicity Avian Influenza (LPAI) where virus strains occur naturally in wild migratory waterfowl and shorebirds without causing illness. LPAI can infect domestic poultry with little or no signs of illness. According to the USDA website, since the start of the outbreak on February 8, 2022, 112.41 million birds have been affected. HPAI has been detected in a total of 1,264 flocks in 49 states. Of those, 559 flocks have been commercial, and 705 flocks have been backyard. In North Dakota, 436,286 birds at 37 sites have been affected in 21 counties.

Responders to the HPAI outbreak include the North Dakota Department of Agriculture, North Dakota Department of Environmental Quality, USDA Animal and Plant Health Inspection Service (APHIS), North Dakota State University (NDSU) Veterinary Diagnostic Laboratory, NDSU Extension, county emergency managers and veterinarians. Many responders are new employees and were not involved in response efforts during the 2015 HPAI outbreak, including 62% of Extension agents. The lack of experience and knowledge resulted in a significant amount of time and effort spent determining the appropriate agencies to contact, defining agency roles, developing educational resources, and creating an awareness of biosecurity and procedures used in active cases. Additionally, limited attention was given to stress management or mental health and well-being during this period of heightened stress for personnel involved in response.

In 2024, NDSU Extension was awarded a USDA APHIS National Animal Disease Preparedness and Response Program grant totaling over $217,000 to train professionals to safely respond to an animal disease outbreak or mass livestock mortality. The trainings were held in person at the NDSU Carrington Research Extension Center (CREC) in June and September, 2024. Training topics included overview of animal diseases, continuity of business planning, personal protective equipment and decontamination, incident command systems, local response roles and impact assessment, humane endings, carcass disposal site selection and methods, stress management and responding to stressed people, effective communication in high stress situations and a response simulation exercise. The training format included classroom, group work, demonstration and hands on. Each participant received a kit that contained personal protective equipment.

A total of 65 professionals attended the trainings, including Extension agents and specialists, county emergency managers, veterinarians, veterinary technicians, brand inspectors and county public health officers. According to participants post-training evaluation, **100% indicated the training increased their confidence and improved their ability to respond** to an animal disease or mass livestock mortality. Additionally, **96% of participants planned to make changes to be better prepared** and better able to respond to animal diseases or mass livestock mortalities as a result of their participation in the training. Finally, **93% said the training improved their ability to provide support to individuals in high stress situations.** Six-month post-training evaluation data will be reported in the 2025 CREC Annual Report.

This training helped professionals develop skills and relationships that will enhance the ability to respond to future animal disease outbreaks and mass livestock mortalities, helping to reduce the spread of animal disease outbreaks and enhance continuity of business of livestock operations. This will help ensure that North Dakota's livestock industry is able to continue providing a safe and secure food supply to consumers.

Project team included: Mary Keena, Miranda Meehan, Ph.D., Carolyn Hammer, DVM, Ph.D., Heidi Pecoraro, DVM, Ph.D., DACVP, Sean Brotherson, Ph.D., Ethan Andress, DVM, Jodi Bruns, Adriana Drusini, Marty Haroldson, Angela Johnson, Margo Kunz, DVM, Julianne Racine, Karl Rockeman, P.E., Jan Stankiewicz, MS, MPH cert., Rachel Strommen, and Kent Theurer.

Special thank you to our support staff members, Myrna Friedt, Linda Schuster, Stephanie Sculthorp-Skrei and Lynne Voglewede as well as the NDSU Agriculture Communications department for all of the time and effort put into these trainings and materials.

Participants of the Animal Disease Response and Mass Livestock Mortality Training viewing the livestock composting demonstration mortality management area at the CREC.

Northern Hardy Fruit Evaluation Project – Orchard Update 2024
Kathy Wiederholt

The Northern Hardy Fruit Evaluation Project provided educational information to over 1,240 people in 2024 via video conference programs, tours, meetings and personal phone calls. Fifty-five people attended the Fruit Project Field Day tour to learn about the orchard and to learn about the growing problem of black rot disease of apples in North Dakota. Our speaker was Dr. Jim Walla, retired NDSU woody plant pathologist. In addition to North Dakota, we provided information to people in Idaho, Minnesota, Montana, South Dakota and Wisconsin.

Dr. Jim Walla discusses black rot of apples at CREC Field Day.

After an 11” snowfall in late October 2023 melted in a few weeks, the weather was generally mild and dry. We received only 27” more snow and temperatures were 7.2ºF warmer than normal for the winter. There was no snow when pruning started in early April. However, cool temperatures in May and especially June set the fruit crops back and delayed ripening later in summer.

This year was notable for the amount of rain we had across the state and at CREC. We recorded rain on 31 of 77 days in spring and 35 of 76 days in summer. It was difficult to keep up with insecticide applications in the orchard and the fruit quality suffered.

Spotted wing drosophila control began June 18 and continued through black currant harvest in August. Control was poor this year, probably due to humidity and frequent rain. Early coverage of currants to control of the currant fruit fly, *Euphranta canandensis* was successful again and the management program for currant borer, *Synanthedon tipuliformis*, seems successful. Few canes were affected at pruning and plants appeared healthy.

Notable events in the orchard:

- The last new planting of Japanese haskap had fruit this year. Approximately seven selections had too many fruit losses and will be discarded. Five seem quite nice.
- Almost all of the older Japanese haskap fruit crop was lost. Whether due to excessive rain, SWD or a combination of both, the fruits fell off the plants before they were ripe. This has never happened before. Most fruit was purple but not sweet and some was still red. With the crop falling and fears that SWD would propagate, the netting was removed and the fallen fruit was crushed so that it would dry. Both early and later-ripening selections succumbed at the same time.
- Due to conditions in 2023, which seemed to be good, or more likely the open winter, there were almost no apples, plums or pears this year. Where there was fruit, it was late to ripen and not as beautiful nor as large as normal due to all the rain.
- All the fruits were less sweet this year.
- Quite a bit of the Aronia fruit has suffered from dry interiors for several years. SWD is suspected because spraying slows down in August. However, worms or maggots are rarely found and no entry/exit hole either.

Northern Hardy Fruit Project - Yearly Production Records										
		No. of plants	2021		2022		2023		2024	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Aronia	Nero	4	15-Sep	70.5	12-Sep	42.0	29-Aug	55.6	20-Sep	29.9
	Raintree Seedling	4	15-Sep	47.6	19-Sep	54.0	29-Aug	26.7	24-Sep	34.4
	Raintree Select	4	12-Sep	95.4	9-Sep	26.0	30-Aug	59.0	25-Sep	15.3
	Viking	4	8-Sep	104.5	12-Sep	32.0	30-Aug	30.6	24-Sep	21.0
	McKenzie	4	14-Sep	78.6	14-Sep	59.3	1-Sep	56.7	20-Sep	41.9
	Galicjanka	4	8-Sep	49.1	9-Sep	36.3	31-Aug	33.0	24-Sep	24.0
				445.7		**249.6**		**261.6**		**166.6**
			Drought, irrigated		*Wet then drought*				*Rain*	
Hardy Cherries	SK Romeo	3	26-Jul	*Birds*	5-Aug	*Birds*	27-Jul	*x*	*x*	*x*
	SK Juliet	5	16-Jul	73.8	19-Jul	19.2	11-Jul	98.9	17-Jul	251.2
				73.8		**19.2**		**98.9**		**251.2**
			Drought, No SWD		*Wet early; disease*				*Rain. SWD*	
New	*Blackcomb*	7	*did not pick*	NA	19-Aug	27.9	4-Aug	33.4	12-Aug	45.8
Black Currant	*Cheakamus*	7	*did not pick*	NA	10-Aug	17.5	31-Jul	49.9	1-Aug	44.2
Variety Trial	*Stikine*	7	*did not pick*	NA	15-Aug	11.5	28-Jul	34.7	1-Aug	16.6
	Tahsis	8	*did not pick*	NA	15-Aug	13.8	29-Jul	36.7	6-Aug	48.4
	Tiben	8	*did not pick*	NA	16-Aug	15.0	7-Aug	60.3	27-Aug	35.0
				0.0		**85.7**		**215.0**		**190.0**
			Borer pruning		*Wet then insect*				*Rain*	
Black Currant	Ben Lomand	4	*did not pick*	NA	9-Aug	2.8	31-Jul	17.0	2-Aug	14.1
	Blackcomb	4	*did not pick*	NA	19-Aug	10.9	4-Aug	26.4	13-Aug	24.8
	Champion	4	*did not pick*	NA	15-Aug	2.0	30-Jul	15.9	26-Jul	19.6
	Minaj Smyriou	4	*did not pick*	NA	8-Aug	8.6	29-Jul	29.7	24-Jul	14.0
				0.0		**24.3**		**89.0**		**72.5**
			Borer pruning		*Wet then insect*				*Rain*	
Red Currant	Jhonkheer Van Tets	4	*did not pick*	*NA*	8-Aug	4.5	19-Jul	43.8	25-Jul	41.7
				0.0		**38.6**		**43.8**		**41.7**
			Borer pruning		*Wet then drought*				*Rain*	
Juneberry	Honeywood	15	6-Jul	NA	15-Jul	NA	4-Jul	NA	12-Jul	NA
Variety Trial	JB30	15	30-Jun	NA	11-Jul	NA	28-Jun	NA	8-Jul	NA
	Martin	15	30-Jun	NA	11-Jul	NA	28-Jun	NA	8-Jul	NA
	Smoky	15	6-Jul	NA	17-Jul	NA	6-Jul	NA	12-Jul	NA
	Thiessen	15	30-Jun	NA	11-Jul	NA	28-Jun	NA	8-Jul	NA
			EST. 4-500 lbs		**Total wt**	**769.2**	**Total wt**	**696.2**	**EST.**	**850.0**
			Remv'd 1/4, open pick		*Open pick*		*Open pick*		*Open pick*	*Estimate*

Northern Hardy Fruit Project - Yearly Production Records

		No. of plants	2021		2022		2023		2024	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Japanese	21-17	2	19-Jul	1.5	28-Jul	2.3	17-Jul	x	*removed*	x
Haskap	67-95	2	19-Jul	3.0	27-Jul	7.0	14-Jul	6.1	x	x
2017	100-22	1	21-Jun	2.2	12-Jul	2.1	*removed*	x	*removed*	x
	108-42	2	27-Jun	5.1	18-Jul	11.1	3-Jul	5.8	x	x
	110-26	2	30-Jun	3.5	18-Jul	6.4	1-Jul	6.3	x	x
	120-10	2	11-Jul	2.3	7/18-25	6.3	*removed*	x	*removed*	x
	120-14	2	27-Jun	2.1	14-Jul	2.1	21-Jun	3.2	x	x
	120-16	2	2-Jul	2.9	7/20-25	5.2	1-Jul	6.3	x	x
	122-03	2	4-Jul	5.6	27-Jul	1.9	*removed*	x	*removed*	x
	122-12	2	15-Jul	2.7	28-Jul	5.7	*removed*	x	*removed*	x
	122-16	1	9-Jul	0.4	13-Jul	1.7	26-Jun	1.1	x	x
	123-05	2	15-Jul	3.5	28-Jul	2.8	*removed*	x	*removed*	x
	125-04	1	4-Jul	0.4	7/10-13	2.0	28-Jun	1.1	*removed*	x
	132-09	2	21-Jun	2.5	7-Jul	4.3	21-Jun	3.8	x	x
	132-10	1	27-Jun	1.0	12-Jul	2.1	26-Jun	2.9	x	x
	132-13	1	4-Jul	1.0	17-Jul	1.1	29-Jun	2.0	x	x
	132-14	2	27-Jun	1.4	10-Jul	7.9	22-Jun	7.9	*removed*	x
	139-24	5	7-Jul	9.6	7/20-21	15.3	6-Jul	16.9	x	x
	142-31	2	13-Jul	2.0	7/21-28	5.5	10-Jul	3.3	*removed*	x
	144-04	1	30-Jun	1.1	17-Jul	2.9	*removed*	x	*removed*	x
	145-10	2	6-Jul	0.6	7/21-25	1.4	3-Jul	2.5	x	x
				54.5		**97.0**		**69.2**		
			Drought, irrigated		*Wet then drought*				*Rain. Crop Failure*	
		No. of plants	2021		2022		2023		2024	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Japanese	111-12	2	11-Jul	0.8	25-Jul	3.6	13-Jul	7.8	x	x
Haskap	124-16	2	11-Jul	0.5	25-Jul	1.6	13-Jul	0.9	*removed*	x
2018	124-19	1	19-Jul	0.6	29-Jul	3.1	*removed*	x	*removed*	x
	125-13	2	19-Jul	1.5	29-Jul	6.4	*removed*	x	*removed*	x
	129-06	2	30-Jun	0.5	14-Jul	4.6	1-Jul	4.1	*x*	x
	130-09	2	19-Jul	0.3	29-Jul	1.2	17-Jul	x	*removed*	x
	135-03	2	9-Jul	0.2	25-Jul	0.6	7-Jul	1.8	x	x
				4.4		**21.1**		**14.6**		**0.0**
			1st year of production		*Wet then drought*				*Rain. Crop Failure*	
Japanese	129-06	1			13-Jul	0.5	1-Jul	0.7	x	x
Haskap	132-05	2			25-Jul	1.7	10-Jul	5.9	x	x
2019	133-07	2			21-Jul	2.9	7-Jul	4.1	x	x
	133-09	2			26-Jul	3.1	14-Jul	3.2	*removed*	x
	134-08	2			28-Jul	0.6	14-Jul	0.5	*removed*	x
	135-01	2			26-Jul	1.2	*removed*	x	*removed*	x
	136-17	2			28-Jul	1.6	10-Jul	2.7	x	x
	138-18	1			*birds*	x	10-Jul	0.1	x	x
	140-14	2			5-Aug	1.1	17-Jul	1.7	*removed*	x
	140-16	2			27-Jul	0.2	*removed*	x	*removed*	x
	141-04	1			*birds*	x	7-Jul	1.0	*removed*	x
	141-05	2			*birds*	x	14-Jul	2.8	*removed*	x
	141-06	2			5-Aug	0.1	10-Jul	x	x	x
	141-07	2			*birds*	x	7-Jul	0.7	*removed*	x
	144-17	2			*birds*	x	7-Jul	0.4	*removed*	x
						21.5		**23.8**		**0.0**

Northern Hardy Fruit Project - Yearly Production Records										
		No. of plants	2021		2022		2023		2024	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Japanese	3-08	2							1-Jul	2.5
Haskap	15-01	2							28-Jun	1.1
2021	118-05	2							7/10-12	2.3
	121-16	2							7/22-24	2.6
	121-18	2							x	x
	123-15	2							12-Jul	1.2
	125-01	2							7-Jul	4.1
	126-11	2							12-Jul	2.1
	126-19	2							8-Jul	1.4
	127-10	2							4-Jul	4.0
	127-20	2							13-Jul	1.4
	127-21	2							4-Jul	6.0
	129-05	1							7-Jul	0.7
	130-02	2							12-Jul	1.1
	130-08	2							7/19-22	3.2
	131-07	2							7/7-10	0.9
	131-08	2							x	x
	132-05	2							13-Jul	1.8
	132-07	2							4-Jul	3.6
	133-05	2							7-Jul	5.6
	135-07	2							15-Jul	3.1
	135-10	1							x	x
	136-10	1							x	x
	139-19	1							7-Jul	1.4
	141-20	2							7-Jul	1.5
										51.4
									Rain	
Haskaps	Boreal Beast	1	7/6	0.6	26-Jul	2.5	28-Jun	3.8	*1-Jul*	3.1
Canadian	Boreal Beauty	2	7/4-13	1.7	14-Jul	3.9	10-Jul	4.2	*1-Jul*	3.4
2018	Boreal Blizzard	1	4-Jul	0.4	12-Jul	*missing*	23-Jun	5.4	*2-Jul*	1.9
	Aurora	2	>7/20	x	7/21-26	3.8	5-Jul	9.2	*2-Jul*	7.2
	Blue Sky	2					25-Jun	4.1	*x*	x
				2.7		**10.2**		**26.8**		**15.6**
					Wet then drought				*Rain*	

CREC 2024 Administrative Updates

Mike Ostlie

The 2024 growing season had its share of ups and downs. The year started with one of the nicest winters on record, yet the planting season did not start until the later side of our normal window. We did experience a spring calving season with few weather problems though. In July, a major hail storm moved through the area, damaging a number of row crop trials including our dry bean, soybean, and sunflower variety trials. Some of these trials were abandoned. Fortunately, the hail stayed away from our seed production fields and the majority of the rest of our research trials. Frequent rains from July through September created abundant disease issues this season, but above-average yields on almost all crops. A very late first frost meant that all crops had ample time to mature, and the corn was able to reach a dry moisture for harvest.

Outside the plots, we had a lot of activity as well. The shop structure at the Oakes Irrigation Research Site was completed. This phase of the headquarters construction was funded and coordinated by the Garrison Diversion Conservancy District. After the shop was built, the building was donated to NDSU.

We will be looking to finish this structure over the next two years so that there is lab, office, and conference space at the site, improving and consolidating processes and working conditions for staff.

Construction was completed on our Livestock Support Facility which now provides a heated space to store and maintain the livestock feeding equipment that is used daily. A future project will include finishing lab spaces in that structure. Our bulk feed storage structure was also completed, maintaining a high quality, more organized feed source, and increasing storage capacity. Our Smartfeed facility and pen expansion is under construction currently. As of this writing, work continues on the foundation and contractors will work through the winter to erect the walls and roof.

New Livestock Research Support Facility.

We continued the recent trend of many retirements this year. In 2024, we experienced two long-term departures with Greg Endres (NDSU Extension) and Kathy Wiederholt (Fruit project). Both are big losses to both our research and outreach efforts. Justin Martin (Livestock) also resigned his position. However, we are happy to have gained new staff with Miguel Paniagua (Oakes Irrigation Research Site), Madison Bierman (Livestock), Qasim Khan (Organic agriculture), Jeff Stachler (NDSU Extension), and Agustin San Pedro (Agronomy). Starting January 2, we will also be welcoming Rupak Karn (Precision Agriculture). We are finally nearly fully staffed with several new programs having new team leaders. We look forward to seeing where this new group can take us!

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!

NDSU CREC Arboretum Shrub Planting

Easton Brown, Foster County Soil Conservation District

In the spring of 2023, the Foster County Soil Conservation District completed a shrub planting at the NDSU Carrington Research Extension Center's Arboretum. The purpose of the single row shrub planting is to exhibit all approved species and varieties of shrubs that can be utilized in conservation tree plantings within our area and to promote diversity of species within the county. The shrub row was planted directly south of NDSU CREC headquarters (indicated by the green line on the aerial photo) and contains 187 individual shrubs composed of 44 different species and cultivars.

While designing the plan, the first hurdle was to take into consideration that there were two different soil types within the planting area (indicated by the thin lines on the aerial photo). Soil types are given ratings based on their properties, and a "Tree/Shrub rating" dictates what species are suited for the site. The entire shrub row was roughly 1100 ft long. The eastern 350 ft is a soil type that dictates a limited selection of species. It was planned so that all species suited for this soil type were planted into this area first. All the shrubs in the row were spaced at 6 feet apart, and to fill the eastern 350 ft, five of each species were planted. Planting started from the east end based on height (shortest to tallest). The western 750 feet is a better soil type suitable for the remaining species. This section was again planted by height, starting with the shortest species on the east and increasing to the tallest species on the west end. In the western 750 ft, the shrubs were still spaced 6 ft apart but a total of 4 of each species/cultivar were planted.

A survival survey was conducted in late summer, and it was concluded the planting had a 70%+ survival rate. Some species didn't fare as well as others due to the extreme heat that occurred in early summer of 2023, which puts a lot of stress on the transplanted seedlings. The soil district intends to replant dead stock in the spring of 2025 and will continue to monitor the planting. Availability of certain shrub seedlings was also a challenge as some species were in short supply. Below is an aerial map outlining the arboretum shrub planting. Also, included is the list of species that were planted in the row.

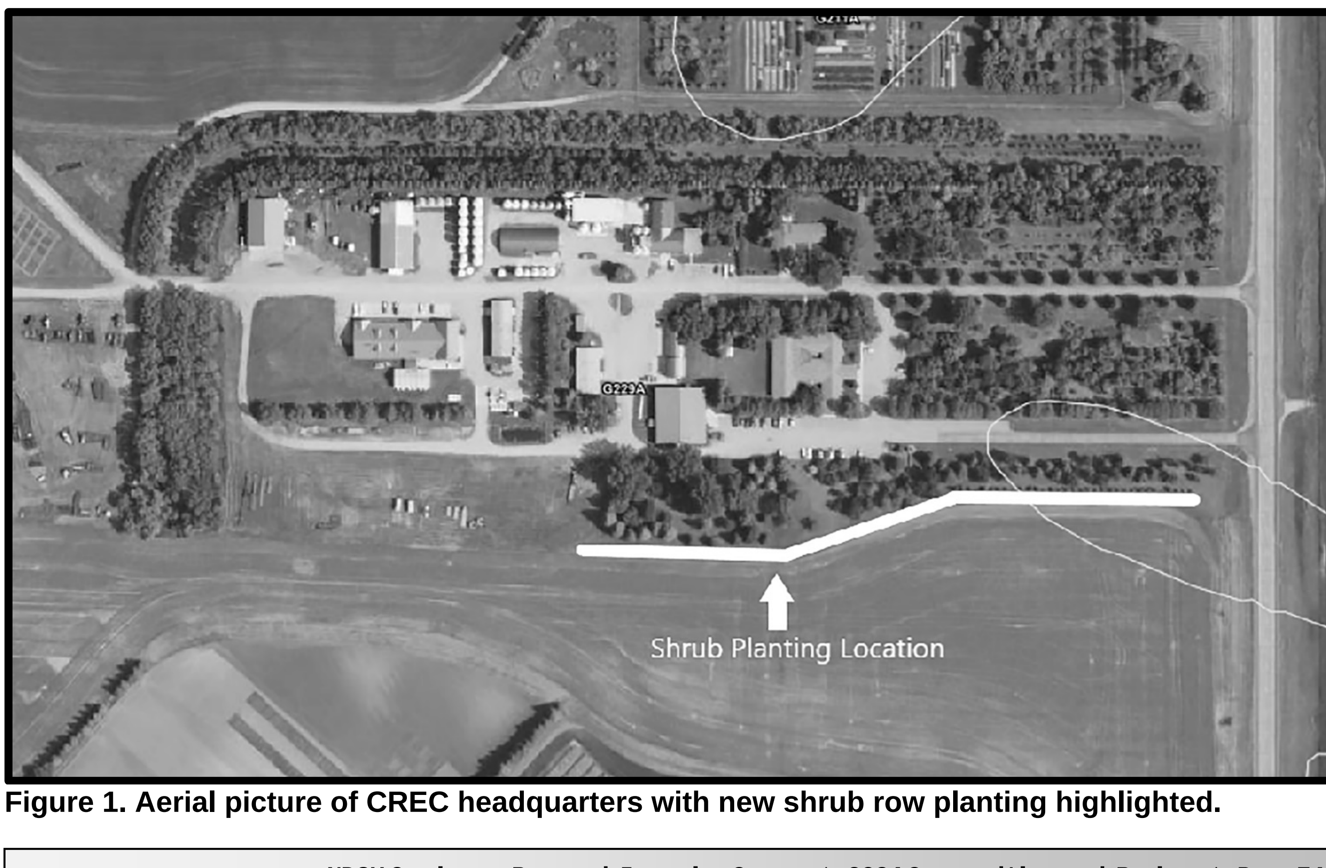


Figure 1. Aerial picture of CREC headquarters with new shrub row planting highlighted.

Species/Cultivars Planted

Eastern 350 ft, starting from the East, 5 of each (in single-species clusters) from shortest to tallest:

1. Golden Currant
2. Skunkbush/3-leaf Sumac
3. Silverberry/Wolfberry
4. Seaberry/Sea-Buckthorn
5. Silver Buffaloberry
6. "Freedom" Blue-Leaf Honeysuckle
7. Tatarian Honeysuckle
8. Common Lilac
9. "White" Common Lilac
10. Caragana
11. Pekin Lilac

Western 750 ft, starting from the East after the Pekin Lilac, 4 of each (in single-species clusters) from shortest to tallest:

1. Woods Rose
2. Hansen Hedge Rose
3. Sandbar Willow
4. Western Sand Cherry
5. Black Currant
6. "Riverview" Black Currant
7. Black Chokeberry/ Aronia Berry
8. "Mckenzie" Black Chokeberry/ Aronia Berry
9. Mongolian/ Carmine Jewel Cherry
10. Russian Almond
11. "Regal" Russian Almond
12. Nanking Cherry
13. Gray Dogwood
14. Redosier Dogwood
15. False Indigo
16. Juneberry/Serviceberry
17. Aromatic Sumac
18. Smooth Sumac
19. American Hazelnut
20. Meadowlark Forsythia
21. Highbush Cranberry
22. Pekin Cotoneaster
23. American Plum
24. "Prairie Red" American Plum
25. Villosa Lilac
26. "Legacy" Villosa Lilac
27. Silky Dogwood
28. "Centennial" European Cotoneaster
29. Purple-Osier/Blue Arctic Willow
30. Nannyberry Viburnum
31. Common Chokecherry
32. "Schubert" Common Chokecherry
33. Bebb's Willow

Shrub planting evident along the southern edge of the trees.

Weather Summary

Monthly Temperatures (°F) and Normals

Month	Max Temp 2024	Max Temp Norm*	Max Temp 2023	Max Temp 2022	Min Temp 2024	Min Temp Norm*	Min Temp 2023	Min Temp 2022	Monthly Avg. Temp 2024	Monthly Avg. Temp Norm*	Monthly Avg. Temp 2023	Monthly Avg. Temp 2022
Apr	54	53	39	40	32	29	24	25	43	41	32	33
May	65	67	74	63	44	42	49	44	55	54	62	53
June	73	76	81	76	53	53	60	54	63	65	70	65
July	79	81	77	80	59	57	55	59	69	69	66	70
Aug	76	81	77	79	54	54	56	56	65	67	67	68
Sept	77	72	73	73	52	45	49	47	65	58	61	60
Avgs:	71	72	70	69	49	47	49	48	60	59	60	58

*Normals = 1991-2020 averages

Monthly Precipitation (in) and Normals

Month	2024 Monthly Precipitation* NDAWN	2024 Monthly Precipitation* NOAA	Normal[1]	2023	2022
Apr	2.63	2.38	1.25	1.39	3.76
May	4.02	5.05	2.76	4.19	6.66
June	4.56	5.70	3.78	3.33	2.86
July	3.79	3.60	3.60	2.09	1.46
Aug	3.65	4.82	2.33	1.83	1.23
Sept	1.19	1.29	1.97	2.24	0.62
Totals:	19.84	22.84	15.69	15.08	16.59

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

Monthly Growing Degree Days and Normals

Month	Wheat GDD 2024	Wheat GDD Norm*	Wheat GDD 2023	Wheat GDD 2022	Sunflower GDD 2024	Sunflower GDD Norm*	Sunflower GDD 2023	Sunflower GDD 2022	Corn GDD 2024	Corn GDD Norm*	Corn GDD 2023	Corn GDD 2022
Apr	366	311	132	124	---	---	---	---	---	---	---	---
May	708	694	911	665	366	360	577	341	250	258	424	226
June	935	982	1154	1005	575	622	794	647	404	461	597	474
July	1156	1159	1049	1169	784	787	654	798	598	583	498	605
Aug	1025	1098	1072	1106	653	726	724	734	478	540	513	551
Sept	978	792	874	831	620	445	529	492	462	322	377	353
Totals	5168	5036	5192	4900	2998	2940	3278	3012	2192	2164	2409	2209

*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
2022	Sept 2	30	2135	Oct 6	25	2907
2023	Oct 6	28	2470	Oct 26	22	3242
2024	*Oct 30	24	2383	**Oct 31	22	3046

*Normal Corn GDD for date = 2250 **Normal Sunflower GDD for date = 2911

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 listing 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

Misc: Spring-planted cover drop demonstration (38 species); *Augustin (Dickinson REC)*
Misc: Summer-planted cover crop demonstration for "Cover Crop Field Training for Ag Professionals"; *Berti (Plant Sciences)*
Soybean: Mitigating salinity effects in soybean using cover crops; *North Dakota Soybean Council*
Wheat: Cover crops as a biological tillage in no-till preceding corn - previous crop year: spring wheat; *North Dakota Corn Utilization Council*
Wheat: Legume interseeding year 1
Wheat: Legume interseeding year 2

Cover crop demonstration trial at Field Day.

Crop Fertility

Corn: Fall application of urea with nitrogen extenders - conventional; *North Dakota Corn Utilization Council*
Corn: Fall application of urea with nitrogen extenders - no-till; *North Dakota Corn Utilization Council*
Soybean: Phosphorus recommendation update for soybean - low P site; *Malone (School of Natural Resources)*
Soybean: Phosphorus recommendation update for soybean - medium P site; *Malone (School of Natural Resources)*

Wheat: Nitrogen and sulfur split application for wheat - Carrington; *Minnesota Wheat Research and Promotion Council*
Wheat: Nitrogen and sulfur split application for wheat - Staples, MN; *Minnesota Wheat Research and Promotion Council*

Crop Management
Canola: Canola planting date by variety; *Johnson (Plant Sciences)*
Dry bean: Dry bean spring cover crop timing; *Northarvest Bean Growers Assoc.*
Dry bean: Effect of inoculant vs. fertilizer on dry bean yield
Dry bean: Ground roll impact on herbicide; *Northarvest Bean Growers Assoc./Ikley (Plant Sciences)*
Field pea: Organic winter pea date of planting; *Hanson (Cornell Univ.)*
Intercropping: Pea and canola intercropping seeding rates
Intercropping: Soybean and canola intercropping seeding rates
Intercropping: Soybean and flax intercropping seeding rates
Misc: Hail insurance demonstration - soybean, wheat, corn, canola, dry bean; *NAU Insurance*
Soybean: Impact of corn residue level on early season disease development in soybean; *North Dakota Soybean Council/Mathew (Plant Sciences)*
Soybean: Impact of tillage history on early season disease development in soybean; *North Dakota Soybean Council/Mathew (Plant Sciences)*
Soybean: Soybean no-till row spacing demonstration
Soybean: No-till row spacing demonstration; Wishek
Sunflower: Early planting and early maturity to manage red sunflower seed weevil; *National Sunflower Association/Prasifka (USDA)*
Wheat: Four wheat variety seeding rate trial; *Keene (Plant Sciences)*

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
Kernza: Kernza demonstration plot
Soybean: Cropping systems experiment - rotation, tillage, and fertility
Sunflower: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Cropping systems experiment - rotation, tillage, and fertility

Cropping systems experiment; soybeans (left), hard red spring wheat (right), and corn in the background.

Inoculants and Plant Health Promotors
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 - ND Victory; *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 - ND Victory; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Lentil: Lentil inoculant - high history; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*
Lentil: Lentil inoculant - low history; *USDA Specialty Crop Block Grant Program/Geddes (Microbiological Sciences)*

Product Evaluation
Barley: Barley sprout reduction evaluation; *North Dakota Barley Council/Stoller*
Chickpea: Chickpea biological inputs; *Germains*
Corn: Evaluation of foliar fertilizer products on corn; *PowerRich*
Corn: Fertility product evaluation: Bioflora starter fertilizer enhancement; *Bioflora*
Corn: Koch fertilizer amendments evaluation (fall and spring applied); *Koch*
Corn: Mosaic phosphorus fertilizer product evaluation on high pH (fall applied); *Mosaic*
Corn: Mosaic phosphorus fertilizer product evaluation on low pH (fall applied); *Mosaic*
Corn: Rhizosorb product evaluation in corn (fall applied); *Phospholutions*
Corn: SIS product testing on corn; *Corteva*
Lentil: Lentil biological inputs; *Germains*
Soybean: Evaluation of Humega, a humic and fulvic acid product (soybean year); *Bioflora*
Soybean: Evo Agri product evaluation to improve soybean yield; *Evo Agri*
Soybean: SIS product evaluation for increased soybean yield; *Corteva*
Soybean: UPL products for mitigating salinity - soybean; *UPL*
Sunflower: Seed priming impact on sunflower hybrids; *Germains*
Wheat: Second year spring wheat plant back after 2023 soybean hulls application - conventional; *North Dakota Soybean Council*
Wheat: Second year spring wheat plant back after 2023 soybean hulls application - no-till; *North Dakota Soybean Council*
Wheat: Evaluation of experimental P fertilizer; *Mosaic*
Wheat: Nitrogen fixing biological products in wheat; *North Dakota Wheat Commission*
Wheat: Phosphorus fertilizer product evaluation (Crystal Green); *Ostara*
Wheat: SIS product testing on spring wheat; *Corteva*
Wheat: UPL products for mitigating salinity - wheat; *UPL*

Plant Pathology
Alfalfa: Evaluation of fungicide seed treatments for management of Rhizoctonia root rot in alfalfa; *McGregor & Co.*
Barley: Evaluation of foliar fungicides for management of Fusarium head blight of barley; *BASF*
Canola: Evaluation of foliar fungicides for management of white mold in canola, experimental fungicides; *BASF*
Canola: Evaluation of foliar fungicides for management of white mold in canola, registered fungicides; *BASF*
Chickpea: Comparative efficacy of fungicide rotation strategies for management of Ascochyta blight in chickpeas; *ND Crop Protection Product Harmonization & Registration Board*
Chickpea: Comparative efficacy of registered fungicides for management of Ascochyta blight in chickpeas; *ND Crop Protection Product Harmonization & Registration Board*
Chickpea: Evaluation of chickpea breeding lines for resistance to Ascochyta blight; *Bandillo (Plant Sciences)*

Chickpea: Evaluation of chickpea breeding lines for resistance to Ascochyta blight; *NuCicer*
Chickpea: Evaluation of foliar fungicides for management of Ascochyta in chickpeas; *Bayer*
Chickpea: Evaluation of foliar fungicides for management of Ascochyta in chickpeas; *FMC*
Chickpea: Evaluation of foliar fungicides for management of Ascochyta in chickpeas; *Vive Crop*
Chickpea: Evaluation of seed treatments for management of seed-borne Ascochyta in chickpeas; *BASF*
Chickpea: Evaluation of seed treatments for management of seed-borne Ascochyta in chickpeas; *Syngenta*
Dry bean: Evaluation of seed treatments for management of Fusarium and Rhizoctonia root rot in dry beans; *Albaugh*
Dry bean: Evaluation of seed treatments for management of Fusarium root rot in pinto beans; *BASF*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans, experimental fungicides; *BASF*
Dry bean: Evaluation of foliar fungicides for management of white mold in dry beans, registered fungicides; *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 seed treatments for management of Fusarium and Rhizoctonia root rot in pinto beans; *McGregor & Company*
Dry bean: Optimizing fungicide application timing and application interval for improved management of white mold in dry beans; *ND Crop Protection Product Harmonization & Registration Board/Northarvest Bean Growers Assoc.*
Dry bean: Optimizing fungicide spray droplet size for improved management of white mold in dry beans; *ND Crop Protection Product Harmonization & Registration Board/Northarvest Bean Growers Assoc.*
Dry bean: Optimizing fungicide spray volume for improved management of white mold in dry beans; *Northarvest Bean Growers Assoc.*
Dry bean: Screening of dry bean varieties for resistance to white mold; *USDA National Sclerotinia Initiative/Chilvers (Michigan State Univ.)*
Dry bean: Evaluation of seed treatments for management of Fusarium root rot in kidney beans; *Syngenta*
Dry bean: Evaluation of seed treatments for management of Fusarium and Rhizoctonia root rot in dry beans; *Wilbur Ellis*
Durum: Evaluation of foliar fungicides for management of Fusarium head blight of durum; *BASF*
Durum: Prosaro Pro efficacy in durum; *Bayer*
Field pea: Evaluation of foliar fungicides for efficacy against Ascochyta blight of field peas; *Bayer*
Field pea: Evaluation of foliar fungicides for efficacy against Ascochyta blight of field peas; *FMC*
Field pea: Evaluation of foliar fungicides for efficacy against Ascochyta blight of field peas; *Vive Crop*
Field pea: Evaluation of foliar fungicides for efficacy against powdery mildew of field peas; *SBARE New and Emerging Crops*
Field pea: Evaluation of fungicide application timing for efficacy against powdery mildew of field peas; *ND Crop Protection Product Harmonization & Registration Board*
Field pea: Evaluation of peroxide-based fungicides for efficacy against powdery mildew in field peas; *SBARE New and Emerging Crops*
Field pea: Evaluation of seed treatment fungicides for management of Aphanomyces root rot in field peas; *Certis*
Field pea: Evaluation of seed treatment fungicides for management of Aphanomyces root rot in field peas; *Valent*
Field pea: Evaluation of seed treatment fungicides for management of Fusarium and Aphanomyces root rot in field peas; *Syngenta*
Field pea: Evaluation of seed treatment fungicides for management of Fusarium root rot in field peas; *BASF*
Field pea: Evaluation of seed treatment fungicides for management of Fusarium root rot in field peas; *Corteva*
Field pea: Evaluation of seed treatment fungicides for management of Pythium in field peas; *Syngenta*

Field pea: Impact of planting date, crop rotation interval, cultivar and fungicide seed treatment on field pea agronomic performance under Fusarium and Aphanomyces pressure; *USDA Specialty Crop Block Grant Program*

Field pea: Impact of planting date, crop rotation interval, cultivar and fungicide seed treatment on field pea agronomic performance under Fusarium and Aphanomyces pressure; *ND Crop Protection Product Harmonization & Registration Board/Northern Pulse Growers Assoc.*

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

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

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

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

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

Soybean: Evaluation of foliar fungicides for general soybean plant health; *BASF*

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

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans, registered fungicides; *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; *Certis*

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, evaluation of registered products, BASF vs. Bayer; *BASF*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans, evaluation of registered products, BASF vs. Corteva; *BASF*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans, evaluation of registered products, BASF vs. generic; *BASF*

Soybean: Evaluation of foliar fungicides for management of white mold in soybeans, evaluation of registered products, BASF vs. Syngenta, Corteva; *BASF*

Soybean: Evaluation of fungicide seed treatments for management of Pythium in soybeans; *Corteva*

Soybean: Evaluation of fungicide seed treatments for management of Pythium in soybeans; *Syngenta*

Soybean: Evaluation of fungicide seed treatments in early- vs. late-planted soybeans under irrigation – Webster, ND; *North Dakota Soybean Council*

Soybean: Evaluation of the impact of adjuvants on efficacy of fungicides for management of white mold in soybeans; *Winfield*

Soybean: Impact of fungicide spray volume on fungicide performance against white mold in soybeans; *North Dakota Soybean Council*

Soybean: Optimizing fungicide application timing and droplet size relative to number of applications and row spacing for management of white mold in soybeans; *North Dakota Soybean Council*

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

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

Various: Crop rotation study for management of Aphanomyces and Fusarium root rot in field peas; *Northern Pulse Growers Assoc.*

Wheat: Evaluation of foliar fungicides for management of foliar and head diseases of wheat; *Syngenta*

Wheat: Evaluation of foliar fungicides for management of Fusarium head blight of wheat; *Syngenta*

Wheat: Evaluation of fungicide seed treatments against Fusarium, Rhizoctonia and common root rot in spring wheat; *Bayer*

Wheat: Evaluation of fungicide seed treatments in spring wheat; *Corteva*

Wheat: Evaluation of fungicide seed treatments in spring wheat; *Valent*

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)*

Seed Increase
Flax: Flax seed increase
Sunflower: Sunflower seed increase for low linoleic oil content for wildlife preference testing; *Klug (Biological Sciences)*

Salinity
Canola: Hybrid tolerance to salinity; *Croplan/Winfield*
Sunflower: Hybrid tolerance to salinity; *Croplan/Winfield*
Wheat: Hybrid tolerance to salinity; *Croplan/Winfield*

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: Organic variety trial
Barley: Barnes County (Dazey) variety trial
Barley: Tri-County (Wishek) variety trial
Buckwheat: Dryland variety trial; *Industry*
Buckwheat: Organic variety trial; *Industry*
Canola: Canola breeder nursery; *Rahman (Plant Sciences)*
Canola: Conventional performance test; *Industry*
Canola: Liberty Link performance test; *Industry*
Canola: Performance test; *BASF*
Canola: Roundup Ready performance test; *Industry*
Corn: Dryland hybrid performance test; *Industry*
Corn: Dryland hybrid performance test - conventional lines; *Industry*
Corn: Fingal hybrid performance test; *Industry*
Corn: Irrigated hybrid performance test; *Industry*
Corn: Dryland corn silage performance test; *Industry*
Corn: Irrigated corn silage performance test; *Industry*
Dry bean: Dry bean breeder nursery; *Osorno (Plant Sciences)*
Dry bean: Dryland variety trial
Dry bean: Irrigated variety trial
Dry bean: Tri-County/Wishek variety trial
Durum: Drill strip demonstration plots
Durum: Dryland variety trial
Durum: Organic 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; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Field pea: Field pea breeder nursery - observational; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Field pea: Drill strip demonstration plots; *Industry*
Field pea: Organic variety trial
Field pea: Field pea protein management; *USDA Pulse Crop Health Initiative/Miller (Montana State Univ.)*
Field pea: Variety trial; *Industry*
Field pea: Organic winter pea nursery; *Hanson* (*Cornell Univ.)*
Field pea: On-farm organic winter pea nursery; *Hanson* (*Cornell Univ.)*
Flax: Variety trial
Flax: Flax breeder nursery; *Rahman (Plant Sciences)*
Forages: Winter rye forage variety trial; *Industry*

Lupin: Drill strip increases
Lupin: Variety evaluation
Oats: Organic oat nursery; *25-2*
Oats: Oat breeder nursery; *McMullen (Plant Sciences)*
Oats: Drill strip demonstration plots
Oats: Dryland variety trial
Oats: Organic variety trial
Oats: Uniform Mid-season Oat Nursery; *McMullen (Plant Sciences)*
Pennycress: Pennycress breeding nursery; *Forever Green*
Rye: Winter rye variety trial; *Industry*
Sorghum: Grain sorghum nursery; *SBARE New and Emerging Crops*
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: Breeder Nursery: 23 CAR third/fourth year Roundup Ready - Dazey; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year Roundup Ready - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year Roundup Ready - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 23 CAR third/fourth year Roundup Ready - Wishek; *Miranda (Plant Sciences)*
Soybean: Dryland soybean agronomic performance trial - Carrington; *BASF*
Soybean: Dryland soybean agronomic performance trial - Oakes; *BASF*
Soybean: Irrigated soybean agronomic performance trial - Carrington; *BASF*
Soybean: Irrigated soybean agronomic performance trial - Oakes; *BASF*
Soybean: LaMoure Roundup Ready variety performance test; *Industry*
Soybean: Organic soybean variety performance trial
Soybean: Soybean agronomic performance trial - Barnes County (Dazey); *BASF*
Soybean: Soybean agronomic performance trial - Tri-County (Wishek); *BASF*
Soybean: Dryland conventional performance test; *Industry*
Soybean: Dryland Roundup Ready variety performance test; *Industry*
Soybean: Irrigated conventional variety performance test; *Industry*
Soybean: Irrigated Roundup Ready variety performance test; *Industry*
Soybean: Variety screening for drought tolerance - dryland; *Miranda (Plant Sciences)*
Soybean: Variety screening for drought tolerance - irrigated; *Miranda (Plant Sciences)*
Soybean: Tri-County (Wishek) Roundup Ready variety performance test; *Industry*
Soybean: Barnes County (Dazey) conventional variety performance test; *Industry*
Soybean: LaMoure conventional variety performance test; *Industry*
Soybean: Tri-County (Wishek) conventional variety performance test; *Industry*
Sunflower: Non-oil sunflower hybrid performance test; *Industry*
Sunflower: Oil sunflower hybrid performance test; *Industry*
Sunflower: Rust effect on seed yield in confectionary vs. oil sunflowers; *Markell (Plant Sciences)*
Sunflower: Sunflower rust resistance nursery; *USDA Specialty Crop Block Grant Program/Markell (Plant Sciences)*
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 nursery; *Marias (Plant Sciences)*
Winter Wheat: Variety trial

Weed Science
Canola: Glufosinate formulations efficacy in canola; *BASF*
Canola: Herbicide tolerance; *Gowan*
Canola: Liberty systems evaluation in canola; *BASF*
Corn: Timing of weed removal - regional trial; *Ikley (Plant Sciences)*
Field pea: Herbicide tolerance; *Gowan*
Misc: Herbicide site of action demonstration
Misc: Weed arboretum
Soybean: Adjuvant comparison for Liberty applications in soybean; *BASF*
Soybean: Enlist system kochia management strategies; *Pioneer/Corteva*
Soybean: Evaluation of new imazamox pre-mixes for soybean; *BASF*
Soybean: Kochia residual product comparisons for soybean; *BASF*
Soybean: Length of residual comparison of soybean PREs; *BASF*
Soybean: Liberty formulation plus residual systems in soybean; *BASF*
Soybean: Liberty Ultra evaluation in soybeans; *BASF*
Soybean: Soybean herbicide programs; *UPL*
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)*
Soybean: Volunteer corn management in soybeans; *BASF*
Wheat: Kochia control with Huskie FX herbicide; *Bayer*
Wheat: Surtain evaluation in spring wheat; *BASF*

Weed control evaluation in corn.

Hard Red Spring Wheat - Dryland										**Carrington (Page 1 of 2)**
				------ Protein ------				---------- Yield ----------		
Variety	Days to Heading	Plant Height	Lodging	2024	3-yr. Avg.	KWT	Test Weight	2024	2-yr. Avg.	3-yr. Avg.
	days	inches	1-9	-------- % --------		g/1000	lb/bu	---------- bu/a ----------		
WB 9590	56	33	6	15.9	14.4	28.0	55.7	67.6	68.2	64.4
AP Murdock	57	35	5	15.4	14.3	32.5	59.3	78.2	71.9	66.1
SY Valda	58	35	5	14.9	13.8	30.8	58.8	77.3	74.8	68.3
SY Ingmar	58	35	4	15.4	14.8	25.8	59.1	75.4	68.1	62.2
MN Torgy	57	38	5	16.1	15.0	27.8	57.9	72.5	65.5	64.4
Shelly	59	36	5	15.3	14.0	28.0	57.5	69.2	67.3	66.6
WB 9719	58	34	6	14.8	--	28.6	59.9	65.7	68.5	--
Faller	58	38	5	15.3	--	30.0	58.4	76.1	74.8	--
Ambush	55	36	5	15.9	--	27.5	57.9	71.7	--	--
AP Elevate	57	35	5	15.4	--	27.5	58.4	76.0	--	--
AP Gunsmoke CL2	57	36	5	18.0	15.2	27.1	56.4	56.8	64.4	62.2
AP Smith	58	34	2	15.0	14.3	25.5	58.3	77.1	70.8	65.0
Ascend-SD	58	40	4	16.7	14.8	28.2	59.2	75.9	79.6	73.2
Ballistic	58	37	6	15.3	--	25.5	57.0	75.1	--	--
Bolles	59	36	4	17.4	16.3	27.6	57.2	68.2	68.3	60.9
Boost	59	37	4	15.9	--	28.7	58.0	61.7	66.0	--
Brawn-SD	57	35	6	15.8	14.0	30.5	59.5	70.5	72.2	66.0
CAG Ceres	57	36	3	14.6	--	31.4	57.7	72.5	--	--
CAG Justify	58	36	6	15.3	13.5	30.5	56.1	68.6	69.3	66.4
CAG Reckless	56	38	5	15.5	14.4	28.3	57.3	64.5	67.9	63.1
CAG Recoil	63	36	4	15.3	--	29.4	58.1	66.2	--	--
Commander	55	37	4	15.1	--	28.4	58.4	76.0	--	--
CP3201AX	55	35	3	14.1	--	27.5	59.8	76.8	--	--
CP3055	63	37	4	14.4	--	28.3	53.7	58.3	--	--
CP3099A	61	38	4	13.2	12.3	30.2	55.1	66.4	64.6	63.0
CP3119A	63	37	1	14.2	--	35.2	51.4	53.9	--	--
CP3188	57	36	6	14.7	13.1	28.2	55.4	66.5	59.9	62.0
CP3322	62	37	3	15.4	--	25.3	56.3	51.3	61.8	--
CP3915	57	35	5	15.2	--	24.9	58.8	70.6	--	--
Driver	58	36	4	15.4	13.9	28.2	59.6	72.6	73.1	68.2
Glenn	54	40	3	16.1	14.7	29.4	61.5	67.2	65.8	59.6
Lanning	57	36	5	17.0	15.1	28.2	54.6	55.7	62.9	58.3
Trial Mean	57	36	4	15.5	--	27.8	57.5	69.8	--	--
C.V. (%)	2	4	29.0	2.8	--	7.0	1.8	7.2	--	--
LSD (0.10)	1	2	1	0.5	--	2.3	1.2	5.9	--	--

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Planting Date = May 9; Harvest Date = September 5; Previous Crop = Field Pea

Variety	Days to Heading	Plant Height	Lodging	Protein 2024	Protein 3-yr. Avg.	KWT	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	1-9	%	%	g/1000	lb/bu	bu/a	bu/a	bu/a
LCS Ascent	53	36	6	14.4	13.6	24.6	57.7	78.8	69.0	63.1
LCS Boom	53	36	5	15.3	--	28.0	58.9	81.8	68.0	--
LCS Buster	61	39	5	14.2	12.6	30.9	56.2	66.1	68.7	65.0
LCS Cannon	53	35	4	15.4	14.2	31.8	58.8	81.2	69.5	64.8
LCS Dual	57	36	3	15.7	14.2	25.4	56.7	66.2	63.2	64.1
LCS Hammer AX	56	36	3	14.7	13.9	25.7	56.8	77.2	70.6	68.1
LCS Trigger	62	36	5	13.3	12.4	27.5	58.3	72.3	72.5	67.8
MN Rothsay	59	33	3	15.2	14.2	24.8	57.9	70.2	71.5	64.7
MS Charger	57	34	6	14.1	12.8	26.0	56.6	86.9	75.4	70.6
MS Cobra	56	35	4	15.4	14.4	24.3	57.7	74.0	68.2	65.7
MS Nova	55	34	4	15.7	--	24.0	57.7	69.6	--	--
MS Ranchero	62	36	7	17.0	14.5	22.3	51.3	38.9	60.1	58.6
MT Carlson	57	33	6	15.3	--	28.3	56.5	69.3	--	--
MT Dutton	57	35	4	16.9	--	24.1	53.4	60.9	--	--
MT Ubet	57	36	6	16.3	--	28.4	56.1	65.7	--	--
ND Frohberg	57	39	3	15.8	14.7	32.1	58.9	68.1	68.6	65.6
ND Heron	55	35	5	15.9	14.5	28.2	58.9	67.4	62.5	59.9
ND Stampede	57	36	4	15.5	14.3	28.7	58.2	84.5	77.7	70.2
ND Thresher	56	34	6	16.0	14.6	25.6	57.8	68.1	68.8	62.2
ND Vitpro	56	38	4	16.1	15.0	28.6	60.1	65.9	61.6	57.3
PFS Buns	64	36	4	14.1	13.5	25.3	54.7	63.9	72.1	62.5
PFS Rolls	60	37	4	15.5	--	29.6	56.7	63.3	--	--
Rocker	58	36	4	16.1	--	25.8	57.4	59.4	--	--
SY611 CL2	56	34	5	15.7	14.4	25.6	58.9	73.3	73.1	67.8
SY Longmire	58	35	3	15.6	14.9	24.9	58.2	67.6	69.3	62.5
TCG Badlands	57	37	4	15.1	--	27.9	58.9	72.9	--	--
TCG Teddy	57	33	2	15.2	--	27.2	56.4	70.6	72.0	--
TCG Wildcat	58	36	3	15.6	15.0	31.9	59.1	82.3	76.9	69.6
TCG Zelda	57	35	4	15.2	--	29.9	58.6	81.5	--	--
PG Predator	57	33	3	15.3	--	26.8	58.0	77.9	--	--
CDC Landmark VB	57	37	4	16.3	--	29.2	58.8	63.9	66.0	--
AAC Starbuck VB	57	37	6	17.3	15.6	24.8	57.1	55.6	64.6	63.3
Trial Mean	57	36	4	15.5	--	27.8	57.5	69.8	--	--
C.V. (%)	2	4	29.0	2.8	--	7.0	1.8	7.2	--	--
LSD (0.10)	1	2	1	0.5	--	2.3	1.2	5.9	--	--

Planting Date = May 9; Harvest Date = September 5; Previous Crop = Field Pea

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

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

Variety	Days to Heading	Plant Height	Protein 2024*	Protein 3-yr. Avg.	KWT	Test Weight	Yield 2024*	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	%	%	g/1000	lb/bu	bu/a	bu/a	bu/a
WB9590	53	30	13.7	13.1	29.6	59.3	67.2	67.7	66.3
AP Murdock	54	33	13.6	12.9	30.7	60.7	74.8	74.4	72.6
SY Valda	56	35	13.0	12.6	31.5	62.2	78.8	78.2	74.3
SY Ingmar	55	33	14.3	14.0	25.9	62.9	69.9	64.3	62.4
MN Torgy	55	35	13.9	13.1	32.4	63.2	75.7	70.4	71.0
Shelly	56	32	13.5	12.9	30.6	61.8	70.8	64.6	65.4
WB 9719	56	32	13.8	--	29.7	62.6	67.2	69.4	--
Faller	55	35	13.0	12.2	33.5	61.9	75.9	76.5	74.3
Ambush	52	33	14.2	--	30.4	62.5	71.1	--	--
AP Elevate	54	31	13.9	--	29.9	61.6	74.8	--	--
AP Gunsmoke CL2	54	34	13.8	12.8	32.8	61.2	71.9	66.9	67.3
AP Smith	56	33	13.7	13.6	28.0	62.2	73.0	72.6	70.9
Ascend-SD	56	39	12.9	12.7	28.6	63.0	74.5	81.6	79.1
Ballistic	55	35	12.5	--	28.6	60.7	75.8	--	--
Bolles	56	33	14.8	14.3	29.7	61.8	68.1	65.1	63.9
Boost	56	34	14.0	--	32.2	62.4	72.8	70.9	--
Brawn-SD	54	36	13.0	12.3	31.3	63.3	74.5	74.8	72.2
CAG Ceres	53	33	13.9	--	32.3	60.0	68.6	--	--
CAG Justify	56	35	12.8	12.0	30.8	59.6	75.9	74.4	74.7
CAG Reckless	54	36	13.6	13.0	30.4	61.4	75.7	74.4	71.8
CAG Recoil	59	34	13.6	--	33.8	62.0	78.0	--	--
Commander	52	34	14.2	--	29.8	60.5	76.2	--	--
CP3201AX	52	33	13.1	--	26.4	59.8	67.7	--	--
CP3055	58	35	12.5	--	30.4	59.1	72.6	--	--
CP3099A	58	36	11.2	10.9	33.4	59.5	72.8	75.7	76.5
CP3119A	59	35	12.4	--	38.5	57.3	73.4	--	--
CP3188	55	36	12.7	11.8	30.2	59.1	75.9	74.8	72.7
CP3322	58	35	13.0	--	26.0	60.3	63.4	67.0	--
CP3915	55	33	14.0	--	25.5	61.8	66.8	--	--
Driver	55	36	13.5	12.7	29.7	62.6	73.1	68.5	67.9
Glenn	52	40	14.4	13.9	29.2	63.3	62.3	62.3	60.8
Lanning	56	34	14.3	13.5	31.5	59.9	62.5	62.4	59.1
Trial Mean	54	34	13.6	--	30.0	60.9	71.2	--	--
C.V. (%)	2	5	2.0	--	5.2	0.7	3.0	--	--
LSD (0.10)	1	2	0.2	--	1.8	0.5	1.8	--	--

Planting Date = May 10; Harvest Date = August 21; Previous Crop = Flax

Variety	Days to Heading	Plant Height	Protein 2024*	Protein 3-yr. Avg.	KWT	Test Weight	Yield 2024*	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	%	%	g/1000	lb/bu	bu/a	bu/a	bu/a
LCS Ascent	51	34	12.7	12.5	26.0	60.1	72.4	70.2	71.4
LCS Boom	51	33	14.2	--	28.6	60.9	71.0	69.5	--
LCS Buster	58	39	12.2	11.7	34.7	61.4	80.5	75.9	74.4
LCS Cannon	51	32	14.3	13.3	28.5	60.5	68.6	68.1	68.2
LCS Dual	53	34	13.1	12.3	29.2	61.2	70.3	66.7	66.2
LCS Hammer AX	53	32	13.3	12.7	28.4	57.6	66.7	63.3	62.6
LCS Trigger	58	36	12.4	11.4	32.8	62.7	75.9	70.7	74.5
MN Rothsay	57	34	13.8	13.2	30.0	63.2	70.2	70.0	67.4
MS Charger	53	33	12.6	12.0	30.1	60.5	73.1	73.7	76.6
MS Cobra	53	32	14.1	13.2	27.8	60.1	66.7	63.4	62.4
MS Nova	52	34	14.1	--	26.9	60.0	60.9	--	--
MS Ranchero	59	39	13.3	12.0	31.9	60.9	68.3	67.6	71.1
MT Carlson	53	32	13.4	--	29.9	57.7	67.0	--	--
MT Dutton	53	35	13.9	--	27.3	58.0	66.6	--	--
MT Ubet	55	36	14.2	--	30.8	59.5	67.8	--	--
ND Frohberg	54	37	14.2	13.3	30.1	61.5	67.7	65.8	65.7
ND Heron	51	34	14.4	13.8	30.7	60.4	64.7	64.1	61.1
ND Stampede	53	36	13.2	12.4	29.5	59.4	76.5	76.9	74.0
ND Thresher	55	32	13.4	12.8	28.4	60.5	71.1	72.6	67.5
ND Vitpro	53	35	14.7	13.9	29.3	62.3	66.0	66.3	63.7
PFS Buns	60	33	12.6	11.9	30.3	59.6	71.3	68.7	68.8
PFS Rolls	57	34	13.6	--	31.7	60.7	73.5	--	--
Rocker	56	35	14.0	--	26.5	60.4	67.2	--	--
SY611 CL2	53	32	13.6	13.0	29.5	61.7	76.2	73.5	71.6
SY Longmire	54	33	13.8	13.5	28.1	61.5	64.9	65.6	66.5
TCG Badlands	55	33	13.6	--	29.0	60.8	71.4	--	--
TCG Teddy	54	31	14.2	--	30.9	60.4	71.0	68.0	--
TCG Wildcat	55	35	13.9	13.2	32.6	61.8	78.2	75.5	71.3
TCG Zelda	54	33	13.8	--	30.5	60.8	74.0	--	--
PG Predator	54	32	13.7	--	29.2	61.4	75.2	--	--
CDC Landmark VB	54	36	14.6	--	30.6	61.2	68.3	67.7	--
AAC Starbuck VB	53	34	15.4	14.3	29.8	60.8	61.8	65.3	65.3
Trial Mean	54	34	13.6	--	30.0	60.9	71.2	--	--
C.V. (%)	2	5	2.0	--	5.2	0.7	3.0	--	--
LSD (0.10)	1	2	0.2	--	1.8	0.5	1.8	--	--

Plant Date = May 10; Harvest Date = August 21; Previous Crop = Flax

* Best Linear Unbiased Estimate

Hard Red Spring Wheat											**Barnes County - Dazey**
				----- Protein -----					---------- Yield ----------		
	Days to	Plant			3-yr.		Test	Seeds/		2-yr.	3-yr.
Variety	Heading	Height	Lodging	2024	Avg.	KWT	Weight	Pound	2024	Avg.	Avg.
	days	inches	1-9	-------- % --------		g/1000	lb/bu		---------- bu/a ----------		
WB9590	52	29	2	14.0	14.6	31.2	57.9	14537	69.8	71.0	74.4
AP Murdock	54	32	4	13.2	13.9	32.4	59.9	13992	84.4	76.0	78.9
SY Valda	54	34	6	13.3	13.9	33.8	60.5	13439	84.3	77.7	79.7
SY Ingmar	55	33	3	13.9	14.7	29.9	61.4	15162	84.5	70.1	73.0
MN Torgy	55	36	4	14.2	15.0	34.4	61.0	13198	84.0	71.5	74.3
WB9719	55	32	4	13.0	--	33.4	62.7	13580	72.1	74.1	--
Faller	55	36	5	12.9	13.8	36.6	61.0	12414	81.2	81.4	81.8
AP Smith	56	30	2	13.6	--	29.2	60.4	15565	79.3	73.8	--
Ascend-SD	56	38	3	13.7	14.6	30.3	61.7	15030	89.7	87.9	85.7
Brawn-SD	54	37	5	13.3	--	33.9	61.9	13372	90.5	88.7	--
CAG Ceres	54	34	3	13.5	--	35.2	59.8	12897	77.5	--	--
CP3055	59	35	3	12.0	--	31.1	58.4	15907	84.0	--	--
CP3188	55	35	4	12.1	--	31.8	58.5	14281	73.0	66.1	--
CP3322	59	34	2	12.8	--	28.0	60.2	16241	78.7	--	--
Driver	56	37	3	13.5	--	31.8	61.7	14272	84.3	80.5	--
Glenn	52	38	3	14.8	15.3	32.1	62.4	14149	71.0	69.2	69.6
LCS Ascent	51	34	5	12.9	13.5	27.8	59.1	16322	83.5	77.0	78.2
LCS Boom	51	33	2	13.8	--	28.9	59.8	15725	73.8	67.5	--
LCS Buster	59	37	2	11.8	--	35.8	59.6	12671	88.5	85.8	--
LCS Dual	54	34	3	13.4	13.6	29.8	59.6	15274	71.9	71.0	69.9
LCS Hammer AX	53	32	2	13.5	--	29.9	58.0	15196	74.1	69.1	--
MN Rothsay	57	31	2	13.7	14.3	28.9	61.2	15779	80.1	75.6	76.5
MS Cobra	54	33	4	13.6	--	29.2	60.2	15532	79.3	--	--
MS Nova	53	32	2	13.9	--	25.0	58.7	18126	69.3	--	--
ND Frohberg	55	37	3	13.7	14.2	34.2	60.6	13310	78.3	76.9	75.4
ND Stampede	54	35	4	13.4	14.1	31.3	59.3	14515	86.0	80.7	81.5
ND Thresher	55	33	3	14.0	14.9	29.5	59.9	15438	68.0	69.3	68.5
PFS Rolls	57	35	4	13.2	--	36.2	60.9	12531	90.2	--	--
Rocker	56	35	5	13.5	--	29.7	59.7	15288	77.7	--	--
SY Longmire	55	34	3	14.1	--	30.1	59.8	15098	65.8	69.2	--
TCG Badlands	55	34	3	13.2	--	29.7	59.9	15290	78.4	--	--
TCG Teddy	55	31	2	13.9	--	31.8	59.4	14287	82.1	--	--
PG Predator	54	32	4	13.6	--	30.4	59.9	14930	85.7	--	--
CDC Landmark VB	56	32	3	13.0	--	31.3	61.2	14555	81.1	77.5	--
AAC Starbuck VB	54	35	5	14.8	15.6	31.7	60.8	14305	79.7	78.0	73.0
Trial Mean	55	34	3	13.4	--	31.3	60.2	14648	79.9	--	--
C.V. (%)	1	3	26	2.7	--	6.0	0.8	8	7.8	--	--
LSD (0.10)	1	1	1	0.4	--	2.2	0.6	1393	7.3	--	--

Planting Date = May 10; Harvest Date = August 28; Previous Crop = Soybean

Variety	Days to Heading	Plant Height	Protein 2024	Protein 3-yr. Avg.	KWT	Test Weight	Seeds/ Pound	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	%	%	g/1000	lb/bu		bu/a	bu/a	bu/a
WB9590	47	26	15.9	15.5	29.9	56.6	15207	45.9	56.5	57.5
AP Murdock	49	28	14.8	14.6	29.3	58.3	15497	57.2	69.3	70.2
SY Valda	48	29	14.7	14.7	32.3	59.1	14052	60.2	66.8	66.0
SY Ingmar	50	27	15.6	15.4	28.2	59.3	16100	49.4	51.1	55.6
MN Torgy	49	28	14.7	15.0	30.7	59.4	14816	52.9	63.6	62.7
Shelly	50	28	13.7	14.1	29.3	59.6	15544	52.9	63.4	63.8
WB9719	49	29	14.5	--	29.2	62.0	15535	61.3	71.2	--
Faller	49	29	13.8	14.0	32.8	59.0	13846	59.4	69.3	71.4
Ambush	48	28	16.1	--	30.0	58.5	15140	50.2	--	--
AP Elevate	50	25	15.3	--	28.1	58.0	16138	50.4	--	--
AP Smith	49	26	15.4	--	26.8	58.6	17018	46.0	58.7	--
Ascend-SD	49	30	13.9	14.6	27.6	60.2	16484	60.9	71.8	72.7
Brawn-SD	49	30	14.6	14.3	27.9	59.8	16446	64.3	74.4	74.4
CAG Ceres	48	29	15.6	--	31.5	57.5	14464	49.3	--	--
CAG Reckless	48	30	15.5	--	29.3	59.1	15520	55.9	--	--
CAG Recoil	54	29	14.0	--	30.9	57.8	14765	59.1	--	--
Commander	48	29	16.1	--	27.5	56.2	16516	43.9	--	--
CP3055	53	30	12.7	--	30.0	55.9	15111	55.3	--	--
CP3188	48	29	13.2	--	28.3	58.0	16195	57.7	58.0	--
CP3322	54	29	13.3	--	25.9	57.6	17700	53.8	--	--
Driver	49	30	14.9	14.7	28.6	59.1	15890	54.0	61.2	63.2
Glenn	46	32	15.3	15.3	28.0	60.7	16299	45.4	60.1	60.7
LCS Ascent	45	28	14.3	13.9	25.8	58.1	17677	55.1	66.0	65.9
LCS Boom	45	28	15.0	--	28.2	59.4	16110	55.9	57.6	--
LCS Buster	54	31	13.6	--	33.0	56.7	13755	55.6	65.4	--
LCS Dual	48	28	15.1	14.5	29.5	58.8	15449	48.2	58.6	60.7
LCS Hammer AX	48	29	14.9	--	30.0	58.0	15184	46.9	54.4	--
MS Nova	47	29	15.2	--	26.0	58.0	17791	56.9	--	--
MT Ubet	50	29	15.2	--	30.9	57.2	14683	57.2	--	--
ND Thresher	50	30	15.8	15.3	24.9	56.1	18362	52.3	58.0	60.1
PFS Buns	58	28	14.0	--	28.4	53.5	16053	50.4	--	--
PFS Rolls	52	31	15.7	--	31.8	56.8	14307	62.7	--	--
Trial Mean	49	29	14.8	--	29.1	58.2	15708	54.3	--	--
C.V. (%)	2	8	4.1	--	5.6	1.6	6	10.6	--	--
LSD (0.10)	1	3	0.7	--	1.9	1.1	1134	6.8	--	--

Planting Date = May 20; Harvest Date = August 29; Previous Crop = Soybean

Variety	Days to Heading	Plant Height	Protein 2024	Protein 3-yr. Avg.	KWT	Test Weight	Seeds/ Pound	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	%	%	g/1000	lb/bu		bu/a	bu/a	bu/a
Rocker	51	31	15.0	--	28.2	57.4	16092	49.5	--	--
SY Longmire	49	28	15.7	--	28.2	58.4	16115	47.5	59.0	--
TCG Badlands	48	29	14.9	--	28.5	57.8	15917	58.1	--	--
TCG Teddy	50	28	15.7	--	29.1	56.2	15672	51.0	--	--
TCG Wildcat	50	29	15.7	--	31.1	59.0	14618	57.0	--	--
PG Predator	49	28	14.6	--	26.2	57.5	17375	53.7	--	--
AAC Starbuck VB	50	29	17.0	16.3	28.7	57.0	15840	46.2	58.3	59.7
Prosper	50	31	14.5	--	34.1	59.1	13294	64.0	--	--
Trial Mean	49	29	14.8	--	29.1	58.2	15708	54.3	--	--
C.V. (%)	2	8	4.1	--	5.6	1.6	6	10.6	--	--
LSD (0.10)	1	3	0.7	--	1.9	1.1	1134	6.8	--	--

Planting Date = May 20; Harvest Date = August 29; Previous Crop = Soybean

No significant lodging.

Small grain harvest in Wishek, 2024.

Hard Red Spring Wheat - Organic									**Carrington**
				-------- Protein -------				--------- Yield ---------	
Variety	Days to Heading	Plant Height	Lodging	2024	3-yr. Avg.	KWT	Test Weight	2024	3-yr. Avg.
	days	inches	1-9	---------- % ----------		g/1000	lb/bu	--------- bu/a ---------	
MN Torgy	62	35	2	14.8	12.5	27.9	57.7	67.1	32.6
Shelly	65	34	2	14.8	12.2	24.7	54.6	50.7	27.0
Faller	64	36	4	13.9	11.7	28.0	56.9	59.0	32.3
Bolles	65	35	3	16.6	13.4	26.1	54.6	52.7	27.0
Brawn-SD	63	37	3	13.7	--	30.0	59.3	71.1	--
Glenn	60	37	4	15.5	13.1	26.6	59.2	48.0	24.4
MN Rothsay	65	33	2	15.1	13.0	23.9	55.4	55.4	28.7
MT Carlson	62	34	4	14.1	--	26.2	54.9	54.7	--
MT Dutton	63	35	4	15.7	--	23.8	52.9	46.5	--
MT Ubet	62	34	3	15.0	--	26.0	54.4	57.6	--
ND Frohberg	64	39	3	14.4	13.0	27.5	57.5	59.4	30.5
ND Heron	61	33	6	15.3	13.3	25.5	55.9	44.6	22.6
ND Vitpro	62	34	5	15.8	13.2	26.5	57.9	47.9	25.1
Red Fife	66	42	6	14.5	11.7	27.0	54.7	29.4	20.9
Prosper	65	36	4	14.1	--	27.1	55.9	58.0	--
Linkert	63	32	2	15.6	--	26.3	56.9	58.8	--
Trial Mean	63	35	3	14.9	--	26.4	56.2	53.8	--
C.V. (%)	1	4	19	2.2	--	8.2	1.8	10.5	--
LSD (0.10)	1	2	1	0.4	--	2.6	1.2	6.7	--

Planting Date = April 24; Harvest Date = August 15; Previous Crop = Fallow

Winter wheat maturing.

Hard Red Winter Wheat										Carrington
					------ Protein ------				------- Yield -------	
	Heading	Plant		Harvest		3-yr.		Test		3-yr.
Variety	Date	Height	Lodging	Moisture	2024	Avg.	KWT	Weight	2024*	Avg.
		inches	1-9	%	--------- % ---------		g/1000	lb/bu	-------- bu/a --------	
Jerry	6/13	37.6	1.5	13.3	12.1	12.9	29.3	59.8	77.9	72.6
ND Noreen	6/14	37.2	1.3	13.6	12.0	13.3	31.2	60.9	74.8	72.7
ND Allison	6/14	35.9	1.0	13.6	11.4	--	26.0	59.9	79.8	--
Northern	6/15	34.0	1.5	13.0	12.9	13.1	25.1	56.7	66.8	72.5
SD Andes	6/12	33.8	1.0	13.1	12.2	12.4	27.2	60.7	79.2	78.1
SD Midland	6/12	34.3	1.0	12.8	12.1	12.4	34.4	60.5	77.7	78.4
Winner	6/9	31.8	1.0	13.3	12.7	12.9	33.9	60.9	74.9	73.6
SD Pheasant	6/12	35.0	1.0	13.2	12.2	--	29.6	59.6	81.3	--
AAC-Wildfire	6/15	36.6	1.0	12.8	12.5	12.7	26.2	57.5	69.8	68.5
AAC Overdrive	6/13	32.6	1.3	13.3	12.8	--	26.5	58.4	76.6	--
AAC Coldfront	6/13	31.2	1.5	13.5	12.2	--	25.5	59.5	73.5	--
AAC Vortex	6/13	33.8	1.3	13.1	12.6	13.4	28.7	60.4	84.4	74.8
Goldrush	6/15	34.5	1.3	13.0	12.3	--	25.0	58.5	64.7	
AC Emerson	6/13	34.7	1.0	13.1	12.8	13.7	23.8	60.1	72.9	67.2
MS Maverick	6/12	31.5	2.5	13.4	13.1	13.1	36.6	61.4	83.2	75.1
SY Monument	6/12	31.2	1.0	13.2	12.7	12.6	27.9	58.4	71.0	71.1
Keldin	6/13	32.8	1.3	12.7	12.6	12.7	33.8	58.7	76.6	79.1
WB4422	6/11	30.4	1.0	13.9	13.6	--	29.7	60.6	75.5	--
WB4309	6/10	32.5	2.3	13.0	14.2	13.5	26.5	58.4	58.1	64.3
LCS Steel AX	6/12	32.6	1.5	13.4	11.4	--	26.2	59.0	70.8	--
LCS Chrome	6/11	32.8	1.0	13.5	13.1	--	28.5	60.6	71.2	--
Trial Mean	6/13	33.9	1.3	13.4	12.6	--	28.8	59.6	73.3	--
C.V. (%)	1	4.9		2.4	1.5	--	5.7	1.0	3.7	--
LSD (0.10)	1	1.9		0.4	0.2	--	1.9	0.7	3.1	--

Planting Date = September 20, 2023; Harvet Date = August 2, 2024; Previous Crop = Forage Barley

*Best Linear Unbiased Estimate after spatial analysis.

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

Durum - Dryland										Carrington
				------- Protein -------				---------- Yield ---------		
Variety	Days to Heading	Plant Height	Lodging	2024*	3-yr. Avg.	KWT	Test Weight*	2024*	2-yr. Avg.	3-yr. Avg.
	days	inches	1-9	--------- % ---------		g/1000	lb/bu	---------- bu/a ---------		
Maier	61	37	2	12.9	13.7	37	57.9	60.6	52.4	51.9
Mountrail	61	41	2	12.0	13.2	33	55.3	65.5	56.8	56.6
Alkabo	61	39	1	12.0	13.4	36	57.6	66.2	57.6	54.3
Divide	62	43	1	12.0	13.1	38	57.6	67.3	60.6	56.4
Carpio	62	41	3	12.5	13.5	40	58.3	66.3	57.2	57.4
Joppa	61	39	2	11.8	12.4	36	57.0	68.7	57.1	55.3
ND Grano	62	42	2	12.2	13.0	33	57.4	65.5	58.6	56.5
ND Riveland	62	44	2	12.3	13.3	39	58.6	71.7	63.1	58.0
ND Stanley	62	40	1	12.3	13.6	36	58.0	67.0	58.6	54.3
Strongfield	62	40	1	12.8	13.6	34	55.8	57.9	54.0	54.4
CDC Defy	61	43	1	12.5	13.3	36	57.8	67.0	62.0	59.0
Trial Mean	62	40	1	12.2	--	37	58.0	65.3	--	--
C.V. (%)	1	4	32	1.9	--	4	0.6	3.2	--	--
LSD (0.10)	1	2	1	0.2	--	2	0.2	1.5	--	--

Planting Date = April 25; Harvest Date = August 20; Previous Crop = Soybean

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

* Best Linear Unbiased Estimate

High levels of scab were observed.

Pennycress nursery.

Durum - Irrigated — Carrington

Variety	Days to Heading	Plant Height	Lodging	Protein 2024	Protein 2-yr. Avg.	KWT	Test Weight	Yield 2024	Yield 2-yr. Avg.
	days	inches	1-9	%	%	g/1000	lb/bu	bu/a	bu/a
Mountrail	57	40	6	14.0	13.4	31.6	53.1	51.6	45.6
Divide	58	40	4	14.0	13.4	33.6	55.3	62.0	53.0
Carpio	58	41	6	14.1	13.6	34.9	56.6	54.0	48.7
Joppa	57	41	4	13.5	13.0	32.8	55.6	65.9	56.7
ND Riveland	57	41	5	14.2	13.5	33.3	55.6	63.1	58.6
ND Grano	57	40	6	14.1	13.6	34.4	55.9	62.0	54.4
ND Stanley	58	39	6	14.1	13.4	34.1	56.3	63.8	57.4
Trial Mean	57	40	5	14.2	--	34.0	55.1	60.2	--
C.V. (%)	2	6	28	3.6	--	7.2	1.4	9.0	--
LSD (0.10)	1	3	2	0.6	--	2.9	0.9	6.4	--

Planting Date = May 14; Harvest Date = September 5; Previous Crop = Field Pea

Durum - Organic — Carrington

Variety	Days to Heading	Plant Height	Lodging	Protein	KWT*	Test Weight*	Yield*
	days	inches	1-9	%	g/1000	lb/bu	bu/a
Maier	65	40	3	15.1	27.3	50.3	39.0
Mountrail	66	42	6	14.4	27.1	49.6	35.0
Alkabo	65	40	3	14.0	25.7	50.5	46.9
Divide	64	40	3	14.6	29.2	49.4	50.2
Tioga	65	42	4	14.6	31.0	49.7	48.9
Carpio	68	41	6	15.8	28.3	49.4	43.7
Joppa	65	42	4	14.0	29.5	50.3	49.1
ND Grano	66	42	5	14.8	27.0	49.7	44.9
ND Riveland	66	42	4	14.6	28.4	49.6	47.3
ND Stanley	66	41	3	14.3	29.1	51.0	54.4
Strongfield	67	40	5	16.8	24.7	46.4	32.4
CDC Defy	65	43	4	15.3	27.1	50.4	45.8
Trial Mean	65	41	4	14.9	28.1	50.0	46.6
C.V. (%)	1	2	26	2.9	4.0	1.2	7.0
LSD (0.10)	1	1	1	0.5	0.9	0.5	2.5

Planting Date = April 24; Harvest Date = August 20; Previous Crop = Fallow

*Best Linear Unbiased Estimate

Barley - Irrigated — Carrington

Variety	Days to Heading	Plant Height	Lodging	Plump	1000 KWT	Protein 2024	Protein 3-yr. Avg.	Test Weight	Yield 2024	Yield 3-yr. Avg.
	days	inches	1-9	%	grams	%	%	lb/bu	bu/a	bu/a
Two Row										
Conlon	48	33	5	97	44	11.9	12.8	51.7	90	74.3
Pinnacle	50	36	2	96	42	10.8	11.4	50.9	108	86.9
ND Genesis	49	35	2	96	41	10.8	11.5	51.4	117	100.0
AAC Synergy	51	33	7	94	42	11.2	12.2	51.0	108	88.7
CDC Fraser	55	33	2	96	44	11.3	12.0	50.4	109	95.1
Explorer	55	27	4	94	47	10.8	12.1	49.5	106	89.0
AAC Connect	50	34	6	91	41	11.8	12.4	50.3	102	89.2
Brewski	50	34	5	94	41	11.0	11.8	51.8	115	98.0
CDC Prairie	50	35	6	93	40	11.6	--	51.2	104	--
ABI Cardinal	55	35	7	92	37	11.8	12.2	48.8	98	92.6
Firefoxx	55	30	7	82	31	9.9	--	42.4	94	--
Winston	56	29	7	96	38	10.0	--	45.7	98	--
KWS Thalis	51	27	4	93	36	10.1	--	47.1	109	--
KWS Jessie	50	26	3	93	35	10.1	--	44.6	99	--
KWS Enduris	53	31	6	95	37	10.2	--	44.5	103	--
KWS Imagis	54	28	4	93	41	10.2	--	44.2	98	--
Six Row										
Tradition	49	38	2	92	33	12.6	13.0	48.9	115	90.0
ND Treasure	49	35	3	94	33	11.4	12.2	47.6	120	105.1
Trial Mean	51	32	4	93	39	10.9	--	48.7	108	--
C.V. (%)	2	6	41	2	12	3.7	--	1.2	6	--
LSD (0.10)	1	2	2	2	6	0.5	--	0.7	8	--

Planting Date = May 5; Harvest Date = August 12; Previous Crop = Flax

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

Barley										**Barnes County - Dazey**
					------- Protein -------			---------- Yield ----------		
Variety	Days to Heading	Plant Height	Lodging	Plump	2024	3-yr. Avg.	Test Weight	2024	2-yr. Avg.	3-yr. Avg.
	days	inches	1-9	%	---------- % ----------		lb/bu	---------- bu/a ----------		
Two Row										
Conlon	52	31	4	93	14.3	14.7	44.0	73	71.8	71.9
Pinnacle	54	31	3	94	12.1	12.6	42.9	85	89.5	85.2
ND Genesis	55	32	2	92	12.1	12.4	45.1	98	100.7	95.3
AAC Synergy	57	31	5	94	13.0	13.3	41.7	92	98.2	92.3
CDC Fraser	60	30	3	95	13.2	13.8	40.3	91	99.9	88.4
Explorer	58	27	3	91	13.9	13.6	41.9	71	83.5	82.7
AAC Connect	57	32	5	92	12.8	13.5	41.9	100	105.1	96.7
Brewski	55	33	4	93	12.6	12.7	44.2	92	95.7	91.1
CDC Prairie	56	31	3	89	13.3	--	41.1	91	--	--
ABI Cardinal	57	29	3	91	13.6	14.1	40.2	93	98.1	87.4
KWS Thalis	56	27	4	92	13.4	--	41.8	82	--	--
KWS Jessie	56	25	3	92	12.5	--	40.1	83	--	--
KWS Enduris	58	28	2	97	12.4	--	41.1	96	--	--
Six Row										
Tradition	53	33	2	84	14.1	13.8	41.1	90	101.3	97.7
ND Treasure	53	31	2	90	13.4	13.4	40.7	103	102.1	98.3
Trial Mean	56	30	3	92	13.1	--	41.9	89	--	--
C.V. (%)	2	6	30	4	4.6	--	2.5	8	--	--
LSD (0.10)	1	2	1	4	0.7	--	1.2	8	--	--

Planting Date = May 10; Harvest Date = August 21; Previous Crop = Soybean

Barley									**Tri-County - Wishek**
				-------- Protein --------			---------- Yield ----------		
Variety	Days to Heading	Plant Height	Plump	2024	3-yr. Avg.	Test Weight	2024*	2-yr. Avg.	3-yr. Avg.
	days	inches	%	---------- % ----------		lb/bu	---------- bu/a ----------		
Two Row									
Conlon	51	31	88	17.9	15.8	44.2	48.8	58.7	54.3
Pinnacle	53	32	86	14.4	--	43.3	78.8	--	--
ND Genesis	52	35	91	13.3	12.9	44.8	68.9	80.0	78.0
AAC Synergy	55	33	87	15.9	15.0	44.4	90.0	92.7	83.8
CDC Fraser	56	31	90	16.2	15.1	46.2	76.5	86.3	75.4
Explorer	54	28	88	15.7	14.9	45.4	82.6	74.1	64.7
AAC Connect	54	33	80	15.8	--	44.2	80.5	--	--
Brewski	55	30	87	13.7	13.3	44.8	85.1	82.0	81.7
CDC Prairie	53	31	79	15.5	--	45.0	65.8	--	--
ABI Cardinal	55	33	91	15.6	15.1	46.2	89.4	91.7	80.1
Six Row									
Tradition	51	31	79	15.9	15.2	44.0	81.3	87.5	83.8
ND Treasure	51	30	84	16.2	15.1	43.2	88.9	88.8	81.9
Trial Mean	53	31	86	15.5	--	44.6	79.8	--	--
C.V. (%)	2	5	4	4.2	--	2.1	8.3	--	--
LSD (0.10)	1	2	4	0.8	--	1.1	5.4	--	--

Planting Date = May 20; Harvest Date = August 29; Previous Crop = Soybean

No significant lodging was observed.

*Best Linear Unbiased Estimate

Barley drill strip demonstration.

Barley - Organic — Carrington

Variety	Days to Heading	Plant Height	Lodging	Protein	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	days	inches	1-9	%	lb/bu	bu/a	bu/a	bu/a
Two Row								
Conlon	58	37	5	15.0	47.0	85.1	61.9	54.4
Pinnacle	61	37	6	13.6	45.1	84.5	--	--
ND Genesis	61	37	6	12.9	45.5	89.3	73.3	66.3
Brewski	61	37	9	13.8	44.9	92.0	76.8	68.7
CDC Prairie	64	39	7	14.5	45.7	86.6	--	--
ABI Cardinal	65	39	5	15.0	44.6	84.8	67.6	--
Six Row								
Tradition	59	38	4	14.9	43.8	95.0	77.6	69.0
ND Treasure	60	38	3	14.6	43.2	109.3	81.9	--
Trial Mean	61	38	5	14.2	44.6	91.7	--	--
C.V. (%)	1	7	50	2.7	1.8	9.1	--	--
LSD (0.10)	1	3	3	0.5	0.9	10.1	--	--

Planting Date = April 24; Harvest Date = August 6; Previous Crop = Fallow

Canola date of planting study.

Canola - Liberty Link Cultivars													**Carrington**
Brand	Hybrid	Blackleg Resistance	Clubroot Resistant	Herbicide Trait	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Oil	1000 KWT	Test Weight	Yield	
					DAP	days	DAP	inches	%	grams	lb/bu	lb/a	
Croplan	CP7130LL	R	Yes	LL	43	19	82	46	39.1	2.9	52.7	1885	
Croplan	CP7250LL	R	Yes	LL	46	19	84	47	37.6	2.7	53.4	1652	
Dyna-Gro	DG 661 LCM	R	Yes	LL	44	19	82	48	41.4	2.7	53.0	1850	
Dekalb	DK400TL	R	Yes	TFLL	41	21	81	46	40.9	3.0	50.5	1755	
Dekalb	DK800LL	R	Yes	LL	43	20	82	48	41.6	3.1	51.8	2040	
Dekalb	DK801LL	R	Yes	LL	42	20	82	46	42.2	3.1	51.8	2171	
Dekalb	DK401TL	R	Yes	TFLL	12	20	81	50	41.6	3.1	51.6	1979	
DL Seeds Inc	DL226031LL	R	Yes	LL	47	19	84	50	40.8	2.9	52.5	2038	
DL Seeds Inc	DL231434LL	R	Yes	LL	48	18	83	47	38.2	2.7	54.0	1747	
DL Seeds Inc	DL231439LL	R	Yes	LL	43	20	81	47	39.3	2.9	53.5	1782	
DL Seeds Inc	DL231558LL	R	Yes	LL	44	21	84	46	41.0	2.9	52.3	1892	
DL Seeds Inc	DL231727LL	R	Yes	LL	48	18	83	45	40.9	3.0	52.2	1915	
DL Seeds Inc	DL231732LL	R	Yes	LL	44	20	82	48	42.3	3.2	51.6	1887	
DL Seeds Inc	DL231851LL	R	Yes	LL	44	19	82	47	38.6	2.7	53.5	1984	
DL Seeds Inc	DL231958LL	R	Yes	LL	47	19	83	47	40.1	3.4	53.2	2054	
BrettYoung	BY 7204LL	R	Yes	LL	44	20	83	49	42.1	3.2	51.9	2039	
InVigor	L340PC	R	Yes	LL	43	19	82	47	39.7	3.0	52.2	2591	
InVigor	L343PC	R	Yes	LL	43	19	82	48	40.5	2.8	51.7	2329	
InVigor	L345PC	R	Yes	LL	43	19	82	47	40.1	2.9	52.6	2519	
InVigor	L350PC	R	Yes	LL	48	17	84	49	40.5	2.8	52.6	2185	
InVigor	LR354PC	R	Yes	TFLL	45	19	83	49	40.4	2.7	53.1	2494	
InVigor	LR344PC	R	Yes	TFLL	44	18	83	46	40.1	2.7	52.1	2112	
InVigor	L333PC	R	Yes	LL	45	18	83	47	39.6	2.7	53.0	2283	
Trial Mean					44	19	83	47	40.4	2.9	52.5	2051	
C.V. (%)					2	5	1	6	2.5	7.4	0.5	9	
LSD (0.10)					1	1	1	3	1.2	0.3	0.3	214	

Planting Date = May 16; Harvest Date = September 9; Previous Crop = Chickpea

Significant hail storm occurred on July 22 with plant/seed pod bruising.

Canola - Roundup Ready Cultivars **Carrington**

Brand	Hybrid	Blackleg Resistance	Clubroot Resistant	Herbicide Trait	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Oil	1000 KWT	Test Weight	Yield*
					DAP	days	DAP	inches	%	grams	lb/bu	lb/a
Croplan	CP9978TF	R	N/A	TF	54	21	94	45	41.9	2.9	52.3	2296
Croplan	CP9221TF	R	Yes	TF	54	19	92	40	41.0	3.2	52.3	2043
Dyna-Gro	DG 781 TCM	R	Yes	TF	54	19	93	45	42.5	3.4	51.2	1886
Dyna-Gro	DG 760 TM	R	No	TF	54	17	94	45	41.0	3.1	52.1	2147
Dekalb	DK902TF	R	Yes	TF	53	18	91	41	42.3	2.9	51.8	1979
Dekalb	DK900TF	R	Yes	TF	54	19	92	41	43.4	2.8	51.4	1877
DL Seeds Inc	DL226040TF	R	Yes	TF	59	18	96	52	42.5	3.0	52.1	1992
DL Seeds Inc	DL226196TF	R	Yes	TF	59	17	94	48	41.5	2.9	52.5	1828
Star Specialty Seed	Starflex	R	No	TF	54	19	91	40	43.1	2.8	51.8	1791
BrettYoung	BY 6219TF	R	Yes	TF	54	21	93	44	41.0	3.1	52.0	2066
Proseed	TR 23127	R	Yes	TF	63	19	93	39	41.9	3.1	52.1	1750
InVigor	LR354PC	R	Yes	TFLL	56	18	93	47	42.4	2.9	52.5	2352
InVigor	LR344PC	R	Yes	TFLL	55	18	92	44	41.2	2.7	51.7	2075
Nuseed	NC527CR TF	R	Yes	TF	55	19	93	43	41.4	3.1	51.1	1814
Trial Mean					55	19	93	44	41.9	3.0	51.9	1960
C.V. (%)					7	7	1	8	1.8	7.3	0.5	4
LSD (0.10)					5	2	2	4	0.9	0.3	0.3	81

Planting Date = May 6; Harvest Date = September 9; Previous Crop = Chickpea

Significant hail storm occurred on July 22 with plant/seed pod bruising.

*Best Linear Unbiased Estimate

Flax								Carrington
						---------- Yield ----------		
		Days to	Plant	Oil	Test		2-yr.	3-yr.
Variety	Color	Flower	Height	Content	Weight	2024	Avg.	Avg.
		DAP	inches	%	lb/bu	---------- bu/a ----------		
Gold ND	Yellow	54	25	46.4	52.3	30.1	29.0	27.4
Carter	Yellow	52	22	45.8	51.7	27.8	29.0	25.5
Omega	Yellow	51	22	45.3	51.2	20.6	24.6	22.3
AAC Bright	Yellow	52	23	47.7	49.1	21.0	26.0	25.1
CDC Durado	Yellow	49	20	45.2	50.2	17.0	--	--
CDC Melyn	Yellow	54	22	47.8	49.9	20.9	--	--
ND Hammond	Brown	51	23	44.3	51.3	26.4	27.2	25.0
York	Brown	51	23	45.6	51.4	30.6	31.3	27.7
Webster	Brown	53	26	46.2	52.0	29.9	28.8	27.1
CDC Neela	Brown	52	25	46.6	51.6	33.3	31.7	29.6
AAC Marvelous	Brown	52	23	47.6	52.0	29.7	30.4	29.1
CDC Rowland	Brown	51	23	45.5	50.6	31.1	28.6	27.6
CDC Glas	Brown	53	25	45.7	49.8	25.4	28.2	25.5
CDC Kernen	Brown	50	21	47.2	50.4	27.6	28.6	26.6
Trial Mean		52	24	46.3	51.3	28.6	--	--
C.V. (%)		1	8	2.4	1.4	13.1	--	--
LSD (0.10)		1	3	1.5	1.0	5.1	--	--

Planting Date = May 13; Harvest Date = September 12; Previous Crop = Spring Wheat

No significant lodging was observed.

Flax variety trial.

Winter Rye **Carrington**

Variety	Heading Date	Plant Height	Lodging	Harvest Moisture	Protein	KWT	Test Weight	Yield 2024	Yield 2-yr. Avg.
		inches	1-9	%	%	g/1000	lb/bu	bu/a	bu/a
ND Dylan	6/3	42.5	4.3	14.7	11.6	25.1	54.3	68.7	61.5
ND Gardner	5/29	44.1	5.3	14.4	13.3	24.3	53.7	60.3	55.6
Hazlet	6/3	42.8	3.8	14.4	11.3	29.0	55.1	69.8	64.3
Danko	6/3	40.9	2.0	14.4	11.3	28.4	55.3	73.7	64.5
Aroostook	6/3	40.2	3.3	14.8	11.5	28.9	55.3	68.6	55.8
Rymin	6/2	40.5	4.3	14.0	12.1	27.7	54.5	66.9	57.9
Spooner	6/1	41.7	4.3	14.7	12.7	27.7	54.1	59.2	52.5
SU Cossani	6/3	40.1	1.8	14.7	10.2	26.9	54.1	90.6	75.6
SU Perspectiv	6/1	39.5	1.3	14.1	10.3	27.7	53.3	87.6	76.1
SU Karlsson	6/1	41.3	1.3	15.0	10.1	28.6	55.0	94.2	--
SU Performer	6/4	40.0	1.5	14.4	9.5	27.1	54.2	98.7	81.8
SU Bebop	6/3	42.3	2.5	14.6	10.8	27.1	54.7	83.4	71.1
KWS Receptor	6/2	40.9	1.5	15.1	9.6	28.7	55.3	112.4	96.4
KWS Serafino	6/2	40.6	1.3	14.8	10.3	30.9	55.1	101.3	86.4
KWS Tayo	6/3	39.7	1.3	15.0	10.6	30.9	53.0	94.8	85.2
Mean	6/2	40.6	2.2	14.9	10.7	28.4	54.2	86.5	--
C.V. (%)	1	7.6		3.2	2.6	5.7	1.2	9.6	--
LSD (0.10)	2	3.6		0.6	0.3	1.9	0.8	9.8	--

Planting Date = September 20, 2023; Harvet Date = August 2, 2024; Previous Crop = Forage Barley

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

Soybean - Irrigated, Conventional Varieties														**Carrington**
												---------- Yield ----------		
Brand	Variety	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	2024	2-yr. Avg.	3-yr. Avg.
			DAP	inches	inches	1-9	%	%	g/1000		lb/bu	---------- bu/a ----------		
NDSU	ND Stutsman	0.7	115	3	32	2	18.2	32.2	139.4	3260	54.3	68.0	72.1	71.2
NDSU	ND Rolette	00.9	108	4	30	2	17.9	33.0	124.1	3657	54.7	56.9	60.8	64.2
NDSU	ND Benson	0.4	113	4	31	2	17.1	35.1	125.2	3626	54.7	53.0	57.4	58.6
NDSU	ND Dickey	0.7	115	4	30	1	17.2	33.7	155.9	2911	54.1	65.7	65.5	64.3
Richland IFC	MK009	00.9	111	3	30	3	16.7	32.1	71.0	6395	55.1	42.0	45.6	47.5
Richland IFC	MK0249	0.2	111	3	29	2	17.3	32.2	89.9	5053	55.0	45.6	49.9	52.7
Richland IFC	MK0603	0.6	117	5	33	5	15.8	34.4	84.6	5369	54.8	54.6	61.9	60.5
Peterson Farms Seed	Aya	0.7	115	3	30	1	16.9	35.7	185.8	2453	53.9	63.6	--	--
Peterson Farms Seed	Wilma	1	120	4	32	1	17.3	33.4	185.7	2442	54.7	73.6	--	--
Trial Mean			114	4	31	2	17.2	33.5	129.1	3907	54.6	58.1	--	--
C.V. (%)			1	27	6	33	0.7	0.8	4.5	4	0.7	4.9	--	--
LSD (0.10)			1	1	2	1	0.2	0.3	7.1	211	0.5	3.4	--	--

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

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

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

Brand	Variety	Trait	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	inches	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	105	3	32	17.4	33.5	141.5	3206	55.1	51.5	56.5	58.0
NDSU	ND2108GT73	GT	0.8	119	3	34	17.8	33.4	139.2	3262	55.0	66.8	74.8	70.8
NDSU	ND17009GT	GT	00.9	107	3	32	17.8	34.6	159.1	2852	55.9	47.8	55.4	55.7
Dyna-Gro	S07EN45	Enlist E3	0.7	118	2	31	17.9	31.5	131.7	3447	54.9	67.3	--	--
Fortus	0544E	Enlist E3	0.5	117	2	32	17.7	33.0	144.6	3138	54.2	63.4	--	--
NK Seeds	NK02-W8E3	Enlist E3	0.2	110	2	31	17.7	33.7	148.5	3054	54.0	66.7	--	--
NK Seeds	NK06-A1E3	Enlist E3	0.6	115	3	33	18.0	32.6	162.8	2787	54.0	71.8	--	--
Legacy Seeds	LS032-23 E	Enlist E3	0.3	115	3	30	17.3	33.2	147.0	3086	54.0	62.8	72.9	--
Legacy Seeds	LS052-24 E	Enlist E3	0.5	115	3	33	18.0	32.8	143.6	3160	53.7	66.8	--	--
Legacy Seeds	LS052-23 E	Enlist E3	0.5	116	2	31	17.7	33.0	148.6	3055	54.1	71.1	78.5	--
Dyna-Gro	S05XF73	RR2XF	0.5	116	4	36	17.6	32.9	139.5	3261	54.2	64.7	78.2	73.5
Integra Seed	XF0493	RR2XF	0.4	117	3	32	18.3	33.0	152.1	2982	54.2	55.2	69.1	--
NK Seeds	NK02-Y2XF	RR2XF	0.3	109	2	32	18.2	31.9	159.7	2841	54.6	62.3	--	--
NK Seeds	NK03-J1XF	RR2XF	0.3	110	3	32	18.3	33.2	165.6	2740	53.7	68.5	--	--
NK Seeds	NK06-C4XF	RR2XF	0.6	113	3	35	17.1	31.4	144.0	3159	54.5	66.5	--	--
NK Seeds	NK08-R3XF	RR2XF	0.8	118	4	37	17.7	33.1	173.8	2610	54.6	75.0	--	--
Legacy Seeds	LS044-23 XF	RR2XF	0.4	116	3	34	18.3	33.3	156.1	2923	54.3	64.7	78.4	--
Legacy Seeds	LS064-23 XF	RR2XF	0.6	116	2	32	17.8	33.2	150.5	3017	54.7	67.3	77.2	--
Trial Mean				114	3	33	17.8	33.0	149.4	3052	54.5	63.8	--	--
C.V. (%)				1	27	4	0.8	0.6	3.5	4	0.3	6.6	--	--
LSD (0.10)				1	1	1	0.2	0.3	6.1	126	0.2	5.0	--	--

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

No significant differences in lodging were observed.

Soybean - Conventional Varieties **Barnes County - Dazey**

Brand	Variety	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
			DAP	inches	inches	1 - 9	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	0.7	123	2	33	1	18.2	32.0	157.6	2878	52.2	71.0	64.5	64.6
NDSU	ND Rolette	00.9	117	3	30	1	18.1	32.4	124.7	3641	52.6	64.0	59.3	60.2
NDSU	ND Benson	0.4	121	3	24	1	17.6	34.5	154.3	2943	52.2	62.6	58.1	59.1
NDSU	ND Dickey	0.7	122	2	27	1	17.8	32.6	175.8	2582	51.7	72.6	65.9	65.6
Richland IFC	MK009	00.9	119	2	27	1	16.7	32.4	84.3	5386	53.1	56.7	51.8	51.7
Richland IFC	MK0249	0.2	119	2	28	2	17.3	31.7	101.0	4496	52.7	60.0	55.6	56.8
Richland IFC	MK0603	0.6	123	4	35	3	15.7	34.1	94.6	4797	52.1	58.6	54.1	53.8
Richland IFC	MK808CN	0.8	123	2	31	2	18.6	31.8	149.5	3039	52.4	63.5	59.8	61.1
Richland IFC	MK1023	1	125	2	29	1	16.3	32.3	99.0	4582	53.0	55.2	52.1	50.4
Richland IFC	MK9102	1.2	126	3	39	2			220.4	2062	55.4	52.4	53.0	--
Richland IFC	Decker	1	123	4	27	1			156.6	2898	54.9	52.9	48.0	--
Richland IFC	MK41	1.1	120	2	34	1	16.6	34.8	181.3	2502	52.4	69.4	66.0	63.7
Richland IFC	MK146	1.1	126	2	30	1	17.5	34.9	174.2	2607	51.9	60.7	63.9	--
Trial Mean			122	3	30	1	13.3	32.1	144.1	3416	52.8	61.5	--	--
C.V. (%)			1	26	12	24	1.2	1.5	3.5	3	0.8	11.5	--	--
LSD (0.10)			2	1	5	0	0.2	0.6	5.9	121	0.5	8.4	--	--

Planting Date = May 17; Harvest Date = October 7; Previous Crop = Spring wheat/barley

Soybean - Dryland, Roundup Ready Varieties — Barnes County - Dazey (Page 1 of 2)

Brand	Variety	Trait	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	inches	1-9	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	117	2	29	2	17.6	33.4	145.4	3127	52.9	42.5	41.6	42.3
NDSU	ND2108GT73	GT	0.8	126	3	31	1	17.8	32.8	143.2	3179	52.5	68.3	61.2	58.4
NDSU	ND17009GT	GT	00.9	119	3	30	1	18.2	34.2	167.5	2709	53.3	52.4	48.7	48.1
Dyna-Gro	S07EN45	Enlist E3	0.7	125	2	28	1	18.0	31.5	152.7	2971	52.3	73.8	--	--
Thunder Seed	TE7407N	Enlist E3	0.7	123	3	30	1	17.3	32.7	166.7	2725	52.5	73.0	--	--
Thunder Seed	TE7509N	Enlist E3	0.9	123	3	29	1	17.0	33.5	184.1	2464	52.8	71.2	--	--
Legacy Seeds	LS092-22 E	Enlist E3	0.9	124	3	27	1	18.6	31.8	150.4	3023	51.8	71.5	67.3	67.4
Legacy Seeds	LS082-24 E	Enlist E3	0.8	125	3	30	1	18.7	31.9	197.5	2297	51.6	76.3	--	--
Legacy Seeds	LS102-22 E	Enlist E3	1	126	3	29	1	17.3	32.7	159.5	2846	51.6	76.3	72.2	68.4
Fortus	0544E	Enlist E3	0.5	123	2	28	1	18.0	32.5	159.9	2840	52.1	51.4	--	--
Fortus	0831E	Enlist E3	0.8	125	3	30	1	17.6	33.0	175.8	2584	51.9	69.5	--	--
Dyna-Gro	S09XF55	RR2XF	0.9	126	4	32	1	17.4	32.7	170.0	2669	52.3	79.4	--	--
NK Seeds	NK02-Y2XF	RR2XF	0.3	120	3	31	1	18.2	31.7	168.0	2702	52.4	66.9	--	--
NK Seeds	NK03-J1XF	RR2XF	0.3	120	3	30	1	18.0	32.9	172.9	2623	51.8	62.1	--	--
NK Seeds	NK06-C4XF	RR2XF	0.6	123	3	33	2	16.7	31.3	160.4	2829	52.5	66.5	--	--
NK Seeds	NK08-R3XF	RR2XF	0.8	124	3	32	1	17.5	32.8	176.1	2581	52.3	76.7	--	--
Thunder Seed	TX8305N	RR2XF	0.5	124	2	29	1	17.6	33.7	183.9	2472	52.5	74.8	68.4	--
Thunder Seed	TX8307N	RR2XF	0.7	125	3	33	1	17.0	32.5	178.5	2544	52.8	76.7	71.4	67.2
Thunder Seed	TX8309N	RR2XF	0.9	126	2	32	2	16.9	32.9	154.5	2940	52.4	71.3	67.9	64.9
Proseed	XF 30-42	RR2XF	0.4	123	3	30	1	17.7	32.9	165.4	2744	51.7	68.0	66.1	--
Trial Mean				124	3	30	1	17.7	32.7	166.2	2752	52.3	69.2	--	--
C.V. (%)				1	22	6	20	1.2	1.5	3.5	4	0.7	12.8	--	--
LSD (0.10)				1	1	2	0	0.3	0.6	6.8	118	0.5	10.4	--	--

Planting Date = May 17; Harvest Date = October 7; Previous Crop = Spring wheat/barley

Soybean - Dryland, Roundup Ready Varieties **Barnes County - Dazey (Page 2 of 2)**

Brand	Variety	Trait	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	inches	1-9	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
Proseed	XF 50-52N	RR2XF	0.5	123	2	29	1	16.9	34.5	187.6	2422	52.9	77.7	--	--
Proseed	XF 50-62N	RR2XF	0.6	124	2	34	1	18.4	31.3	166.1	2732	51.9	70.3	--	--
Legacy Seeds	LS094-24 XF	RR2XF	0.9	127	5	33	1	17.4	32.7	168.0	2700	52.2	81.2	--	--
Legacy Seeds	LS104-24 XF	RR2XF	1	127	4	33	1	17.8	32.0	167.6	2709	51.8	75.7	--	--
Legacy Seeds	LS124-23 XF	RR2XF	1.2	128	2	29	1	17.8	33.4	177.8	2554	51.8	74.6	71.2	--
Trial Mean				124	3	30	1	17.7	32.7	166.2	2752	52.3	69.2	--	--
C.V. (%)				1	22	6	20	1.2	1.5	3.5	4	0.7	12.8	--	--
LSD (0.10)				1	1	2	0	0.3	0.6	6.8	118	0.5	10.4	--	--

Planting Date = May 17; Harvest Date = October 7; Previous Crop = Spring wheat/barley

Soybean - Dryland, Conventional Varieties												**Wishek**
Brand	Variety	Mat Group	Time to Maturity	Pod Ht	Plant Ht	Lodging	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield
			DAP	inches	inches	1-9	%	%	g/1000		lb/bu	bu/a
NDSU	ND Stutsman	0.7	117	5	30	1	18.0	33.4	142.6	3187	54.4	54.1
NDSU	ND Rolette	00.9	114	4	28	2	17.9	33.9	128.5	3533	54.2	48.9
NDSU	ND Benson	0.4	117	5	28	1	17.4	35.9	145.5	3123	54.3	51.2
NDSU	ND Dickey	0.7	119	8	29	1	17.0	34.6	157.5	2891	54.1	56.2
Richland IFC	MK009	00.9	117	4	29	4	16.2	34.3	70.5	6453	54.8	44.2
Richland IFC	MK0603	0.6	116	3	31	5	15.5	35.3	87.4	5207	54.7	45.6
Richland IFC	MK808CN	0.8	117	5	31	2	18.6	32.5	129.9	3496	55.0	43.8
Richland IFC	MK9102	1.2	123	8	39	1			210.0	2167	56.3	43.4
Richland IFC	Decker	1	116	4	27	4			130.5	3477	56.5	26.6
Richland IFC	MK41	1.1	116	3	33	2	16.4	37.2	178.9	2544	54.1	58.2
Richland IFC	MK146	1.1	125	5	30	1	17.5	36.1	162.1	2803	53.6	55.5
Peterson Farms Seed	Wilma	1	129	4	34	2	16.9	35.2	188.6	2410	54.3	65.8
Trial Mean			119	5	31	2	12.8	33.6	144.3	3441	54.7	49.5
C.V. (%)			4	35	8	46	2.4	1.9	4.5	6	0.6	9.8
LSD (0.10)			6	2	3	1	0.4	0.8	7.8	228	0.4	5.8

Planting Date = May 20; Harvest Date = October 8; Previous Crop = Wheat

Soybean - Dryland, Roundup Ready Varieties — Wishek

Brand	Variety	Trait	Mat Group	Time to Maturity	Plant Ht	Oil	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	%	%	g/1000		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	115	29	17.5	33.4	133.9	3385	54.6	40.0	42.0	--
NDSU	ND2108GT73	GT	0.8	119	30	17.3	33.6	129.6	3504	54.8	55.5	55.3	53.0
NDSU	ND17009GT	GT	00.9	113	32	17.7	35.7	151.1	3005	55.1	39.8	42.4	43.7
Dyna-Gro	S07EN45	Enlist E3	0.7	119	27	17.6	32.4	135.5	3352	54.8	56.2	--	--
Dyna-Gro	S09XF55	RR2XF	0.9	119	33	17.0	35.1	148.3	3066	54.6	60.6	--	--
Trial Mean				117	30	17.5	34.0	138.2	3299	54.7	49.5	--	--
C.V. (%)				3	9	2.0	1.7	4.0	4	0.4	11.4	--	--
LSD (0.10)				4	3	0.4	0.7	6.8	162	0.3	6.9	--	--

Planting Date = May 20; Harvest Date = October 8; Previous Crop = Wheat

No significant lodging was observed.

Carrington dryland soybeans after hail on July 22.

Soybean - Irrigated, Conventional Varieties													**Dickey County - Oakes**
								Seed			--- Seed Yield ---		
Brand	Variety	Mat Group[1]	Time to Mat.	Pod Ht	Plant Ht	Lodging	Seeds/ Pound	Oil	Protein	Test Wt	2024	2-yr. Avg.	
			DAP	inches	inches	1 to 9		%	%	lb/bu	---- bu/ac ----		
NDSU	ND Benson	0.4	119	5.0	30.8	6.8	2373	18.5	38.9	54.4	58.9	61.7	
NDSU	ND Dickey	0.7	120	5.5	38.5	2.3	2029	18.3	36.2	55.6	73.6	76.0	
NDSU	ND Rolette	0.9	111	5.5	37.3	1.8	2750	19.2	35.8	55.8	70.2	--	
NDSU	ND Stutsman	0.7	123	6.3	39.3	4.3	2248	18.9	35.9	55.4	77.4	--	
Peterson Farms Seed	Aya	0.7	119	5.0	35.5	4.3	1861	17.9	38.7	55.8	75.9	--	
Peterson Farms Seed	Wilma	1.0	124	5.5	36.3	6.5	1975	18.3	36.6	55.5	81.9	--	
Trial			119.4	5.5	36.3	4.3	2206	18.5	37.0	55.4	76.1	--	
C.V (%)			0.7	12.8	8.6	15.1	2.2	1.0	0.9	2.8	7.2	--	
LSD (0.10)			1.1	0.9	3.9	0.8	60.8	0.2	0.4	1.9	6.5	--	
LSD (0.05)			1.3	1.1	4.7	1.0	73.9	0.3	0.5	2.3	7.9	--	

Planting Date = May 16; Harvest Date = October 2; Previous Crop = Corn

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

Soybean - Irrigated, Roundup Ready Varieties														**Dickey County - Oakes**
								Seed				Seed Yield		
Brand	Variety	Mat Group[1]	Time to Mat.	Pod Ht	Plant Ht	Lodging	Seeds/ Pound	Oil	Protein	Test Wt	2024	2-yr. Avg.	3-yr. Avg.
			DAP	inches	inches	1 to 9		%	%	lb/bu	-----bu/ac-----		
NDSU	ND21008GT20	00.8	108.0	4.5	28.3	7.0	2575	19.3	35.0	56.4	47.8	--	--
NDSU	ND2108GT73	0.8	122.0	4.3	33.3	4.0	2496	18.8	35.8	55.5	67.0	73.6	73.1
NDSU	ND17009GT	00.9	112.0	5.0	34.3	4.9	2214	19.8	37.0	56.7	48.7	54.9	54.4
Legacy Seeds	LS094-24 XF	0.9	122.8	5.3	36.5	3.4	2185	18.4	36.7	55.7	80.6	--	--
Legacy Seeds	LS092-22 E	0.9	121.5	5.0	32.3	6.2	2500	20.0	35.2	55.3	74.4	79.4	77.5
Legacy Seeds	LS082-24 E	0.8	120.3	6.0	37.8	2.3	1856	19.8	35.2	55.7	71.0	--	--
Legacy Seeds	LS102-22 E	1.0	122.8	5.8	35.0	1.6	2518	19.1	36.2	54.6	75.2	83.7	83.0
Legacy Seeds	LS104-24 XF	1.0	121.8	5.0	38.3	4.2	2272	19.2	34.8	55.2	79.9	--	--
Legacy Seeds	LS124-23 XF	1.2	122.8	5.3	38.0	1.4	2153	18.8	35.9	55.3	75.2	--	--
Legacy Seeds	LS132-24 E	1.2	123.5	4.8	34.0	5.3	2291	20.7	34.8	54.1	78.3	--	--
Trial Mean			120.1	5.1	34.5	4.1	2306	19.3	35.7	55.5	69.1	--	--
C.V. (%)			0.7	17.2	6.1	14.92t	2	0.9	0.8	0.8	7.8	--	--
LSD (0.10)			1.0	1.1	2.6	0.79 - 1.94	55	0.2	0.3	0.6	6.4	--	--
LSD (0.05)			1.3	1.3	3.1	0.98 - 2.28	66	0.3	0.4	0.7	7.7	--	--

Planting Date = May 16; Harvest Date = October 1; Previous Crop = Corn

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

t = highly variable data was transformed for statistical analysis and LSDs are reported as a range.

Soybean - Dryland, Conventional Varieties													**Dickey County - Oakes**
								-- Seed ---			--- Seed Yield ---	
Brand	Variety	Mat Group[1]	Time to Mat.	Pod Ht	Plant Ht	Lodging	Seeds/ Pound	Oil	Protein	Test Wt	2024	2-yr. Avg.
			DAP	inches	inches	1 to 9		%	%	lb/bu	---- bu/ac ----	
NDSU	ND Benson	0.4	120.0	5.0	34.0	4.0	2356	18.9	38.1	53.5	61.4	51.6
NDSU	ND Dickey	0.7	124.0	4.8	35.0	2.8	2081	18.7	36.0	55.6	68.6	60.8
NDSU	ND Stutsman	0.7	117.8	5.5	37.0	1.8	2400	19.4	35.2	55.2	61.2	--
NDSU	ND Rolette	0.9	121.5	6.3	38.5	2.0	2354	19.3	35.7	53.1	67.6	--
Peterson Farms Seed	Aya	0.7	124.0	5.0	33.5	5.8	2051	18.2	38.4	56.0	64.7	--
Peterson Farms Seed	Wilma	1.0	127.3	4.5	35.8	5.0	2022	18.3	37.2	55.9	70.1	--
Trial Mean			122.4	5.2	35.6	3.6	2211	18.8	36.8	54.9	65.6	--
C.V (%)			2.1	17.7	6.3	33.0	6.5	1.1	0.9	4.7	15.1	--
LSD (0.10)			3.1	1.1	2.8	1.5	212	0.3	0.4	3.2	12.3	--
LSD (0.05)			3.8	1.4	3.4	1.8	260	0.3	0.5	3.9	14.9	--

Planting Date = May 13; Harvest Date = October 7; Previous Crop = Soybean

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

Soybean - Dryland, Roundup Ready Varieties **Dickey County - Oakes**

Brand	Variety	Mat Group[1]	Time to Mat.	Pod Ht	Plant Ht	Lodging	Seeds/ Pound	Seed Oil	Seed Protein	Test Wt	Seed Yield 2024	Seed Yield 2-yr. Avg.
			DAP	inches	inches	1 to 9		%	%	lb/bu	-----bu/ac-----	
NDSU	ND21008GT20	00.8	110.5	4.5	33.3	6.5	2563	19.1	35.2	53.8	44.1	42.6
NDSU	ND2108GT73	0.7	126.3	5.0	37.0	1.9	2572	19.0	35.6	54.9	72.5	65.8
NDSU	ND17009GT	00.9	116.0	4.8	37.7	4.2	2361	19.6	37.1	56.7	43.9	44.1
Legacy Seeds	LS094-24 XF	0.9	125.8	5.0	39.0	1.2	2248	18.5	36.6	55.4	90.7	--
Legacy Seeds	LS092-22 E	0.9	125.3	4.8	35.3	4.6	2538	19.6	35.6	55.8	79.8	71.3
Legacy Seeds	LS082-24 E	0.8	125.0	5.0	37.0	1.2	1932	20.3	35.3	56.1	79.8	--
Legacy Seeds	LS102-22 E	1.0	127.3	5.3	37.7	2.0	2494	18.5	36.4	54.4	90.5	81.7
Legacy Seeds	LS104-24 XF	1.0	127.8	5.8	39.7	3.4	2275	19.3	34.9	56.5	89.0	--
Legacy Seeds	LS124-23 XF	1.2	128.3	5.0	37.7	2.0	2195	18.8	36.1	55.1	70.3	74.5
Legacy Seeds	LS132-24 E	1.2	128.8	5.0	37.0	5.6	2239	20.3	36.1	54.0	84.8	--
Trial Mean			124.4	5.1	37.3	3.2	2341	19.3	35.9	55.2	74.7	--
C.V (%)			1.1	25.2	7.2	21.59t	5	1.2	1.2	3.2	17.2	--
LSD (0.10)			1.7	1.6	3.8	0.92 - 2.20	141	0.3	0.5	2.1	15.5	--
LSD (0.05)			2.0	1.9	4.6	1.15 - 2.56	170	0.3	0.6	2.6	18.6	--

Planting Date = May 13; Harvest Date = October 7; Previous Crop = Soybean

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

t = highly variable data was transformed for statistical analysis and LSDs are reported as a range.

Soybean - Dryland, Conventional											**LaMoure County**
										--------- Yield ---------	
Brand	Variety	Trait	Mat Group	Time to Maturity	Plant Ht	Lodging	Oil	Protein	Test Weight	2024	2-yr. Avg.
				DAP	inches	1-5	%	%	lb/bu	---------- bu/a ----------	
NDSU	ND Benson	Conv	0.4	125	33	1	19.1	35.6	56.7	61.0	54.3
NDSU	ND Dickey	Conv	0.7	126	34	1	18.9	34.4	56.2	71.8	65.4
NDSU	ND Rolette	Conv	00.9	120	32	2	19.9	33.4	57.0	60.8	52.0
NDSU	ND Stutsman	Conv	0.7	127	34	1	19.7	33.6	57.4	64.6	--
Richland IFC	MK0603	Conv	0.6	128	38	3	17.1	36.4	56.7	56.3	54.4
Richland IFC	MK808CN	Conv	0.8	128	34	3	20.2	33.9	58.4	56.1	56.0
Richland IFC	MK9102	Conv	1.2	129	45	3			57.9	53.6	50.1
Richland IFC	Decker	Conv	1	123	30	3			58.4	46.5	44.9
Richland IFC	MK41	Conv	1.1	124	35	2	17.5	37.5	56.5	63.3	58.8
Richland IFC	MK146	Conv	1.1	130	32	1	18.4	37.5	56.1	59.4	59.3
Peterson Farms Seed	Wilma	Conv	1	129	38	2	18.4	36.4	56.2	62.1	--
Brushvale	BS91615	Conv	1.2	130	37	1	18.5	36.6	56.6	69.8	--
Trial Mean				127	35	2	18.8	35.4	56.9	61.3	--
C.V. (%)				1	5	22	0.8	1.1	0.6	6.5	--
LSD (0.10)				1	2	1	0.2	0.5	0.5	5.6	--

Planting Date = May 14; Harvest Date = September 24; Previous Crop = Corn followed by rye cover crop

Lodging: 1 = no lodging; 5 = plants lying flat.

Soybean - Dryland, Roundup Ready Varieties — LaMoure County

Brand	Variety	Trait	Mat Group	Time to Maturity	Plant Ht	Lodging	Oil	Protein	Test Weight	Yield 2024	Yield 2-yr. Avg.
				DAP	inches	1-5	%	%	lb/bu	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	116	30	3	19.5	33.8	57.2	46.4	35.9
NDSU	ND17009GT	GT	00.9	119	32	2	19.5	35.7	59.1	53.2	38.1
NDSU	ND2108GT73	GT	0.8	129	33	1	19.3	34.2	57.1	67.5	51.3
Channel	0823RXF	RR2XF	0.8	127	33	1	18.8	34.6	56.6	68.6	--
Channel	0924RXF	RR2XF	0.9	128	40	2	19.7	34.6	56.8	72.7	--
Dyna-Gro	S09XF55	RR2XF	0.9	129	34	1	18.4	36.5	57.0	77.2	--
Proseed	XF 30-72N	RR2XF	0.7	126	33	1	18.7	34.7	56.5	69.4	56.2
Proseed	XF 50-82N	RR2XF	0.8	125	33	1	19.9	33.8	57.2	75.9	--
Proseed	XF 30-92N	RR2XF	0.9	129	35	2	18.1	36.3	57.0	65.9	55.3
Proseed	XF 51-02N	RR2XF	1	129	37	1	19.0	34.8	56.8	70.0	--
Legacy Seeds	LS094-24 XF	RR2XF	0.9	129	34	1	18.2	36.7	57.1	74.8	--
Legacy Seeds	LS092-22 E	Enlist E3	0.9	125	29	1	19.4	34.2	57.0	75.8	55.3
Legacy Seeds	LS082-24 E	Enlist E3	0.8	127	33	1	20.3	33.5	56.3	70.7	--
Legacy Seeds	LS102-22 E	Enlist E3	1	129	33	1	18.6	35.9	56.3	70.9	52.8
Legacy Seeds	LS104-24 XF	RR2XF	1	128	37	1	18.8	34.7	56.7	69.2	--
Legacy Seeds	LS124-23 XF	RR2XF	1.2	130	34	1	19.4	35.5	55.5	70.8	54.3
Legacy Seeds	LS132-24 E	Enlist E3	1.2	130	34	1	20.1	35.3	55.0	69.4	--
Trial Mean				126	33	1	19.2	34.9	56.7	67.8	--
C.V. (%)				1	4	23	1.4	1.1	0.9	3.9	--
LSD (0.10)				1	2	0	0.4	0.5	0.7	3.6	--

Planting Date = May 14; Harvest Date = September 24; Previous Crop = Corn followed by rye cover crop

Lodging: 1 = no lodging; 5 = plants lying flat.

Variety	Market Class	Days to Maturity	Plant Height	Lodging[1]	Direct Harvest[2]	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 3-yr. Avg.
		DAP	inches	1-9	%	%	g/100		lb/bu	lb/a	lb/a
La Paz	Pinto	96	27	2	92	19.0	31.1	1458	62.1	2074	2610
Lariat	Pinto	100	26	4	86	20.3	37.7	1203	61.1	2723	3180
Monterrey	Pinto	95	27	2	95	19.3	31.5	1439	62.3	2445	2870
ND Falcon	Pinto	101	27	4	93	20.5	36.2	1256	58.3	1959	2657
Torreon	Pinto	95	27	2	96	19.5	34.9	1301	61.5	2311	2594
Windbreaker	Pinto	95	25	4	91	19.6	35.5	1280	57.7	2372	2591
Cowboy	Pinto	95	27	2	94	19.8	34.1	1332	61.4	2351	2780
USDA Rattler	Pinto	100	26	3	92	19.3	35.0	1297	60.9	2112	--
Charro	Pinto	99	27	3	95	20.3	34.0	1336	61.5	2825	--
Vibrant	SD-Pinto	95	27	2	94	19.4	30.9	1468	59.1	2291	2382
ND Palomino	SD-Pinto	101	26	4	91	20.0	33.9	1356	58.9	2067	2555
ND Rodeo	SD-Pinto	101	28	4	88	19.9	38.5	1179	62.3	2175	3004
USDA Diamondback	SD-Pinto	100	27	3	95	19.9	33.8	1344	61.9	2634	--
Bronco	SD-Pinto	101	26	4	90	20.9	41.5	1094	63.7	2414	--
Mystic	SD-Pinto	98	28	2	95	20.4	36.6	1239	64.4	2776	--
ND Pegasus	Great Northern	102	28	5	87	21.1	33.5	1353	62.4	2602	3374
Powderhorn	Great Northern	95	25	2	92	19.3	32.1	1415	56.5	1699	--
ND Rosalind	Pink	99	26	4	92	19.0	32.2	1409	63.8	2520	3214
Rosetta	Pink	87	22	8	60	20.1	30	1507	62.1	896	1678
Trial Mean		98	26	3	90	19.9	34.6	1322	61.2	2334	--
C.V. (%)		1	5	20	4	2.1	3.4	4	1.0	11	--
LSD (0.10)		1	2	1	4	0.5	1.4	59	0.7	297	--

Planting Date = May 31; Harvest Date = October 3; Previous Crop = Flax

[1] Lodging: 1 = no lodging, 9 = plants lying flat.

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

Dry Bean - Irrigated — Carrington (Page 2 of 2)

Variety	Market Class	Days to Maturity	Plant Height	Lodging	Direct Harvest[1]	Protein	KWT	Seeds/ Pound	Test Weight	Yield 2024	Yield 3-yr. Avg.
		DAP	inches	1-9	%	%	g/100		lb/bu	lb/a	lb/a
Blizzard	Navy	100	25	1	95	19.9	15.0	3031	59.6	1741	2523
ND Polar	Navy	103	26	3	93	20.6	17.4	2615	60.7	1905	2832
T9905	Navy	100	24	2	96	20.5	18.0	2517	60.0	2093	2782
HMS Medalist	Navy	100	25	1	96	19.7	14.6	3107	59.7	2159	2961
Black Tails	Black	92	26	2	96	20.2	17.9	2539	61.5	2586	2952
Eclipse	Black	96	25	1	96	19.3	18.1	2509	60.1	2518	2778
ND Twilight	Black	95	25	2	95	19.0	18.4	2461	61.1	2222	2810
Merlot	Small Red	95	25	5	78	19.5	32.8	1385	59.3	1844	2171
Viper	Small Red	96	26	3	95	20.1	24.9	1825	60.5	2322	--
Trial Mean		97	25	2	94	20.2	20.7	2350	60.3	2211	--
C.V. (%)		1	5	30	3	2.3	3.0	2	3.0	10	--
LSD (0.10)		2	2	1	4	0.6	0.8	64	2.2	277	--

Planting Date = May 31; Harvest Date = October 3; Previous Crop = Flax

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

Dry Bean, Misc - Irrigated — Dickey County, Oakes

Variety	Market Class	Days to Mat.	Moisture	Seeds/ Pound	Seed Weight	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		DAP	%		g/100	lb/bu	lb/a	lb/a	lb/a
Merlot	Small Red	90	14.7	1133	40.0	59.6	2742	3498	3664
ND Pegasus	Great Northern	90	14.5	1230	36.9	60.7	2582	3258	3915
ND Rosalind	Pink	90	15.3	1246	36.4	60.6	3118	4160	4160
Powderhorn	Great Northern	83	12.9	1362	33.4	59.0	1676	2622	2622
Rosseta	Pink	77	14.3	1362	33.3	59.3	2020	--	--
Viper	Small Red	88	14.7	1615	28.1	60.9	2484	--	--
Trial Mean		87	14.4	1306	35.2	60.1	2489	--	--
C.V. (%)		5.6	2.5	3.5	3.2	0.8	5.6	--	--
LSD (0.10)		4.5	0.3	42	1.1	0.4	130	--	--
LSD (0.05)		5.9	0.4	55	1.4	0.6	169	--	--

Planting Date = May 30; Harvest Date = September 10; Previous Crop = Soybean

Dry Bean, Black - Irrigated — Dickey County, Oakes

Variety	Market Class	Days to Mat.	Moisture	Seeds/ Pound	Seed Weight	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		DAP	%		g/100	lb/bu	bu/a	bu/a	bu/a
Black Tails	Black	89	12.8	2210	20.5	62.9	2364	3211	3281
Eclipse	Black	88	13.0	2051	22.1	62.3	2789	3351	3484
ND Twilight	Black	91	14.1	1808	25.1	62.9	3156	3639	3829
Trial Mean		90	13.6	2001	23	62.1	2977	--	--
C.V. (%)		2.0	2.7	3.7	3.8	0.7	6.0	--	--
LSD 0.10		1.8	0.4	72	0.8	0.4	173	--	--
LSD 0.05		2.4	0.5	95	1.1	0.6	230	--	--

Planting Date = May 30; Harvest Date = September 10; Previous Crop = Soybean

Dry Bean, Navy - Irrigated — Dickey County, Oakes

Variety	Market Class	Days to Mat.	Moisture	Seeds/ Pound	Seed Weight	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		DAP	%		g/100	lb/bu	lb/a	lb/a	lb/a
Blizzard	Navy	91	13.7	2289	19.8	63.2	2389	3267	3509
HMS Medalist	Navy	91	13.6	2518	18.1	63.3	2596	3317	3482
ND Polar	Navy	92	14.1	2357	19.3	62.5	1819	2855	3275
T9905	Navy	92	14.2	2058	22.1	62.9	2531	3430	3618
Trial Mean		92	13.9	2305	19.8	63.0	2334	--	--
C.V. (%)		0.7	2.7	3.7	3.3	0.5	5.7	--	--
LSD (0.10)		0.6	0.4	84	0.6	0.3	130	--	--
LSD (0.05)		0.8	0.5	111	0.9	0.4	172	--	--

Planting Date = May 30; Harvest Date = September 10; Previous Crop = Soybean

Dry Bean, Pinto - Irrigated **Dickey County, Oakes**

Variety	Market Class	Days to Mat.	Moisture	Seeds/ Pound	Seed Weight	Test Weight	Yield 2024	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		DAP	%		g/100	lb/bu	bu/a	bu/a	bu/a
Cowboy	Pinto	84	14.6	1197	37.9	59.8	2244	3225	3776
La Paz	Pinto	88	14.6	1252	36.3	59.8	2034	3030	3675
Lariat	Pinto	88	14.9	1193	38.1	59.3	2508	3266	3515
Monterrey	Pinto	87	14.6	1296	35.1	59.8	2327	3153	3703
ND Falcon	Pinto	92	14.9	1228	37.0	57.2	2131	2921	3066
ND Palomino	SD-Pinto	90	15.7	1189	38.2	58.6	2769	3391	3859
ND Rodeo	SD-Pinto	89	15.4	1109	40.9	61.4	2933	3666	3666
Torreon	Pinto	86	15.1	1149	39.5	60.0	2256	3120	3553
USDA Diamondback	SD-Pinto	89	15.5	1283	35.4	60.2	1950	3051	3051
USDA Rattler	Pinto	89	14.6	1186	38.3	58.8	2451	3301	3301
Vibrant	SD-Pinto	84	13.3	1296	35.0	60.9	2184	2991	3429
Windbreaker	Pinto	82	14.0	1226	37.0	58.7	2367	3281	3753
Trial Mean		88	14.9	1198	38	59.3	2363	--	--
C.V. (%)		3.4	2.6	3.5	3.4	1.0	9.9	--	--
LSD (0.10)		2.7	0.4	39	1.2	0.6	215	--	--
LSD (0.05)		3.5	0.5	50	1.6	0.7	278	--	--

Planting Date = May 30; Harvest Date = September 10; Previous Crop = Soybean

SD-Pinto = slow darkening pinto

White mold management strategies in dry bean.

Buckwheat									**Carrington**
							---------- Yield ----------		
Variety	Days to Flowering	Days to Maturity*	Plant Height	Lodging	KWT	Test Weight*	2024	2-yr. Avg.	3-yr. Avg.
	DAP	DAP	inches	1-9	g/1000	lb/bu	---------- lb/a ----------		
Devyatka	37	103	36	1	29.7	42.5	947	1149	1132
DBP2020	44	104	47	1	28.3	42.6	1175	1278	1428
333106	45	105	46	1	30.0	43.8	1042	--	--
Manor	44	105	48	2	27.8	44.6	1191	--	--
Kenmar	47	103	45	1	31.9	43.7	1033	1443	--
Horizon	46	101	42	1	32.4	43.1	1282	1422	1600
Trial Mean	44	104	44	1	30.0	43.6	1111	--	--
C.V. (%)	2	0	3	19	1.9	1.3	11	--	--
LSD (0.10)	1	0	2	0	0.9	0.9	192	--	--

Planting Date = June 3; Harvest Date =September 19; Previous Crop = Soybean

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

*Best Linear Unbiased Estimate

DBP2020 is a specialty release yet to be named.

Swathing and rolling buckwheat.

Buckwheat - Organic									Carrington
							---------- Yield ----------		
Variety	Days to Flowering	Days to Maturity	Plant Height	Lodging	KWT	Test Weight	2024*	2-yr. Avg.	3-yr. Avg.
	DAP	DAP	inches	1-9	g/1000	lb/bu	---------- lb/a ----------		
Devyatka	35	107	44	4	25.2	38.2	500	1216	1010
DBP2020	43	110	48	4	25.0	37.0	656	1156	1068
333106	46	110	54	3	25.7	39.5	953	--	--
Manor	44	109	46	4	24.6	38.9	831	--	--
Kenmar	46	108	52	3	28.6	37.9	924	1303	--
Horizon	45	107	52	3	28.4	38.0	979	1287	1226
Kota	44	109	50	3	27.2	38.6	811	1286	1250
Trial Mean	43.2	108.4	49.6	3.1	26.4	38.3	807.0	--	--
C.V. (%)	3.1	1.6	8.8	22.6	9.0	3.8	17.4	--	--
LSD (0.10)	1.6	NS	5.3	NS	NS	NS	117.1	--	--

Planting Date = June 3; Harvest Date = September 23; Previous Crop = Fallow

*Best Linear Unbiased Estimate

Devyatka had 3 of 4 plots with considerable nightshade present at harvest.

DBP2020 is a specialty release yet to be named.

Study of the impact of planting date, crop rotation interval, cultivar and fungicide seed treatment on field pea agronomic performance under Fusarium and Aphanomyces pressure.

Field Pea											**Carrington (Page 1 of 2)**
				----- Harvest Ease -----						---------- Yield ----------	
Variety	Brand	Days to Flower	Days to Maturity	2024	3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	2024*	3-yr. Avg.
		days	days	---------- 1 - 9 ----------		%	gram		lb/bu	---------- bu/a ----------	
Yellow Cotyledon Type											
DS Admiral	Pulse USA	59	91	6	4.9	24.4	246	1845	64.1	35.6	44.3
CDC Inca	Meridian Seeds	61	90	5	4.3	25.0	244	1859	64.8	41.7	51.8
ND Dawn	NDSU	59	89	5	5.9	23.7	236	1926	63.1	38.9	46.5
AAC Profit	Premier Genetics	61	91	4	5.3	26.4	217	2096	65.0	38.5	51.8
Majestic	JB Farms	60	90	4	--	27.0	257	1767	63.4	28.8	--
EP_6816	Equinom	60	91	6	--	25.2	210	2166	63.8	33.0	--
EP_8971	Equinom	59	90	7	5.9	24.0	230	1978	63.6	36.5	38.3
EP_6381	Equinom	60	91	6	--	24.7	211	2147	63.5	36.2	--
CDC Spectrum	Meridian Seeds	60	91	4	4.1	27.5	247	1837	64.0	41.6	47.2
MS Growpro	Meridian Seeds	59	90	4	4.5	31.8	305	1491	63.7	39.5	49.5
AAC Beyond	Meridian Seeds	60	90	6	6.1	27.3	218	2079	65.2	42.7	56.8
MS Prostar	Meridian Seeds	60	91	6	6.2	24.9	244	1864	63.7	40.0	47.5
AAC Carver	Meridian Seeds	59	90	6	--	25.6	248	1833	64.0	38.5	--
CP5222Y	Winfield United/Croplan	58	91	5	--	25.3	246	1843	64.7	35.8	--
CP5244Y	Winfield United/Croplan	59	90	7	--	26.4	293	1550	64.2	36.7	--
PG 2601	Pulse Genetics	60	89	6	5.6	28.1	230	1973	64.4	41.6	49.1
PG 8619	Pulse Genetics	59	90	4	--	26.0	231	1963	64.1	38.3	--
PG 8807	Pulse Genetics	60	91	5	--	24.6	235	1931	64.4	41.6	--
MS23-Y1	Meridian Seeds	61	92	5	--	23.4	200	2270	63.7	42.5	--
Trial Mean		60	90	5	--	25.8	238	1905	64.0	37.2	--
C.V. (%)		1	1	22	--	4.8	3	3	0.5	7.4	--
LSD (0.10)		1	1	2	--	1.4	11	84	0.4	2.2	--

Planting Date = May 25; Harvest Date = August 12; Previous Crop = Durum

Variety	Brand	Days to Flower	Days to Maturity	Harvest Ease 2024	Harvest Ease 3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	Yield 2024*	Yield 3-yr. Avg.
		days	days	1 - 9	1 - 9	%	gram		lb/bu	bu/a	bu/a
Yellow Cotyledon Type											
AAC Julius	NDCISA	60	90	4	4.4	26.8	217	2093	64.2	39.4	51.6
Caphorn	NDCISA	60	90	5	--	24.2	263	1726	64.0	38.4	--
PS1710022	NDCISA	59	89	8	6.5	24.3	265	1712	62.9	33.3	46.0
Iconic	NDCISA	60	90	4	--	26.2	290	1565	64.3	37.6	--
Orchestra	Premier Genetics	59	89	5	5.3	25.9	283	1602	64.2	29.3	37.3
PG-Cash	Premier Genetics	60	90	5	--	26.0	267	1702	63.8	39.2	--
PG-Prairie	Premier Genetics	60	90	5	--	26.0	261	1738	64.3	36.3	--
PG-Bank	Premier Genetics	59	91	5	--	25.9	238	1907	64.3	41.1	--
Green Cotyledon Type											
CDC Striker	Pulse USA	60	91	6	5.8	25.8	243	1869	64.3	29.7	40.4
Aragorn	Pulse USA	59	90	8	7.6	25.3	219	2072	62.8	27.5	39.5
Arcadia	Pulse USA	59	90	7	7.1	25.6	227	2000	63.4	36.8	43.3
ND Victory	NDSU	62	92	4	4.2	27.6	160	2843	64.1	26.4	41.5
Bluemoon	JB Farms	60	91	5	--	26.1	257	1768	64.2	34.6	--
MS22-G1	Meridian Seeds	61	93	5	--	25.3	214	2124	65.2	22.4	--
PG-Greenback	Premier Genetics	61	92	6	--	25.3	251	1811	64.8	50.0	--
Trial Mean		60	90	5	--	25.8	238	1905	64.0	37.2	--
C.V. (%)		1	1	22	--	4.8	3	3	0.5	7.4	--
LSD (0.10)		1	1	2	--	1.4	11	84	0.4	2.2	--

Planting Date = May 25; Harvest Date = August 12; Previous Crop = Durum

Brand	Hybrid	Trait	RM	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	Yield 2024*	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	inches	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Channel	183-13VT2	RR2	83	71	44	102	16.2	9.3	70.8	3.9	59.0	207.5	--	--
Channel	186-56VT2	RR2	86	71	44	100	16.2	9.3	68.6	4.1	60.1	219.4	--	--
Channel	187-20VT2	RR2	87	72	43	103	17.4	9.4	68.7	4.0	58.8	234.2	--	--
Channel	188-67VT2	RR2	88	72	42	102	18.0	9.2	69.0	4.0	59.3	241.0	--	--
Dyna-Gro	D26VC64RIB	RR2	86	73	43	106	14.9	9.0	69.5	3.9	57.8	226.8	208.9	
Dyna-Gro	D29VC85RIB	RR2	89	72	46	106	16.1	8.5	70.7	3.9	58.0	217.9	--	
Integra Seed	3114 VT2P RIB	RR2	81	70	46	109	13.9	9.3	67.9	3.7	60.0	199.3	--	
Integra Seed	3431 VT2P RIB	RR2	84	72	48	110	15.3	8.7	70.3	3.8	59.7	210.4	195.9	184.4
Integra Seed	3884 VT2P RIB	RR2	88	72	46	107	16.4	8.9	69.2	3.9	59.0	224.7	206.3	--
Thunder Seed	T6485 PC	Enlist	85	73	48	113	15.1	8.6	70.4	3.6	57.3	223.7	202.1	--
Thunder Seed	T6587 PC	Enlist	87	73	48	115	17.0	9.3	69.6	3.8	55.9	225.6	--	--
Thunder Seed	T6588 AV	GT/LL	88	74	53	112	18.2	9.8	69.6	4.1	56.4	240.9	--	--
Thunder Seed	T6389 VT2P	RR2	89	73	46	105	16.3	8.8	70.4	3.9	58.5	243.9	223.4	203.0
Proseed	1984 VT2P	RR2	84	71	47	109	15.1	8.6	69.8	3.8	59.4	214.4	194.5	181.2
Proseed	2486 AA	GT	86	74	51	114	16.2	8.7	70.8	3.8	58.4	203.2	207.0	--
Golden Harvest	G82B12-AA	GT/LL	82	73	51	112	15.7	10.0	69.4	3.8	59.2	201.8	202.1	--
Golden Harvest	G85B04-AA	GT/LL	85	73	48	111	16.4	8.7	70.7	3.8	58.1	216.5	213.3	--
Golden Harvest	G85Z56-V	GT/LL	85	77	48	107	18.4	10.4	69.4	4.0	59.3	202.5	--	--
Golden Harvest	G87U44-V	GT/LL	87	77	52	112	19.8	9.9	70.5	4.2	58.8	210.6	--	--
Legacy Seeds	LC351-24	RR2	85	72	47	112	15.5	9.2	69.9	3.9	59.5	194.3	--	--
Trial Mean				73	48	110	17.0	9.2	69.8	3.9	58.7	222	--	--
C.V. (%)				2	7	5	6.1	2.9	1.1	2.7	1.9	4.3	--	--
LSD (0.10)				2	4	6	1.2	0.3	0.9	0.1	1.3	7.2	--	--

Planting Date = May 21; Harvest Date = October 25; Previous Crop = Field Pea/Soybean

Corn - Dryland

Brand	Hybrid	Trait	RM	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	Yield 2024*	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				DAP	inches	inches	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Legacy Seeds	LC363-23	GT/LL	86	74	49	115	17.3	8.8	70.7	3.9	58.3	191.0	203.2	--
Legacy Seeds	LC354-23	Enlist	85	72	51	114	15.7	8.7	69.4	3.7	56.4	219.5	205.8	--
Legacy Seeds	LC373-24	GT/LL	87	74	53	111	18.9	10.2	69.7	4.3	59.9	236.1	--	--
Legacy Seeds	LC381-23	RR2	88	74	49	112	17.7	9.0	69.4	4.1	58.8	236.4		--
Legacy Seeds	LC394-24	Enlist	89	75	51	112	18.2	9.5	70.3	3.8	58.8	241.3		--
Legacy Seeds	LC414-21	RR2	91	74	49	114	17.3	8.8	70.5	4.0	59.1	242.2	230.2	209.2
Champion Seed	35A24 VT2P	RR2	85	70	48	110	15.6	9.4	69.1	3.9	60.0	204.1	191.7	--
Champion Seed	38A25 VT2P	RR2	88	73	51	114	17.7	9.2	70.6	4.0	58.6	231.4	--	--
Champion Seed	39A25 PWC	Enlist	89	73	52	112	18.3	9.6	69.5	4.0	58.6	229.4	--	--
Champion Seed	40A25 VT2P	RR2	90	71	50	110	18.6	8.8	68.9	4.0	59.4	257.2	--	--
Champion Seed	37A24 AA	GT/LL	87	73	49	112	16.2	8.5	71.1	3.9	58.7	214.2	215.3	--
Gateway Seed	4789 VT2P	RR2	89	72	48	105	19.6	9.3	69.0	4.2	58.8	241.7	--	--
Gateway Seed	4394SS	RR2Y/LL	94	77	48	106	22.7	10.0	69.2	4.4	59.3	225.0	--	--
Trial Mean				73	48	110	17.0	9.2	69.8	3.9	58.7	222	--	--
C.V. (%)				2	7	5	6.1	2.9	1.1	2.7	1.9	4.3	--	--
LSD (0.10)				2	4	6	1.2	0.3	0.9	0.1	1.3	7.2	--	--

Planting Date = May 21; Harvest Date = October 25; Previous Crop = Field Pea/Soybean

* Best Linear Unbiased Estimates

Corn - Irrigated														**Carrington**
												---------- Yield ----------		
				Days	Ear	Plant	Harvest				Test		2-yr.	3-yr.
Brand	Hybrid	Trait	RM	to Silk	Height	Height	Moisture	Protein	Starch	Oil	Weight	2024	Avg.	Avg.
				DAP	inches	inches	%	%	%	%	lb/bu	---------- bu/a ----------		
Dyna-Gro	D26VC64RIB	RR2	86	70	46	107	13.6	8.4	68.5	3.8	57.8	225.9	235.3	--
Dyna-Gro	D29VC85RIB	RR2	89	69	40	100	16.9	8.5	71.2	3.9	58.7	246.1	--	--
RENK	RK261VT2P	RR2	86	69	42	105	15.3	8.0	70.2	4.0	58.1	204.4	208.5	--
RENK	RK296AA	GT	89	73	45	112	17.2	8.3	70.3	3.7	57.9	259.1	290.1	--
RENK	RK297VT2P	RR2	89	72	44	106	14.8	8.0	70.6	3.7	58.1	244.7	262.0	242.9
RENK	RK300RR	RR2	90	71	46	107	16.5	9.3	69.2	4.1	59.2	248.4	264.0	235.7
Integra Seed	3114 VT2P RIB	RR2	81	67	43	102	12.6	8.7	69.1	3.7	59.0	188.0	--	--
Integra Seed	3884 VT2P RIB	RR2	88	68	48	104	15.0	8.3	69.4	3.7	58.4	227.3	240.3	--
Golden Harvest	G85B04-AA	GT/LL	85	72	44	108	14.1	7.8	72.2	3.7	58.0	207.0	--	--
Golden Harvest	G87U44-V	GT/LL	87	72	53	109	15.9	9.0	71.2	4.1	58.7	225.5	--	--
Legacy Seeds	LC351-24	RR2	85	70	45	96	14.1	8.5	70.7	3.7	59.0	211.1	--	--
Legacy Seeds	LC363-23	GT/LL	86	71	48	112	14.1	7.7	71.7	3.7	58.2	196.2	239.5	--
Legacy Seeds	LC354-23	Enlist	85	70	47	109	13.2	8.0	69.5	3.5	56.5	219.6	231.7	--
Legacy Seeds	LC373-24	GT/LL	87	72	51	109	16.2	9.3	70.7	4.0	58.8	225.4	--	--
Legacy Seeds	LC381-23	RR2	88	71	45	107	15.7	8.4	69.8	4.1	58.2	226.4	--	--
Legacy Seeds	LC394-24	Enlist	89	70	47	108	15.3	8.5	70.8	3.8	58.5	220.3	--	--
Legacy Seeds	LC414-21	RR2	91	72	45	104	16.8	8.7	69.6	4.1	60.5	253.2	268.5	243.6
Gateway Seed	4789 VT2P	RR2	89	70	46	106	17.7	8.7	70.4	4.0	58.4	243.0	--	--
Gateway Seed	4394SS	RR2Y/LL	94	74	49	112	19.2	9.3	70.5	4.0	58.4	233.7	--	--
Trial Mean				71	46	106	15.5	8.5	70.3	3.9	58.4	226.6	--	--
C.V. (%)				1	7	4	5.9	4.1	1.0	2.6	0.9	8.3	--	--
LSD (0.10)				1	4	5	1.1	0.4	0.8	0.1	0.6	22.1	--	--

Planting Date = May 21; Harvest Date = October 24; Previous Crop = Flax

Corn - Dryland **Fingal**

Brand	Hybrid	Trait	RM	Ear Height*	Plant Height	Harvest Moisture	Protein	Starch	Oil	Test Weight	---------- Yield ---------- 2024*	2-yr. Avg.	3-yr. Avg.
				inches	inches	%	%	%	%	lb/bu	---------- bu/a ----------		
RENK	RK304VT2P	RR2	90	45	107	14.8	8.3	69.2	3.9	59.4	239.2	--	--
RENK	RK456VT2P	RR2	93	46	105	16.3	7.9	70.0	4.4	57.3	236.9	--	--
RENK	RK519VT4P	RR2	95	46	113	15.9	8.6	69.1	4.0	59.1	227.2	--	--
RENK	RK561DGVT2P	RR2	95	43	111	16.0	8.9	69.3	4.1	59.2	231.9	229.5	218.8
Thunder Seed	T6389 VT2P	RR2	89	45	105	13.3	7.7	71.2	3.8	57.9	240.2	--	--
Thunder Seed	T6591 PC	Enlist	91	47	113	14.3	8.5	70.6	3.8	58.2	238.8	--	--
Thunder Seed	T6592 VT2P	Enlist	92	46	103	15.0	8.6	69.5	4.0	58.5	239.1	--	--
Thunder Seed	T6294 VT2P	RR2	94	44	111	15.6	8.6	68.5	3.9	60.6	229.0	233.8	215.3
Proseed	2392 VT2P	RR2	92	45	110	15.1	9.1	69.0	4.1	60.4	253.2	241.4	210.6
Proseed	2594 VT2P	RR2	94	46	111	15.6	8.3	69.0	4.0	58.5	239.0	--	--
Legacy Seeds	LC381-23	RR2	88	45	116	13.9	8.2	70.6	3.8	58.7	250.0	--	--
Legacy Seeds	LC394-24	Enlist	89	48	105	15.0	8.3	68.6	3.9	58.9	232.8	--	--
Legacy Seeds	LC414-21	RR2	91	43	107	14.7	8.8	69.4	4.1	60.2	230.0	225.4	201.8
Legacy Seeds	LC404-24	GT/LL	90	48	108	14.5	8.0	68.9	3.8	58.6	247.7	--	--
Legacy Seeds	LC461-21	RR2	95	42	111	15.8	8.3	68.5	3.8	59.8	222.6	221.6	200.2
Trial Mean				45	109	15.1	8.4	69.4	4.0	59.0	237.2	--	--
C.V. (%)				3	2	3.7	3.6	1.2	3.1	1.0	3.3	--	--
LSD (0.10)				1	3	0.7	0.4	1.0	0.2	0.7	6.5	--	--

Planting Date = May 22; Harvest Date = October 23; Previous Crop = Soybean

*Best Linear Unbiased Estimate

Corn - Irrigated	**Dickey County - Oakes**

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Grain Protein	Content: Starch	Content: Oil	Moisture	Test Weight	--Grain Yield-- 2024	--Grain Yield-- 2 yr. Avg.
				DAP	inches	inches	%	%	%	%	lb/bu	bu/a	bu/a
Dyna-Gro	D34VC93RIB	94	RR2	63.8	48.6	109.6	7.8	72.2	3.9	13.0	58.0	274.2	279.9
Dyna-Gro	D37PN35RA	87	Enlist	63.5	54.8	111.2	7.7	72.2	3.9	13.8	56.9	309.3	--
RENK	RK304VT2P	90	RR2	61.5	49.5	107.8	7.8	72.3	3.9	12.8	58.1	270.6	--
RENK	RK456VT2P	93	RR2	62.5	49.7	107.4	7.6	71.7	4.4	13.2	56.8	301.6	--
RENK	RK519VT4P	95	RR2	62.5	51.2	110.9	8.0	71.8	4.1	12.9	58.1	315.6	--
RENK	RK561DGVT2P	95	RR2	62.5	47.9	107.8	8.1	71.7	4.1	13.8	58.1	278.8	283.2
RENK	RK571PCE	96	Enlist	64.3	50.6	112.9	8.5	72.1	3.4	14.0	56.5	287.8	--
Legacy Seeds	LC461-21	95	RR2	62.3	50.9	110.1	8.1	72.6	3.7	13.2	59.7	296.2	303.3
Legacy Seeds	LC465-23	96	Enlist	64.5	48.9	111.2	8.1	72.5	3.3	14.0	56.6	278.0	296.3
Legacy Seeds	LC474-23	97	Enlist	64.0	54.0	110.5	8.2	71.8	4.0	13.9	56.8	290.3	307.8
Trial Mean				63.1	50.6	109.9	8.0	72.1	3.9	13.5	57.5	290.2	--
C.V. (%)				1.0	5.3	1.9	4.5	0.5	5.3	2.3	0.6	5.0	--
LSD (0.10)				0.7	3.2	2.5	0.4	0.5	0.2	0.4	0.4	17.5	--
LSD (0.05)				0.9	3.9	3.0	0.5	0.6	0.3	0.5	0.5	21.1	--

Planting Date = May 5; Harvest Date = October 17; Previous Crop = Soybean

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

Corn - Dryland													**Dickey County - Oakes**
												--- Grain Yield ---	
Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Grain Protein	Starch Content	Oil Content	Harvest Moisture	Test Weight	2024	2-yr. Avg.
				DAP	inches	inches	%	%	%	%	lb/bu	bu/ac	bu/ac
Channel	189-64VT2	89	RR2	57.0	36.2	91.7	8.6	71.8	3.7	14.7	57.2	233.0	--
Channel	192-81VT2	92	RR2	57.3	41.2	103.4	7.8	72.8	3.6	14.9	58.3	247.3	--
Dyna-Gro	D34VC93RIB	94	RR2	59.5	47.4	105.2	8.0	72.3	3.8	15.8	57.4	266.5	211.9
Dyna-Gro	D37PN35RA	97	Enlist	57.8	45.8	102.7	9.0	71.5	3.8	16.0	56.6	269.3	--
RENK	RK304VT2P	90	RR2	56.8	42.5	102.7	7.6	72.7	3.9	15.1	57.6	251.0	--
RENK	RK456VT2P	93	RR2	58.5	44.8	101.5	8.2	71.6	4.3	15.9	56.2	254.6	--
RENK	RK519VT4P	95	RR2	59.0	45.0	105.5	8.4	71.6	4.1	14.9	58.0	279.7	--
RENK	RK561DGVT2P	95	RR2	58.8	44.0	102.1	8.7	71.8	4.0	16.1	57.2	271.0	232.7
Thunder Seed	T6294 VT2P	94	RR2	58.5	46.7	104.0	8.6	72.6	3.6	16.0	59.2	284.3	226.1
Thunder Seed	T6695 VT2P	95	RR2	58.5	43.9	102.9	7.6	72.5	4.0	15.3	57.1	268.3	--
Thunder Seed	T6396 VT2P	95	RR2	59.0	47.3	104.7	8.2	72.0	4.0	15.3	57.6	273.7	244.2
Thunder Seed	T6498 PC	98	Enlist	59.5	49.4	105.9	8.7	72.7	3.0	16.3	57.2	269.6	256.0
Proseed	2594 VT2P	94	RR2	58.5	43.2	103.8	7.8	72.3	3.9	15.6	56.9	263.1	--
Proseed	2398 TRE	98	RR2	61.8	46.8	107.6	8.4	72.1	3.9	16.6	56.6	283.4	258.5
Proseed	2598 VT4	98	RR2	58.8	41.5	100.2	8.0	72.6	3.8	16.8	56.9	271.2	--
Golden Harvest	G94U63-V	94	GT/LL	59.0	47.8	107.5	9.4	71.4	3.9	16.7	58.9	268.2	--
Golden Harvest	G97B68-DV	97	GT/LL	61.3	51.9	104.0	9.3	71.6	3.8	17.0	57.4	278.3	219.3
Golden Harvest	G98B99-AA	98	GT/LL	57.5	53.3	106.3	9.6	71.7	3.6	17.6	58.1	259.4	--
Golden Harvest	G98U62-DV	98	GT/LL	59.0	44.0	103.5	8.3	72.5	3.7	16.4	57.9	269.2	--
Legacy Seeds	LC461-21	95	RR2	58.3	45.4	103.7	8.0	72.9	3.6	15.7	59.2	263.3	243.6
Legacy Seeds	LC465-23	96	Enlist	59.8	46.0	105.9	9.2	72.1	3.2	16.2	57.4	267.9	236.4
Legacy Seeds	LC474-23	97	Enlist	57.8	47.8	102.8	9.2	71.2	4.0	15.7	57.4	271.7	257.6
Trial Mean				58.7	45.5	103.5	8.5	72.1	3.8	15.9	57.6	266.5	--
C.V. (%)				1.2	5.2	1.9	4.8	0.7	5.0	3.2	0.7	8.0	--
LSD (0.10)				0.9	2.8	2.3	0.5	0.6	0.2	0.6	0.5	25.1	--
LSD (0.05)				1.0	3.4	3	0.6	0.7	0.3	0.7	0.6	30.1	--

Planting Date = May 13; Harvest Date = October 21; Previous Crop = Soybean

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

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

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	DM	---------- Yield ---------- 2024*	2-yr. Avg.	3-yr. Avg.
				DAP	inches	inches	%	%	---------- ton/a ----------		
Croplan	3200	93	RR	79	53	127	52.7	47.3	26.1	26.3	25.0
Croplan	4100	101	VT2P RIB	84	47	115	51.9	48.1	24.7	24.8	22.7
Croplan	4200	102	RR	85	47	123	58.5	41.5	26.0	26.2	--
Golden Harvest	G01U74-AA	101	Agrisure Above	78	46	109	57.8	42.2	23.2	--	--
Golden Harvest	G03U08-D	103	Duracade	77	46	108	51.9	48.1	25.8	--	--
Proseed	Lfy 101 RR	101	RR	86	45	118	55.5	44.5	27.3	27.8	25.9
Integra Seed	STP4723	94	RR2	80	47	123	45.4	54.6	24.6	23.3	--
Integra Seed	STP5191	101	RR2	86	47	120	55.0	45.0	26.5	27.8	25.7
Integra Seed	STP5203	102	GSS RIB	80	45	120	49.0	51.0	29.2	--	--
Proseed	STS 102	102	GT	81	43	112	54.4	45.6	24.6	--	--
Proseed	STS 104	104	GT	80	49	117	50.9	49.1	26.0	--	--
Proseed	STS 106	106	GT/CB/LL	86	54	119	60.5	39.5	27.2	25.7	23.7
Trial Mean				81	48	117	53.2	46.8	25.6	--	--
C.V. (%)				3	7	3	7.2	8.2	5.8	--	--
LSD (0.10)				3	4	5	5.3	5.3	1.7	--	--

Planting Date = May 21; Harvest Date = October 17; Previous Crop = Field Pea/Soybean

*Best Linear Unbiased Estimate

		55 days after ensiling												
Brand	Hybrid	pH	Crude Protein	ADF	aNDF	Starch	EE	Ca	P	Mg	K	TDN (OARDC)	NEg (OARDC)	RFV
			% DM									% DM	Mcal/cwt	
Croplan	3200	4.2	8.0	28.9	46.9	26.8	2.2	0.2	0.2	0.1	1.3	68.0	69.7	138.4
Croplan	4100	4.2	8.1	27.5	45.1	26.0	2.3	0.2	0.2	0.2	1.3	69.0	71.2	140.9
Croplan	4200	4.3	8.3	24.2	39.7	33.7	2.5	0.2	0.2	0.2	1.3	71.8	75.1	166.6
Golden Harvest	G01U74-AA	4.2	8.4	25.7	42.3	28.3	2.8	0.3	0.2	0.2	1.3	70.6	73.5	151.4
Golden Harvest	G03U08-D	4.1	8.1	24.7	40.5	30.7	2.4	0.2	0.2	0.2	1.2	71.6	74.8	161.4
Proseed	Lfy 101 RR	4.1	7.7	21.8	36.7	36.4	2.9	0.2	0.2	0.1	1.1	74.1	78.1	182.9
Integra Seed	STP4723	4.2	8.3	27.7	45.6	24.1	2.5	0.2	0.2	0.2	1.3	68.9	71.2	138.9
Integra Seed	STP5191	4.0	7.7	22.4	37.7	35.1	3.0	0.2	0.2	0.2	1.0	73.5	77.2	181.1
Integra Seed	STP5203	4.1	8.0	25.7	42.2	31.2	2.8	0.2	0.2	0.2	1.2	71.2	74.2	155.5
Proseed	STS 102	4.1	7.6	25.5	42.6	27.6	2.5	0.2	0.2	0.2	1.2	71.3	74.2	151.0
Proseed	STS 104	4.1	7.6	24.1	40.9	30.5	2.5	0.2	0.2	0.2	1.1	72.1	75.3	165.3
Proseed	STS 106	4.2	7.6	26.1	42.7	30.9	2.4	0.2	0.2	0.1	1.2	70.8	73.5	151.5
Trial Mean		4.2	8.0	25.2	41.7	30.1	2.6	0.2	0.2	0.2	1.2	71.1	74.1	158.0
C.V. (%)		2.4	5.9	13.9	12.9	19.4	12.2	11.6	8.6	13.0	10.7	3.7	5.0	17.0
LSD (0.10)		0.1	0.7	4.9	7.5	8.1	0.4	NS	NS	NS	0.2	3.7	5.2	37.5

Planting Date = May 21; Harvest Date = October 17; Previous Crop = Field Pea/Soybean

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	DM	Yield 2024	Yield 2-yr. Avg.
				DAP	inches	inches	%	%	ton/a	ton/a
Integra Seed	STP5191	101	RR2	81.7	41.7	121.1	60.4	39.7	21.8	31.6
Integra Seed	STP5203	102	GSS RIB	80.3	39.1	118.9	52.4	47.7	30.8	--
Croplan	3200	93	RR	78.7	43.0	123.2	54.3	45.7	28.8	--
Croplan	4100	101	VT2P RIB	82.0	39.9	114.2	50.2	49.9	29.2	32.6
Croplan	4200	102	RR	86.0	39.9	118.5	62.8	37.2	21.8	32.0
Trial Mean				80.7	40.6	117.3	56.4	43.6	26.5	--
C.V. (%)				2.8	6.0	2.3	7.8	10.1	16.1	--
LSD (0.10)				3.3	3.6	3.9	6.5	6.5	6.3	--

Planting Date = May 21; Harvest Date = October 9; Previous Crop = Flax

Corn silage chopping.

Brand	Hybrid	pH	Crude Protein	ADF	aNDF	Starch	EE	Ca	P	Mg	K	TDN	NEg	RFV
		60 days after ensiling												
			% DM										Mcal/cwt	
Integra Seed	STP5191	4.1	8.3	29.7	49.1	22.1	2.4	0.3	0.2	0.2	1.3	67.3	42.0	126.6
Integra Seed	STP5203	4.1	8.0	26.4	44.6	27.7	2.7	0.2	0.2	0.2	1.2	70.1	45.4	144.0
Croplan	3200	4.1	8.1	31.1	51.7	20.8	2.4	0.3	0.2	0.2	1.3	66.5	40.9	116.8
Croplan	4100	4.1	7.7	29.9	49.9	24.1	2.5	0.3	0.2	0.2	1.3	67.6	42.1	126.1
Croplan	4200	4.1	8.2	31.9	51.8	19.8	2.4	0.3	0.2	0.2	1.4	65.5	39.7	117.8
Trial Mean		4.1	8.1	28.7	47.9	24.3	2.6	0.3	0.2	0.2	1.3	68.3	43.1	132.6
C.V. (%)		3.2	6.7	13.0	11.7	21.8	11.0	11.0	8.6	12.9	11.5	4.2	8.4	15.6
LSD (0.10)		NS	0.8	5.5	8.3	7.8	0.4	NS	NS	NS	0.2	4.2	5.3	30.6

Planting Date = May 21; Harvest Date = October 9; Previous Crop = Flax

Winter Rye Forage	**Carrington**

Variety	Crop Type	Harvest Date	Harvest Moisture	Yield Dry Matter	CP	ADF	NDF	ASH	Lignin	Ca	K	Mg	P	S	TDN ADF	RFV	RFQ
			%	ton/a	%	%	%	%	%	%	%	%	%	%	%		
ND Dylan	Winter Rye	June 7	85.0	0.9	18.2	30.0	49.1	10.3	2.7	0.5	3.1	0.2	0.4	0.3	65.5	124	174
Aroostook	Winter Rye	June 7	84.6	0.9	18.2	31.9	50.3	12.4	2.8	0.5	3.2	0.3	0.4	0.3	64.0	118	166
Hazlet	Winter Rye	June 7	84.9	0.9	18.7	30.5	49.9	10.1	2.8	0.5	3.2	0.2	0.4	0.3	65.2	122	172
ND Gardner	Winter Rye	June 7	82.9	1.0	17.1	33.4	53.1	9.6	3.4	0.5	3.0	0.2	0.4	0.3	62.9	110	153
KWS Aviator	Winter Rye	June 7	85.0	0.8	18.8	30.1	49.7	9.3	2.8	0.5	3.2	0.2	0.4	0.3	65.5	123	178
KWS Progas	Winter Rye	June 7	83.8	0.7	18.6	29.6	49.5	9.5	2.7	0.5	3.1	0.2	0.4	0.3	65.8	124	178
SU Bebop	Winter Rye	June 7	84.6	0.7	19.9	29.9	47.9	10.3	2.8	0.5	3.2	0.3	0.4	0.3	65.6	127	174
Trial Mean			84.5	0.8	18.6	30.6	49.8	10.2	2.8	0.5	3.1	0.2	0.4	0.3	65.1	122	173
C.V. (%)			0.8	18.4	3.5	3.0	1.6	13.8	3.7	5.5	3.6	4.9	3.9	3.6	1.1	2.5	4.9
LSD (0.10)			0.8	0.2	0.9	1.3	1.1	NS	0.2	NS	NS	NS	0.0	0.0	1.0	4.3	12.0

Planting Date = September 20, 2023; Harvest Date = June 7*; Previous Crop = Forage Barley

*ND Gardner was harvested 5 days past optimal boot stage due to weather conditions.

ACKNOWLEDGEMENTS

The Carrington Research Extension Center would like to acknowledge the following cooperators for their contributions to the success of CREC programs in 2024.

Walt Albus
Lyle and Karen Bettenhausen
Bryn Farms
Travis Carr
CenDak Cooperative
City of Carrington
Pat Copenhaver
Fetch Farms
Charnell Haak
Langemo Farms
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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, Ewan Aberle, Leeland Brewer, Maxim Ciubotareanu, Maddyx Davis, Sierra Friedt, Callen Garber, Nicholas Garber, Khendra Garcia, Jerome Gibson, Brett Harmon, Peyton Harrington, Bryan Harris, Jared Hartl, Tessa Hartl, Jennifer Heller, Gabriela Henson, Grady Idland, Marlys Lange, Lilly Larson, Abigail Lee, Baylee Lura, Jaedyn Lura, Easton Mittleider, Betty Montgomery, Rebecca Morstad, Richard Ray Jr., Jaxsyn Remmick, Tyson Scanson, Trisa Schroeder, Duane Schumacker, Emily Tjelta, Kaitlyn Tjelta, Alexis Wells, Maximus Whitman, and Maverick Zink.

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