Carrington Research Extension Center

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

A Report of Agricultural Research and Extension in Central North Dakota

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CONTENTS

Research Highlights from 2022

Crop Variety Comparison Data

The Carrington Research Extension Center conducts research and educational programs to enhance the productivity, competitiveness, and diversity of agriculture in central North Dakota and beyond. Research activities at the CREC include scientists and support staff trained in implementing programs in Agronomy, Plant Pathology, Soil Science, Precision Agriculture and Animal Science. These program teams are able to address a broad scope of factors that impact North Dakota agriculture. The crop diversity of the state is addressed in all program areas and is further supported by the ability to conduct research under both dryland and irrigated conditions. Projects addressing organic crop production and a fruit and berry program broaden the constituency being served. The foundation seed program of the Center represents an important part of the overall NDSU Foundation Seed program. The CREC is the base of operation for four state Extension specialists. This report highlights a portion of the department's contributions to research and extension. Following are a few examples of highlights from our past season and significant impacts and contributions to the region's agriculture.

Field pea research was conducted along a salinity gradient in 2022 to begin identifying the genes that field peas regulate in response to increasing salt concentrations. Four varieties were tested along this gradient. Tissue samples and yield and quality parameters were collected from the study which will lead to the creation of the first database of gene expression information involving field peas and their salt response.

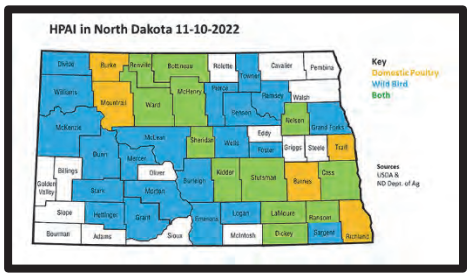
The soils program at the CREC evaluated the efficacy of yield enhancing biological products. This year a multi-site study was conducted to test biological products that contain nitrogen-fixing bacteria that may be able to fix nitrogen in non-nodulated crops such as corn. The results did not show any yield enhancements. Testing these organisms outside of their native habitats is a rather new approach worth continuing study to determine what conditions might generate economic returns for producers.

Over the past year, the CREC Livestock Unit evaluated the partial or complete substitution of corn with hybrid rye in backgrounding and finishing rations in feedlot steers. Results from this study indicated that the inclusion of hybrid rye had no effect on animal performance throughout the trial. Also, the inclusion of hybrid rye had no effect on carcass characteristics which include hot carcass weight, marbling, calculated yield grade, and backfat thickness.

Glufosinate (Liberty) in combination with a set of PPO-inhibiting herbicides were tested at CREC to determine if any synergy existed between the chemistries. Early results indicate that low rates of PPO herbicides may provide some additional benefit to glufosinate in controlling difficult species such as kochia and pigweeds.

CREC held a collaborative Field Day with WREC and LREC to connect intercropping farmers and those interested in intercropping with each other. This was done on-farm in north central North Dakota and was attended by over 50 farmers and grain buyers. This was a one-of-a-kind event for the region and helped demonstrate the concept of intercropping and how farmers are implementing it in the region.

Geospatial technologies were applied to IPM surveying during the 2022 growing season. This resulted in streamlined data collection, automated calculations, and an interactive map with pest outbreaks occurring in the state.



NDSU Extension agents and specialists responded to the 2022 highly pathogenic avian influenza (HPAI) outbreak that impacted both backyard and commercial poultry operations. Seventeen counties in North Dakota accounting for 24 sites and 236,526 birds have been affected by HPAI as of November 10. Response efforts by Extension agents and specialists included six press releases reaching at least 30,000 individuals; two publications; eight radio, podcast and television interviews reaching at least 87,000 individuals; 3,951 engagements on social media; 2,874 webpage views; more than 894 phone calls to individuals residing in the control zones; and carcass disposal management technical support provided at four sites.

The plant pathology program has developed outreach programming concisely summarizing a decade of multi-location research that demonstrates sharp improvements in white mold management can be achieved by optimizing soybean row spacing relative to anticipated disease pressure, fungicide timing relative to growth stage and canopy closure. Results were disseminated to approximately 300 stakeholders at winter meetings in North Dakota and Minnesota. White mold pressure was high in irrigated soybeans in western Minnesota in 2022, and stakeholders adopting the recommendations reported greatly improved disease control.

The CREC has coordinated winter rye variety testing across the NDSU Research Extension Centers for many years. The state-wide testing system is important to give producers current information on rye variety selection across the various regions of the state. The CREC also coordinates uniform variety testing of buckwheat at a number of NDSU research sites; works with public and private oat breeders to evaluate experimental lines; and collaborates with USDA organic cover crop breeders to evaluate winter peas in an organic environment. This network of testing for minor crops is needed to give producers timely information on variety selection.

Conducted the third year of a study aimed at enhancing mycorrhizal colonization of corn using crop rotation and a commercial mycorrhizal inoculant. The results showed that previous crop had the only measurable impact on root colonization, which correlated with nutrient uptake in the grain but not with yield.

In 2022, the Northern Hardy Fruit Evaluation Project provided educational information to over 900 people with video conference programs, tours, meetings and personal phone calls. Field Day was attended by 55 people who toured the CREC orchard and listened to local winemaker Bruce Gussiaas and later visited the winery.

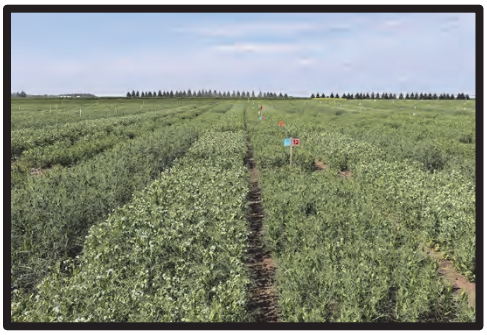
A total of 334 commercial fields of wheat, barley, soybean and sunflower were scouted to record agronomic factors and crop pests in 11 south-central North Dakota counties during the 2022 crop season. The survey work was conducted by Carrie Nichols, crop scout based out of the CREC, as part of the annual statewide NDSU Extension integrated pest management (IPM) program. Compiled results of the program can be found at https://www.ndsu.edu/agriculture/ag-hub/ag-topics/crop-production/diseases-insects-and-weeds/integrated-pest-management. The data is used for educational programs to serve farmers and crop advisers.

Researchers at CREC coordinated an intercropping café talk in Devil's Lake which brought in 20 agriculture professionals and three farmer intercroppers for a discussion about planning and expanding intercropping in North Dakota.

Research demonstrated that management of Ascochyta blight of chickpeas is sharply improved when standard fungicides are tank-mixed with the older contact fungicide chlorothalonil and developed preliminary recommendations on the fungicide droplet size that optimizes performance of the tank-mix while minimizing costs. Ascochyta pressure was high in North Dakota's chickpea production region in 2022, and growers who adopted these new recommendations reported sharply improved disease management and successful chickpea crops.

NDSU Extension hosted four horse management webinars in 2022. The topics included mortality management, geriatric horse and foal care, hay management and bedding, and manure management. The webinars were attended by 87 individuals live followed by 327 views of the online videos. Find videos here: https://youtube.com/playlist?list=PLnn8HanJ32l5_IQihkj8Xb3dNGa8p4MAf.

Initiated fungicide droplet size research on field peas and expanded fungicide droplet size research on dry beans and chickpeas. Research conducted to-date has demonstrated that optimizing fungicide droplet size can confer sharp gains in fungicide performance at minimal cost, and the expanded research effort will facilitate the development of broad recommendations for optimizing fungicide droplet size relative to the crop tissues targeted and crop canopy characteristics.



A five-year field study conducted at the CREC was completed and results published March 2022 in the NDSU Extension publication 'Winter Rye as a Preceding Cover Crop for Pinto Bean Production in North Dakota' (https://www.ndsu.edu/agriculture/extension/publications/winter-rye-preceding-cover-crop-pinto-bean-production-north-dakota). This dry bean production strategy can greatly reduce soil erosion and supplement weed management while maintaining seed yield compared to a conventional-till system.

Spring wheat biofortification studies were completed. Results demonstrated successful and repeatable methods for increasing grain zinc concentration. The most reliable method for increasing zinc was to apply with fungicide at anthesis. This increase provided a large enough boost so the final product could be considered zinc fortified, which opens new markets for North Dakota spring wheat.

A statewide lupin variety trial was conducted. The purpose was to test the stability of yield and grain quality across locations. These lupin accessions were bred in North Dakota to ensure environmental suitability while maintaining low grain alkaloid content. The trials will be used for selecting potential lupin varieties to be released for the region.

North Dakota field trials conducted during the past decade examined the response of pinto bean to row spacing and plant populations. Results were summarized in the NDSU Extension publication 'Pinto Bean Response to Row Spacing and Plant Population in North Dakota' (https://www.ndsu.edu/agriculture/extension/publications/pinto-bean-response-row-spacing-and-plant-population-north-dakota). Greatest yield was achieved with intermediate rows and the densities of 64,700 and 83,600 plants per acre. Yield was similar among plant populations with wide rows.

NDSU Extension Responds to Highly Pathogenic Avian Influenza Outbreak

Mary A. Keena and Miranda A. Meehan

Highly Pathogenic Avian Influenza (HPAI) impacted 236,526 domestic birds in North Dakota this year. NDSU Extension aided in response efforts, creating educational resources and providing local support for cases, building awareness about the disease, and reducing the number of cases in the state. Poultry owners should continue to practice good biosecurity measures to keep their birds healthy. In addition, they should remain vigilant as there is a risk of HPAI during active migration periods during the spring and fall.

Introduction

Highly Pathogenic Avian Influenza (HPAI) spread across the United States in 2022, wreaking havoc on commercial and backyard poultry owners alike. As of November 10, 618 confirmed flocks (264 commercial and 354 backyard) have been affected in 46 states. Over 50 million birds have been affected by this HPAI outbreak. Avian influenza is caused by influenza Type A virus (influenza A). Avian influenza viruses are classified as either “low pathogenic” or “highly pathogenic” based on their genetic features and the severity of the disease they cause in poultry.

The first confirmed case of HPAI in North Dakota was in a wild snow goose on March 24, followed by a backyard flock on March 29. Seventeen counties reported cases of HPAI from March 29 thru November 10 in either commercial or backyard flocks at 24 sites consisting of 236,526 birds (Figure 1).

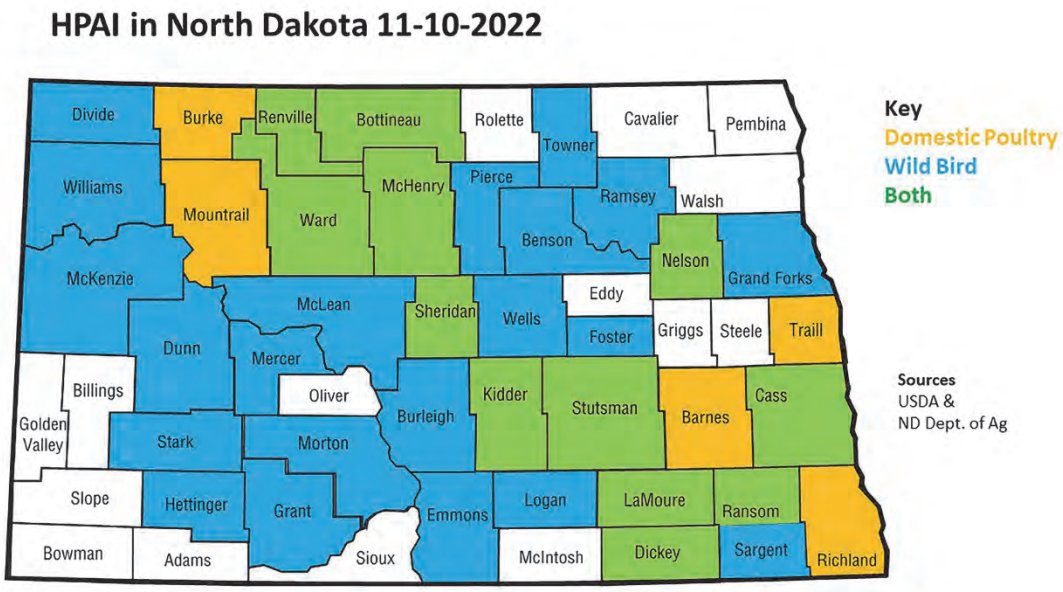


Figure 1. Map depicting positive cases of highly pathogenic avian influenza in domestic poultry and wild bird populations in North Dakota during the 2022 outbreak.

Extension Response

NDSU Extension agents and specialists were an integral part of the disaster response team for poultry owners in North Dakota. The response efforts ranged from awareness and preparedness prior to outbreaks, information sharing and control zone contacts during outbreaks, and disposal efforts after outbreaks.

Internal Response Efforts

NDSU Extension took immediate action to ensure that Extension agents had the information and resources needed to respond to HPAI. NDSU Extension formed an HPAI response team to coordinate

with state and federal partners, develop resources, and support personnel responding to HPAI cases. Regular updates were provided via biweekly meetings (17) and emails (15). The response team developed talking points, handouts, press releases and social media posts for Extension personnel to use in their response efforts.

External Response Efforts
NDSU Extension specialists prepared and disseminated six press releases prior to and during the onslaught of HPAI reaching at least 30,000 individuals. These press releases consisted of general virus knowledge, information regarding flock biosecurity, action steps if infection was suspected, and information on wild flock infection and response. These press releases led to eight radio, podcast and television interviews reaching approximately 87,000 individuals and the creation of two publications, *"Handling Wild Bird Carcasses, Guidance for Highly Pathogenic Avian Influenza (HPAI) Outbreaks"* and *"Protect your Flock from Highly Pathogenic Avian Influenza (HPAI)."* Over 1,000 copies of each publication (1,075 and 1,150, respectively) were sent to NDSU Extension offices. All this information was shared via NDSU Extension social media platforms and the NDSU Ag Hub (https://www.ndsu.edu/agriculture/ag-hub/highly-pathogenic-avian-influenza).

From January through October, NDSU Extension created 96 posts for Facebook and Twitter reaching 103,356 followers, leading to 4,030 engagements, including reactions, comments and sharing of information. NDSU Extension agents with active cases in their counties also used social media to distribute information about HPAI, reaching over 12,000 followers. In addition, the Ag Hub webpage received 2,874 pageviews by 733 individuals (of which 32% were returning visitors) accessing HPAI resources.

To share resources with those concerned about their poultry flocks contracting HPAI, NDSU Extension created a voluntary survey and sent email updates on the status of HPAI and available resources to those wishing to receive them. The survey was completed by 63 poultry owners.

NDSU Extension was on site aiding in response efforts in counties with active cases in backyard and commercial flocks. NDSU Extension agents assisted with contacting individuals within the control zone (quarantine area) associated with each case; sharing information and resources with poultry owners within this area and reporting back to the North Dakota Department of Agriculture, Animal Health Division. Extension agents directly contacted 949 individuals as part of surveillance efforts in the control zones. An NDSU Extension specialist coordinated, assisted with, monitored and reported the carcass disposal efforts for four commercial flocks in coordination with the North Dakota Department of Agriculture, Animal Health Division, the North Dakota Department of Environmental Quality, Division of Water Quality and the United States Department of Agriculture Animal and Plant Health Inspection Service veterinarians and staff. The role of this Extension specialist was to provide carcass disposal management technical support, ensuring virus inactivation in the mortalities from each site. This Extension specialist attended two professional development opportunities between cases to increase understanding of foreign animal diseases and become certified in appropriate disposal methods.

Summary
The resources and support provided by NDSU Extension during the HPAI outbreak aided in building awareness about the disease and reducing the number of cases in the state. Poultry owners should continue to practice good biosecurity measures to keep their birds healthy. In addition, they should remain vigilant as there is a risk of HPAI during active migration periods during the spring and fall. NDSU Extension is actively evaluating opportunities to improve our ability to support producers impacted by HPAI and other foreign animal diseases in the future.

"In response [to HPAI], North Dakota took a multi-agency approach to address the needs and concerns of industry and world trade entities. NDSU Extension leadership and educational services provided essential information for the public including 4-H youth, poultry producers, hunters and concerned citizens. NDSU Extension Specialist Mary Keena personally oversaw four commercial turkey disposal

processes involving composting. Her instruction at the front lines allowed commercial producers to have an educated and caring local person to ask questions and help guide them through the process in coordination with a USDA APHIS Subject Matter Expert (SME) acting in a virtual role. The teamwork and collaboration achieved in this response will serve as the groundwork for tackling the challenges we are going to face in the future." – Ethan Andress, DVM, North Dakota State Veterinarian, Board of Animal Health

Acknowledgments
Thank you to everyone who partnered with us in these response efforts, including NDSU Extension agents, specifically those in counties with positive cases; NDSU Agriculture Communication staff including Stacy Wang, Kristin Harner, Dave Haasser and Sonja Fuchs; Leigh Ann Skurupey; Gerald Stokka; North Dakota Department of Agriculture, Animal Health Division; North Dakota State University, Veterinary Diagnostic Laboratory; North Dakota Game and Fish Department; and North Dakota Department of Environmental Quality, Division of Water Quality.

Biofortification Strategies in Spring Wheat

Mike Ostlie and Jasper Teboh

Introduction

Biofortification is an emerging strategy that increases the nutrient content of food crops. Wheat, rice, and corn are common crops that are targeted for biofortification efforts. One of the common goals of biofortification is a food system-wide increase in key micronutrients, especially in countries with widespread malnutrition. The amount of desired nutrient content (biofortification) varies by average consumption of a product within a country, so that the grain nutrient concentration increases average intake of the nutrient. This could be considered similar to providing a vitamin supplement on a large scale.

Zinc is one of the primary nutrients utilized in biofortification strategies. Zinc deficiency is common in some parts of the world, including India and Southeast Asia. One of the primary ways to increase zinc concentration in grain is to use varying management strategies. This can be accomplished through soil-applied fertility management, in-season nutrient applications, or through plant breeding efforts. A good benchmark for a grain to be considered zinc biofortified is a zinc concentration of 45 mg/kg in the kernels.

North Dakota hard red spring wheat (HRSW) is already considered high quality and often marketed at a premium compared to other wheat types. It is only natural for this class of wheat to be considered for biofortification purposes. Areas that grow HRSW may apply inputs that are not as common in other areas of the country or world, including post-anthesis nitrogen applications and sometimes multiple fungicide applications. Initial information has indicated that wheat grown under standard conditions in North Dakota often contains between 30-45 mg/kg zinc. Could zinc products be added to these applications to increase grain zinc concentration? Confirmation of zinc fortification would lead to new marketing opportunities for HRSW.

Methods

Studies were conducted in 2020 and 2021 in dryland and irrigated environments to test different application timings of zinc to HRSW which could be paired with existing passes across a field. These timings were herbicide timing, scab fungicide timing, and post-anthesis nitrogen timing. At each timing, the standard input was applied with or without a zinc product. A zinc EDTA (Blue Tsunami) was used with the applications. Huskie was the herbicide used in the first timing, which also included UAN. Prosaro fungicide was used for the scab timing and UAN was used in the post-anthesis timing. Tissue samples were collected one week after application to test for increases to zinc content in the plants. Grain samples were also tested for zinc concentration. The study included a high yielding (Faller) and

high protein (Bolles) variety to test if nutrient partitioning changed with varieties. The study was arranged as a split-split-plot randomized complete block design (RCBD), with timing being the main plot, variety as the subplot, and zinc as the sub-sub-plot.

Results

Results from the dryland and irrigated studies could not be combined, but the years could be combined. Results are presented as either dryland or irrigated and include both years. For the dryland site, yield was not impacted by any of the treatment combinations (Table 1). Leaf nitrogen and phosphorous concentrations did not change with the addition of zinc. At the early timing, leaf zinc concentrations also did not increase. However, leaf zinc concentrations did increase with the latter two applications, with the highest concentration at post-anthesis timing. There were no differences between variety accumulation of zinc. For the grain concentration, there again was no accumulation of zinc at the early timing but increases at the later two timings. The largest benefit was realized using the variety Bolles, which was statistically greater than the zinc concentration of Faller. However, Faller zinc concentration was still greater than the no-zinc treatment and increased to a point that could be considered biofortified.

Table 1. Dryland HRSW response to zinc application timings.

Timing	Treatment	Variety	Yield	Leaf	Leaf	Leaf	Grain	Grain	Grain
			bu/a	N %	P %	Zn ppm	N %	P %	Zn ppm
3-4 leaf wheat	Nitrogen (UAN)	Bolles	45.1	4.60	0.294	34.6	3.19	0.425	38.0
3-4 leaf wheat	Nitrogen (UAN)	Faller	46.7	4.89	0.300	24.0	3.03	0.478	44.3
3-4 leaf wheat	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Bolles	48.6	4.75	0.290	25.1	3.19	0.480	45.4
3-4 leaf wheat	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Faller	48.3	4.55	0.291	24.0	2.95	0.383	30.8
Flowering	Proline Fungicide	Bolles	45.6	4.16	0.203	20.9	3.20	0.431	37.9
Flowering	Proline Fungicide	Faller	46.9	4.23	0.204	15.0	3.01	0.408	33.9
Flowering	Proline Fungicide + Zinc (Blue Tsunamai)	Bolles	45.9	4.21	0.206	93.0	3.21	0.494	67.3
Flowering	Proline Fungicide + Zinc (Blue Tsunamai)	Faller	48.6	4.23	0.211	63.1	2.92	0.418	47.4
Post-anthesis	Nitrogen (UAN)	Bolles	45.5	4.33	0.216	16.0	3.28	0.446	40.9
Post-anthesis	Nitrogen (UAN)	Faller	48.3	4.44	0.218	26.1	3.22	0.460	41.1
Post-anthesis	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Bolles	44.4	4.24	0.205	176.1	3.27	0.503	61.8
Post-anthesis	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Faller	49.4	4.29	0.200	178.1	3.03	0.446	49.1
LSD (0.05)			NS	0.24	0.027	45.8	0.25	0.069	12.5
C.V. (%)			12.7	5.6	11.6	79.3	8.1	15.4	28.0

The irrigated environment performed similarly (Table 2). There was less variability in the data which led to yield differences between treatments, but only between varieties. Neither leaf nor grain zinc concentration increased at the earliest application timing. Leaf concentration of zinc once again was greatest at the post-anthesis application timing, but also increased at the fungicide timing. Grain zinc concentration was greatest at the fungicide application timing for Bolles. Faller had no difference between application timings. Both Bolles and Faller reached zinc concentrations that could be considered biofortified.

Table 2. Irrigated HRSW response to zinc application timings.

Timing	Treatment	Variety	Yield	Leaf	Leaf	Leaf	Grain	Grain	Grain
			bu/a	N %	P %	Zn ppm	N %	P %	Zn ppm
3-4 leaf wheat	Nitrogen (UAN)	Bolles	68.8	5.36	0.311	40.0	2.90	0.511	42.5
3-4 leaf wheat	Nitrogen (UAN)	Faller	67.8	5.49	0.329	27.8	2.83	0.511	42.6
3-4 leaf wheat	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Bolles	66.4	5.51	0.311	40.3	2.95	0.510	43.8
3-4 leaf wheat	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Faller	65.9	5.38	0.320	26.5	2.71	0.479	39.9
Flowering	Prosaro Fungicide	Bolles	70.3	4.52	0.276	35.0	2.82	0.478	39.1
Flowering	Prosaro Fungicide	Faller	68.7	4.35	0.251	32.8	2.84	0.511	43.9
Flowering	Prosaro Fungicide + Zinc (Blue Tsunamai)	Bolles	64.3	4.36	0.260	80.1	3.04	0.559	65.3
Flowering	Prosaro Fungicide + Zinc (Blue Tsunamai)	Faller	70.6	4.56	0.265	64.9	2.61	0.476	50.5
Post-anthesis	Nitrogen (UAN)	Bolles	67.6	4.63	0.278	34.4	2.98	0.503	41.6
Post-anthesis	Nitrogen (UAN)	Faller	70.1	4.79	0.280	20.8	2.77	0.515	42.4
Post-anthesis	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Bolles	64.8	4.57	0.266	164.3	2.85	0.494	54.6
Post-anthesis	Nitrogen (UAN) + Zinc (Blue Tsunamai)	Faller	69.9	4.62	0.275	199.8	2.72	0.464	47.9
LSD (0.05)			4.5	0.32	0.028	33.7	0.20	0.055	5.9
C.V. (%)			6.7	6.6	9.9	53.0	7.0	11.1	12.8

Some take-aways from this study are that in all four environments tested, both Bolles and Faller responded to zinc applications. Bolles often had a better response. This could mean that protein-oriented varieties may be better suited for biofortification strategies or it could be some other factor in the genetics between the varieties. Leaf zinc concentrations were greatest with the post-anthesis timing, but much of that zinc did not translocate to the grain. Applying zinc with the fungicide was the most reliable method for increasing grain zinc concentration in the study.

It would be important to test this theory on additional varieties to confirm whether there are differences in responses. However, this study confirmed the potential to fortify HRSW with the addition of zinc during the growing season. This could be a new value-added value added product that would be suited for export as either raw or processed to many parts of the world that are looking for more nutrient dense diets.

Partial support for this research was provided by the National Wheat Foundation and the Grain Foods Foundation.

Using Spatial Analysis to Overcome Heterogeneity in Field Trials

Kristin Simons

Introduction

Field trials provide valuable crop information to breeders, dealers, producers and processors. The location and design of each field trial is optimized to obtain homogeneity across the experimental site to provide the best head-to-head comparison between entries. Often the experiments are blocked into smaller groups to reduce the amount of variation for a research trial. However, underlying differences such as differing soil types, soil fertility, water holding capacity, etc. may exist within the trial site. Typically, a coefficient of variation (C.V.) is calculated to show the extent of the trial variability from the trial mean. In instances where the C.V. is high, a post-adhoc analysis that incorporates the plot spatial arrangement can be utilized to generate a better estimate of the crop data.

Methods

Two variety field trials grown at the CREC in 2022 were selected and the yield analyzed using two statistical methods. The field location of the first trial had a known fertility gradient as the shadow of the shelterbelt reduced fertility. The precise location and orientation of the trial was selected to minimize the

variation within trial replication blocks. The design was a randomized complete block design (RCBD), consisting of three blocks with each block containing 22 entries. The second field site was expected to be nearly homogenous and contained a larger trial, an RCBD consisting of four blocks with 46 entries per block. The first statistical method used a linear mixed model analysis. Means were reported for each entry. The second method incorporated a post-adhoc analysis step using SpATS (Spatial Analysis of field Trials with Splines; Rodriguez-Alvarez et al. 2018) in the Mr. Bean R software package. In the second analysis method, the spatial effect is modeled as a surface and subsequently decomposed into a number of fixed and random components for mixed model analysis. The best linear unbiased estimates (BLUEs) were reported for each entry using the second analysis method. The least significant differences (LSD) were also calculated for each analysis method with an alpha of 0.1.

Results and Discussion

The first site with the expected field gradient was orientated on the site so the blocks ran parallel to the shelterbelt and produced acceptable results using the simple linear mixed model analysis. The plot yields ranged from 205 to 3286 pounds/acre and were graphed spatially in Figure 1. The C.V. for the trial was 13.6%. The second statistical analysis, the post-adhoc spatial analysis, lowered the C.V. value to 7.5%. The spatial trend was plotted (Figure 1) and indicates a spatial effect on the plots corresponding to their distance from the shelterbelt. Depending on the spatial location of each plot, the BLUEs for some entries may be lower/higher than the averages as more plots of one particular entry may have randomly been placed in higher/lower producing areas (Table 1). The lower amount of residual variation calculated using the second analysis method also means smaller differences are more significant as indicated by lower LSD values.

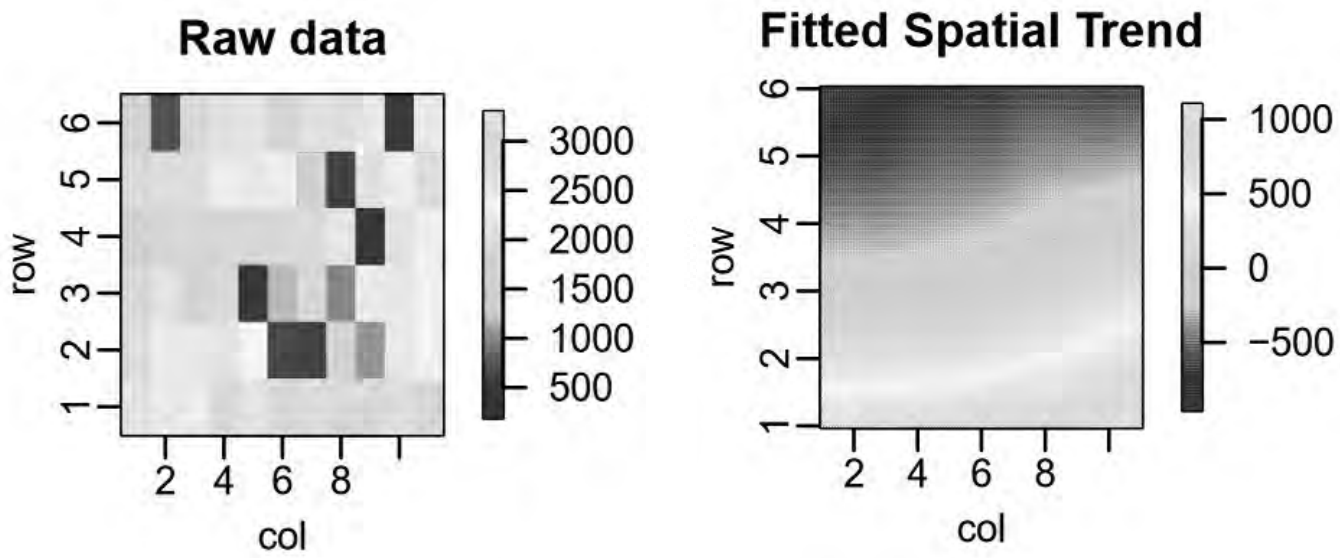


Figure 1. Raw yield data from the first site was plotted by row and column (col) with observable differences throughout the trial. The Spatial trend was graphed two dimensionally to better observe the effect of spatial placement on the yield results.

Table 1. Comparison of means versus BLUEs for the first field trial.

Entry	Mean (pounds/acre)	BLUEs (pounds/acre)
1	2252	2298
4	2171	2319
5	2075	1977
9	2630	2559
15	2025	2267
Trial Mean	1950	1988
CV %	13.6	7.5
LSD (0.10)	418	117

The second field site was not as homogeneous as expected with a calculated C.V. of 29.5% using a linear mixed model without spatial effects. Individual plot yields ranged from 299 to 3901 pounds/acre. The LSD (0.1) value of 837 pounds/acre would indicate few significant differences between entries. Completion of the second statistical model incorporating the spatial analysis indicated spatial arrangement affected the yield (Figure 2). The C.V. from the second statistical model was 13% with an LSD (0.1) of 233 pounds/acre. The BLUEs from the second model likely better reflect the estimated means in this trial.

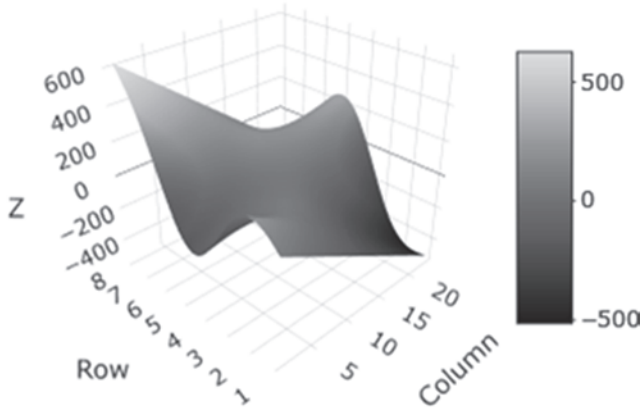


Figure 2. Three-dimensional representation of the spatial trend for the second field trial indicates a spatial effect on yield.

Conclusions

A simple linear mixed model analysis on an RCBD works well to compare entries head-to-head if the field location is homogeneous. For sites less homogeneous, BLUEs provide a better estimate of the actual means than simple means since the statistical model incorporates spatial effects. Better estimates lead to more accurate data during decision making for breeders, dealers, producers and processors. As you see values noted as BLUEs in the variety trial reports, keep in mind underlying variability was found and corrected to report an unbiased estimate of the mean.

Reference

Rodriguez-Alvarez, M.X, Boer, M.P., van Eeuwijk, F.A., and Eilers, P.H.C. (2018). Correcting for spatial heterogeneity in plant breeding experiments with P-splines. Spatial Statistics, 23, 52 - 71.

Nitrogen Fixing Bacteria for Corn: Testing Two Commercial Products

Dave Franzen, Clair Keene, Szilvia Yuja, Kelly Cooper and Heidi Eslinger

Introduction

Lately, biological-based products have been marketed to enhance crop production. One class of products is as essentially seed inoculants that claims to either infect the seed, which enables them to perform N-fixation functions similar to Rhizobia in legumes, or they inhabit the immediate soil outside the root (the rhizosphere) and use plant-root exudates as food-stuffs, enabling the N-fixing organisms to fix N from the air. There is much more marketing information available to corn growers on these products than there is real unbiased data; particularly data from North Dakota and the immediate region.

There is evidence that N-fixing organisms are already present in our soils. Part of the long-term no-till N credit used as part of North Dakota N fertilizer recommendations for spring wheat/durum, sunflower and corn is likely the result of asymbiotic N-fixers whose activity is maximized by preservation of their soil 'homes' through minimal disturbance and presence of a greater and more varied food supply than in conventional-till soils (Franzen, Inglett and Gasch 2019).

Envita™ by Azotic North America and Utrisha™ by Corteva Agriscience are nitrogen-fixing products sold in our region. The most repeated N contribution of marketing literature of the two products is that it would reduce the rate of N required to grow the crop by at least 40 pounds N/acre. If this were accurate, it would be a savings of $20-$50 per acre (less the cost of the products) to a corn grower. In addition to possible corn grower cost savings, there is increasing pressure from the public and government to reduce fertilizer rates of all types due to environmental concerns, including greenhouse gas emissions during manufacture and after application.

A study funded in part by the North Dakota Corn Utilization Council, was conducted to evaluate the ability of these two products to supplement some or all of the N required to grow a corn crop in North Dakota.

Methods and procedure

There were four research sites in North Dakota with similar protocols: one near Carrington, one at Oakes, one at Absaraka and one at Prosper.

Each site was on soil with relatively low residual soil nitrate values. The Absaraka site was managed through one-pass seeding (no-till), while the other three sites were conventionally tilled using a chisel plow at least once in the fall to at least 8-inch depth, followed by a spring field cultivation prior to planting.

Treatments at Carrington, Absaraka and Prosper were the same (Table 1), but due to an error in calculation, the nitrogen rates applied were four times lower at Oakes (Table 2). The Oakes site is also on a sandier soil and received 11.5 inches of irrigation water, resulting in visible signs of nitrogen deficiency throughout the trial.

Table 1. Treatment structure at Absaraka, Prosper and Carrington sites.

Trt #	N-rate (lbs/a)	N-fixing product
1	0	
2	0	Utrisha
3	0	Envita
4	40	
5	80	
6	80	Utrisha
7	80	Envita
8	120	
9	160	
10	200	

Table 2. Treatment structure at Oakes site.

Trt #	N-rate (lbs/a)	N-fixing product
1	0	
2	0	Utrisha
3	0	Envita
4	8.5	
5	17	
6	17	Utrisha
7	17	Envita
8	25	
9	34	
10	42	

N treatments were applied at or before planting using SuperU™ urea (Koch Industries). All experimental units were planted with an in-furrow application of 2.5 gallon/acre 7-23-5. The treatments with Envita were made using 7-23-5 (low salt) as a carrier and applied to the appropriate treatment areas with a 5-gallon total solution in-furrow. The starter dilutions were made using distilled water or water straight from a well without chlorination. The Envita solution was made with the dilutions specified on the label with non-chlorinated water. Harvest was completed by hand at Absaraka and with a plot combine at the other three locations.

Results

Corn yields responded to nitrogen rates at all the sites. At Absaraka, corn yield increased with N up to a treatment of 120 lbs N/acre (Figure 1); at Prosper, up to 200 lbs N/acre (Figure 2); at Carrington up to 80 lbs N (Figure 3) and at Oakes up to 42 lbs N/acre, which was the highest rate applied there (Figure 4). The nitrogen yield curve was linear at Oakes, because of the low rates applied. Greater N rates at Oakes would have resulted in greater yield. The Utrisha and Envita additives did not result in greater yield at either the 0 or the 80 lbs/acre N level at any of the three locations using full rates or the 0 and 17 lbs/ acre rates at Oakes (Figures 1 through 4).

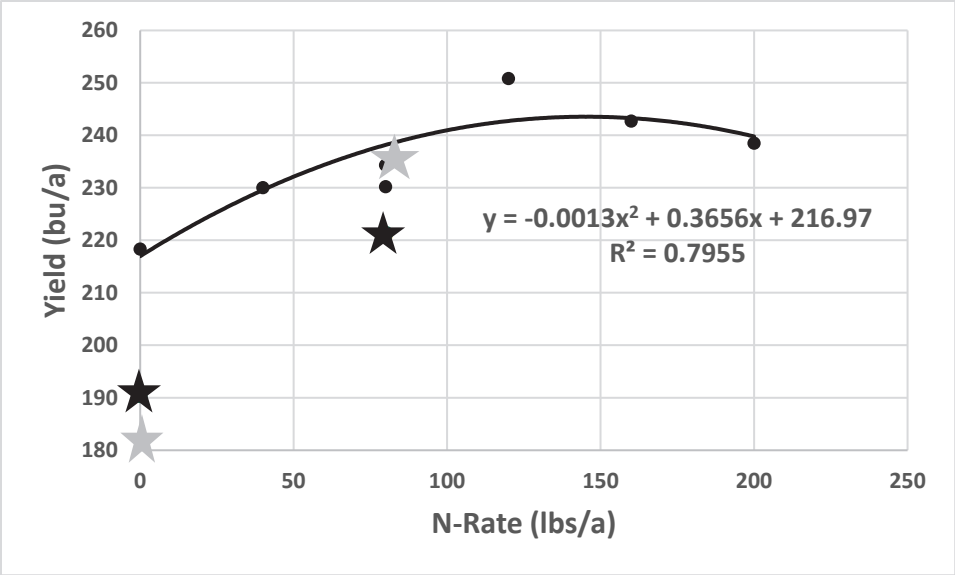


Figure 1. Absaraka response of corn to N treatment and N rate with additives. Gray stars indicate treatments (0 and 80 lbs N/acre) with Utrisha post-applied V6. Black stars indicate treatments (0 and 80 lbs N/acre) with Envita in furrow at planting.

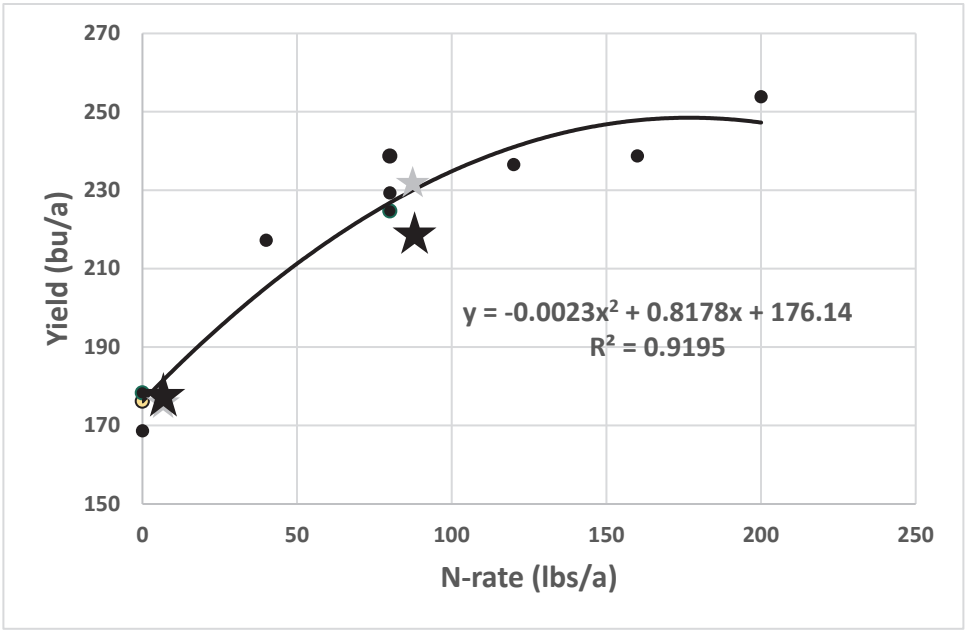


Figure 2. Prosper response of corn to N treatment and N rate with additives. Gray stars indicate treatments (0 and 80 lbs N/acre) with Utrisha post-applied V6. Black stars indicate treatments (0 and 80 lbs N/acre) with Envita in furrow at planting.

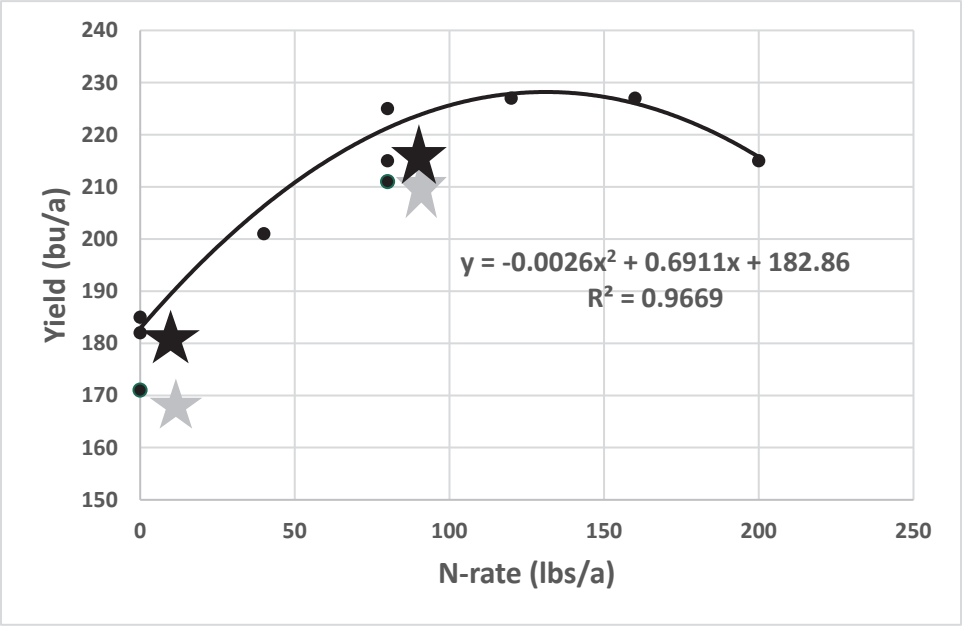


Figure 3. Carrington response of corn to N treatment and N rate with additives. Gray stars indicate treatments (0 and 17 lbs N/acre) with Utrisha post-applied V6. Black stars indicate treatments (0 and 17 lbs N/acre) with Envita in furrow at planting.

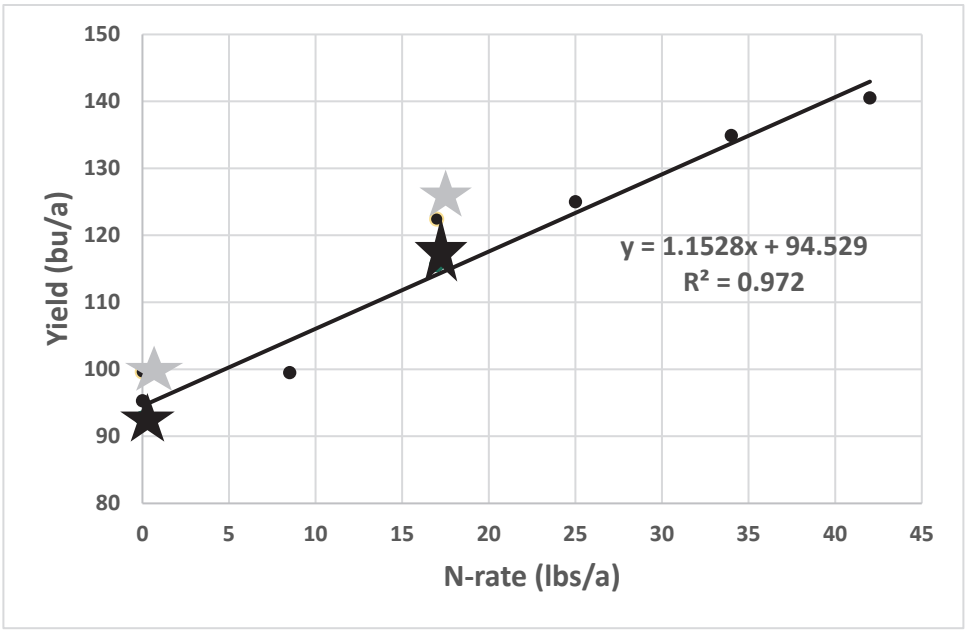


Figure 4. Oakes response of corn to N treatment and N rate with additives. Gray stars indicate treatments (0 and 17 lbs N/acre) with Utrisha post-applied V6. Black stars indicate treatments (0 and 17 lbs N/acre) with Envita in furrow at planting.

Summary

Four sites in eastern North Dakota were subjected to an N-rate trial, with the N-fixing bacteria containing products Envita and Utrisha applied per their respective labels in-furrow and foliar at V6. The results indicate that there was a positive response to N at all locations; however, neither Envita nor Utrisha contributed greater yield at either of the N-rates or locations where they were applied. The application of these nitrogen-fixing bacteria outside of their native habitat and in crops other than their natural hosts is a somewhat novel concept. The scope of this study did not allow testing whether

colonization had happened successfully. There is likely more to learn about the precise conditions under which these organisms can thrive and establish a symbiotic relationship with crops beyond their original hosts.

Literature

Franzen, D.W., P. Inglett, and C.K. Gasch. 2019. Asymbiotic nitrogen fixation is greater in soils under long-term no-till versus conventional tillage. Soil Science Society of America Journal 83:1148-1152. Doi:10.2136/sssaj2019.03.0062.

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

Greg Endres, Leo Bortolon, Shana Forster and Mike Ostlie

Durum growers and the pasta industry need consistent seed yield and especially quality for profitability. Durum growers have indicated supplemental postemergence applied nitrogen (N) fertilizer and sequential, late-season foliar fungicide may increase yield, and seed protein and vitreous kernels ('hard count') percentage. These two intensive management strategies are being investigated with an NDSU field study initiated in 2021.

The study was conducted by the Carrington Research Extension Center (REC) and the North Central (Minot) REC, and with partial financial support from the North Dakota Wheat Commission. The research was conducted under irrigation at Carrington and dryland at Minot to provide variable durum production environments. Trial preplant (PP) soil nitrate-N levels, based on NDSU Extension recommendations, ranged from 100-140 lbs N per acre. 'ND-Riveland' was grown with early-season stand at 1- to 1.4-million plants per acre. Foliar fungicide (Miravis Ace or Prosaro Pro) was applied at early flower growth stage across trials. The study included six treatments:

1. Check (PP N and fungicide at early flower growth stage)
2. 30 lbs N per acre at tillering wheat stage
3. Foliar fungicide 4-7 days following fungicide at early flower stage
4. 30 lbs N per acre at tillering stage/Foliar fungicide (tebuconazole, Prosaro or Prosaro Pro) 4-7 days following fungicide at early flower stage
5. 30 lbs N per acre at early post-flowering (PF) stage
6. Foliar fungicide 4-7 days following fungicide at early flower stage/30 lbs N per acre at PF stage

Three site-years (Carrington, 2021-22 and Minot 2022) of data have been generated. The following is a summary of preliminary data:

- At Carrington in 2021, averaged across N and fungicide treatments, 989,000 and 1,368,000 plants per acre resulted in similar seed yield, protein and vitreous kernels.
- During each of the three trials, foliar disease and Fusarium head blight (scab) were essentially absent, and seed yield and quality were generally similar among fungicide treatments and the check.
- Seed yield across the 3 site-years averaged 82.3 bu per acre with N applied at tillering stage compared to 77.1 bu per acre with N applied at PF stage and 77.0 bu per acre with check. Test weight was similar among treatments, averaging from 63.0-63.3 lbs per bu.
- At Carrington in 2022, seed protein was 12.2% and 13.4% with N applied at tillering or at PF stages, respectively, compared to the check at 11.5%. Averaged across site-years, seed protein averaged 13.0% with the check compared to 13.7% with N at tillering and 14.2% with N at PF stage.
- At Carrington in 2022, N applied at tillering or at PF stages increased vitreous kernels to 87 and 96%, respectively, compared to the check at 82%. Averaged across site-years, vitreous kernels

averaged 91% with the check compared to 94% with N at tillering stage and 97% with N at PF stage.

Durum seed protein at Carrington was higher with N applied at tilling or at post-flowering.

Quantifying the Impact of Fungicide Spray Volume on White Mold Management in Dry Beans and Soybeans

Michael Wunsch, Jesse Hafner, Suanne Kallis, Aaron Fauss, Kelly Cooper, Heidi Eslinger, and Spencer Eslinger

The use of fungicide spray volumes greater than 10 gal/ac is widely recommended for white mold management in soybeans and dry beans, but data to support this recommendation is lacking.

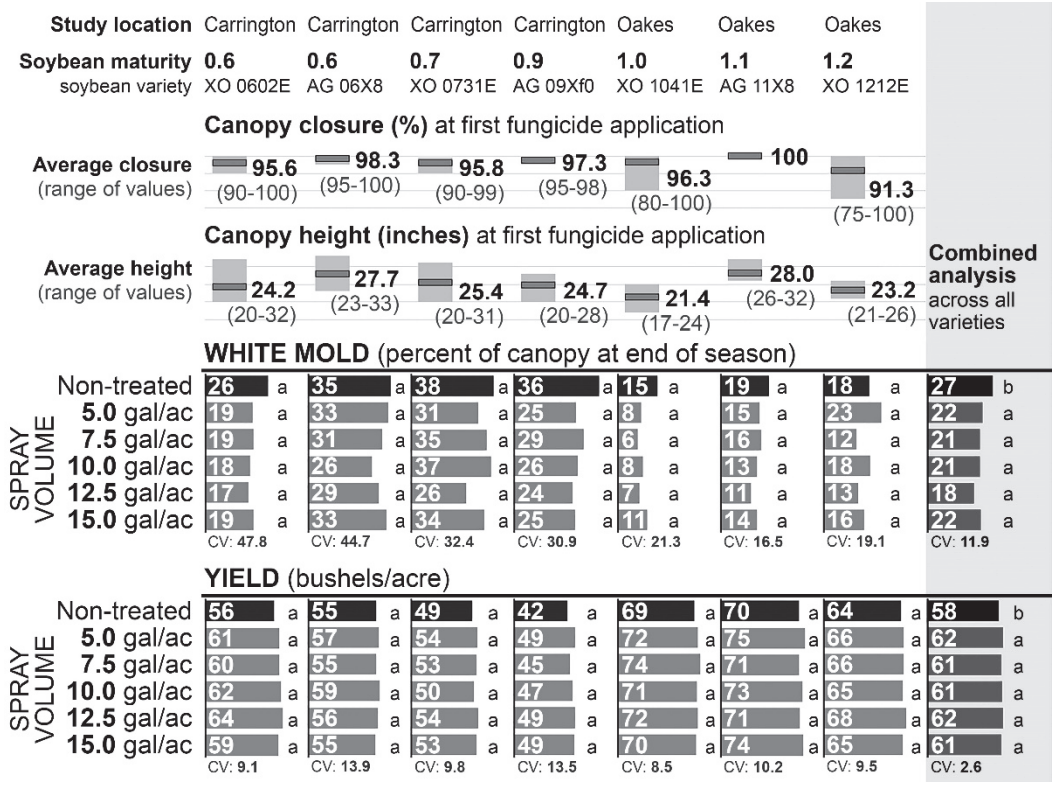
Recent research from Brazil suggests that increasing fungicide spray volume may not improve white mold management as much as previously assumed. In field studies conducted in southern Brazil from 2012 to 2014 with two different fungicides, increasing fungicide spray volume from 10.7 to 21.4 gal/ac conferred no reduction in white mold incidence and conferred no increase in soybean yield with either fungicide tested. The Brazilian studies were conducted with a hand-held spray boom at walking pace, and it is unclear whether similar results might be found with driving speeds and spray equipment utilized commercially.

Field studies rigorously evaluating the impact of fungicide spray volume on white mold management were initiated with dry edible beans in Carrington in 2020 and expanded to soybeans in 2022. Fungicides were applied with a PTO-driven, tractor-mounted sprayer equipped with a pulse-width modulation system (Capstan AG; Topeka, KS), with pulse width modified as needed to maintain the same driving speed, nozzles and application pressures across all treatments. Pulse width was set on the basis of the measured spray output immediately before making applications and was always greater than 20%. The dry bean studies were conducted with two sequential fungicide applications, the first at early bloom and the second 11 to 12 days later. In 2020, Endura (8 oz/ac) was applied twice; in 2021 and 2022, Topsin (40 fl oz/ac) was applied first and Endura (8 oz/ac) second. In 2020 and 2021, fungicides were applied with TeeJet XR11006 nozzles at 35 psi (medium droplets) at 6.0 mph. In 2022, fungicide droplet size was calibrated relative to canopy closure, and fungicides were applied with XR11008 nozzles at 50 psi (medium droplets) and 11.5 mph (10, 15 and 20 gal/ac) or 9.0 mph (25 gal/ac) in the first application and XR11010 nozzles at 30 psi (coarse droplets) at 8.0 mph (all

treatments) at the second application. In the soybean studies, the impact of fungicide spray volume was tested with a single application versus two sequential applications of Endura (5.5 oz/ac), and spray droplet size was calibrated relative to canopy closure. In Carrington, the first application was made at early to full R2 growth stage with XR11008 nozzles at 30 psi (coarse droplets) at 11.2 mph, and the second application was made nine days later with the same nozzles and pressure at 10.5 mph. In Oakes, the first application was made at the full R2 growth stage with XR11006 nozzles at 35 psi at 10.0 mph, and the second application was made 11 days later with XR11008 nozzles at 30 psi at 9.5 mph. In all studies, dry beans and soybeans were seeded to narrow (14-inch) rows. Treatment plots consisted of four rows centered within a 5-foot width, and non-harvested filler plots were established on the edges of plots to permit overspray of treatments and capture fungicide spray drift. Additional non-harvested filler plots were established at the ends of treatment plots for turning on and off the spray while maintaining full driving speed.

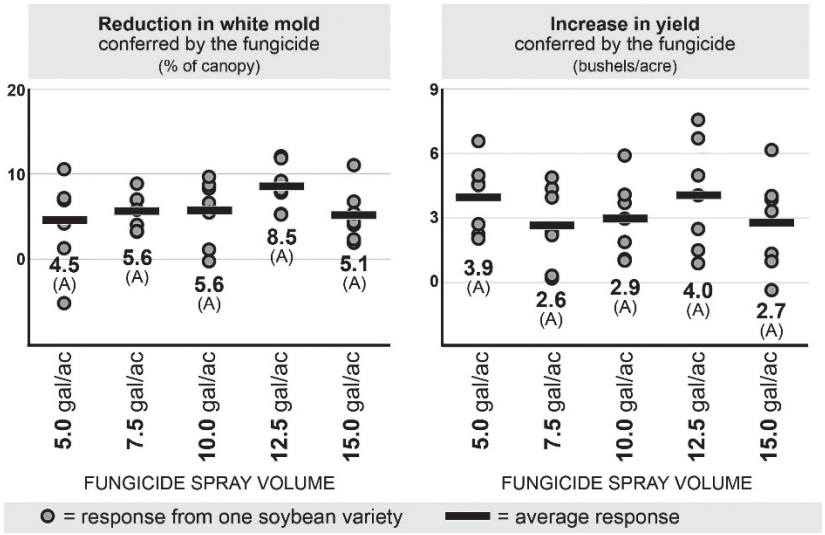
Increasing fungicide spray volume from 5.0 to 15.0 gal/ac had very little impact on white mold management across the seven soybean varieties tested in 2022. Response to fungicide spray volume was similar across upright varieties with delayed canopy closure, bushy varieties with early canopy closure, tall varieties and short varieties (Figures 1, 3). When a single fungicide application was made, no impact on white mold severity or soybean yield was observed as fungicide spray volume increased from 5.0 to 15.0 gal/ac (Figures 1, 2). When two sequential fungicide applications were made 9 or 11 days apart, a weak trend of slightly improved disease control and increased yield was observed as spray volume increased from 5.0 to 15.0 gal/ac (Figures 3, 4), but statistical separation across spray volume treatments was only observed for the disease reduction conferred by 5.0 vs. 12.5 gal/ac (Figure 4).

Figure 1. White mold and soybean yield response to a single fungicide application (Endura, 5.5 oz/ac) applied at in 5.0 to 15.0 gal/ac spray volume.



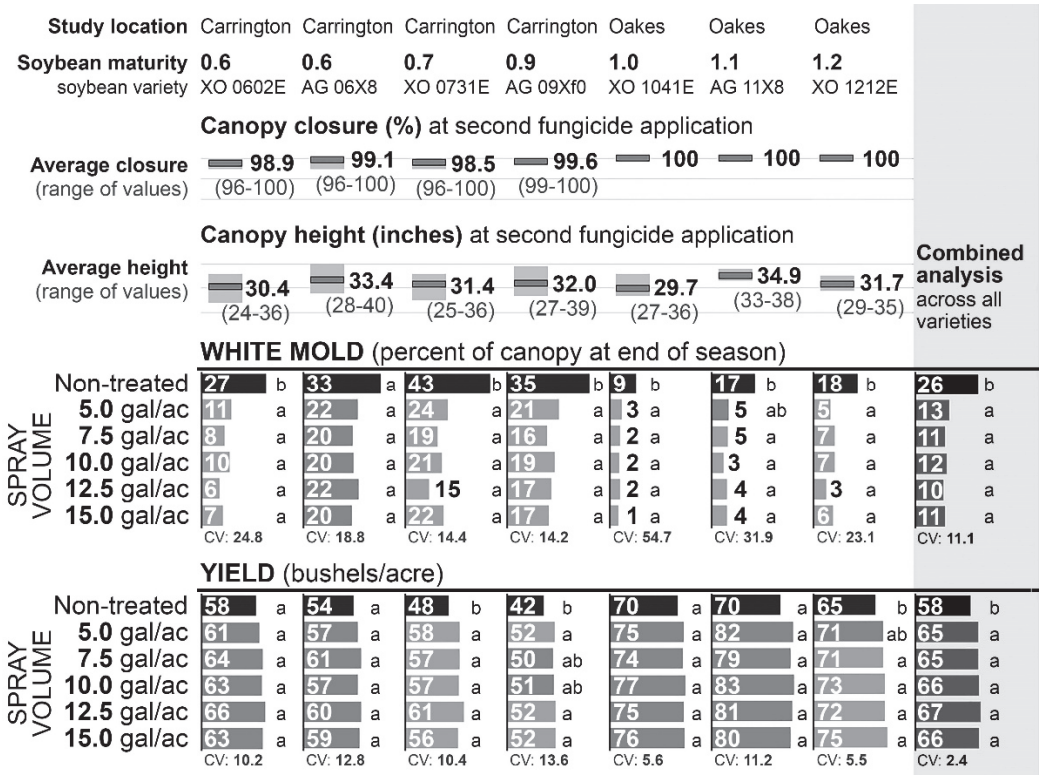
Within-column means followed by different letters are significantly different ($P < 0.05$; Tukey multiple comparison procedure).

Figure 2. Reduction in white mold and increase in soybean yield conferred by a single fungicide application (Endura, 5.5 oz/ac) applied in 5.0 to 15.0 gal/ac spray volume.



Means followed by different letters are significantly different ($P < 0.05$; Tukey multiple comparison procedure).

Figure 3. White mold and soybean yield response to two applications of Endura (5.5 oz/ac) made nine days (Carrington) or 11 days (Oakes) apart applied in 5.0 to 15.0 gal/ac spray volume.



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

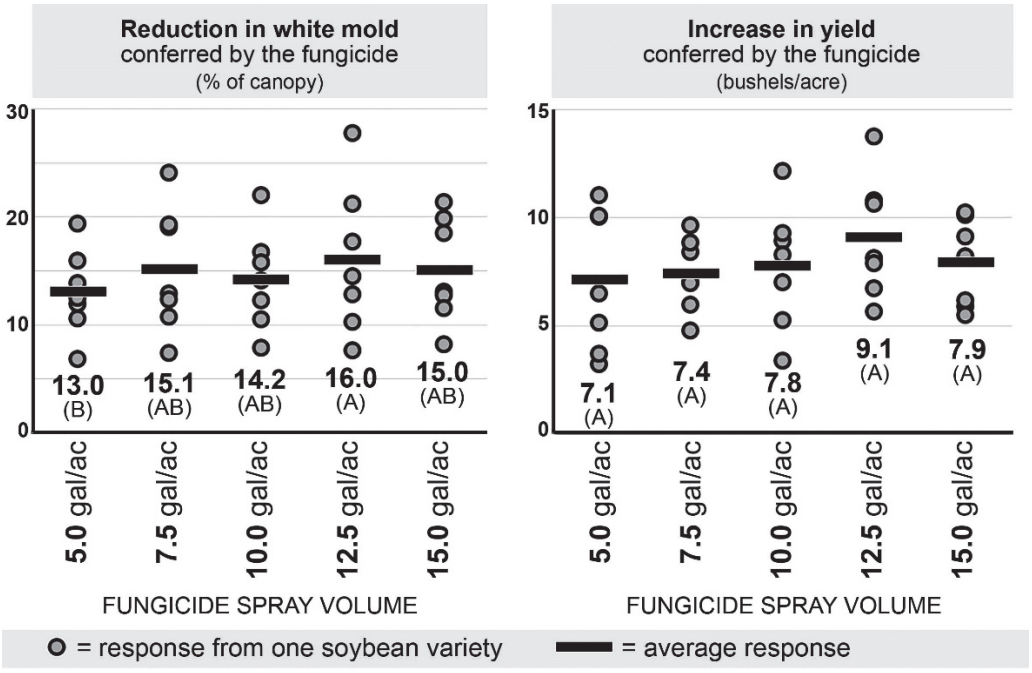


Figure 4. Reduction in white mold and increase in soybean yield conferred by two fungicides applications (Endura, 5.5 oz/ac) applied in 5.0 to 15.0 gal/ac spray volume.

Means followed by different letters are significantly different ($P < 0.05$; Tukey multiple comparison procedure).

Increasing fungicide spray volume from 10.0 to 25.0 gal/ac also had little or no impact on white mold management in dry beans. Across nine studies conducted across four market classes and six dry bean varieties from 2020 to 2022, no statistical separation of spray volume treatments was observed in any individual study or the combined analysis across studies (Figures 5, 6), and a weak numerical trend of improved disease control or yield with increased spray volume was only observed twice (Figure 5).

The lack of response to increased fungicide spray volume observed in these studies is surprising, and follow-up research is planned for 2023.

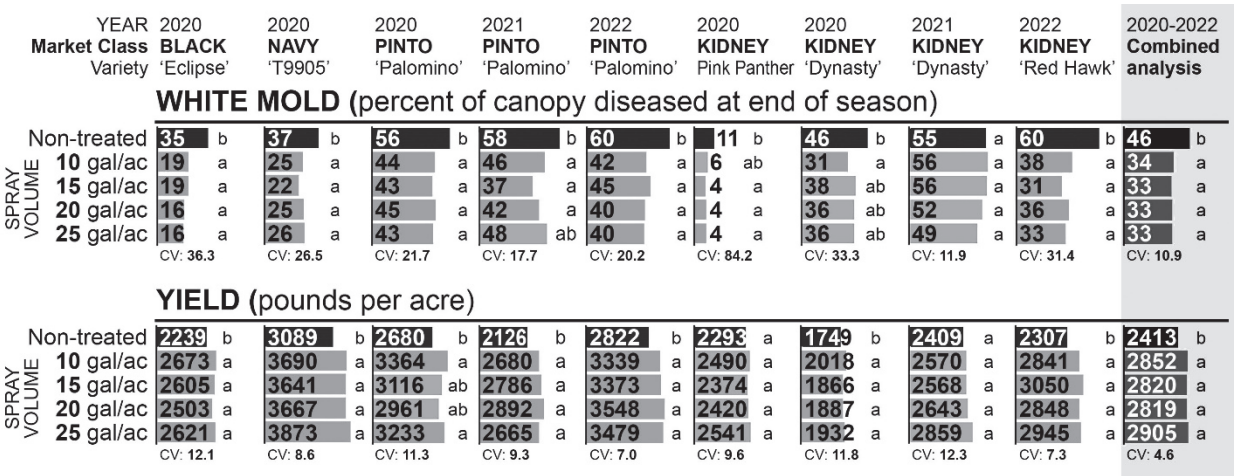
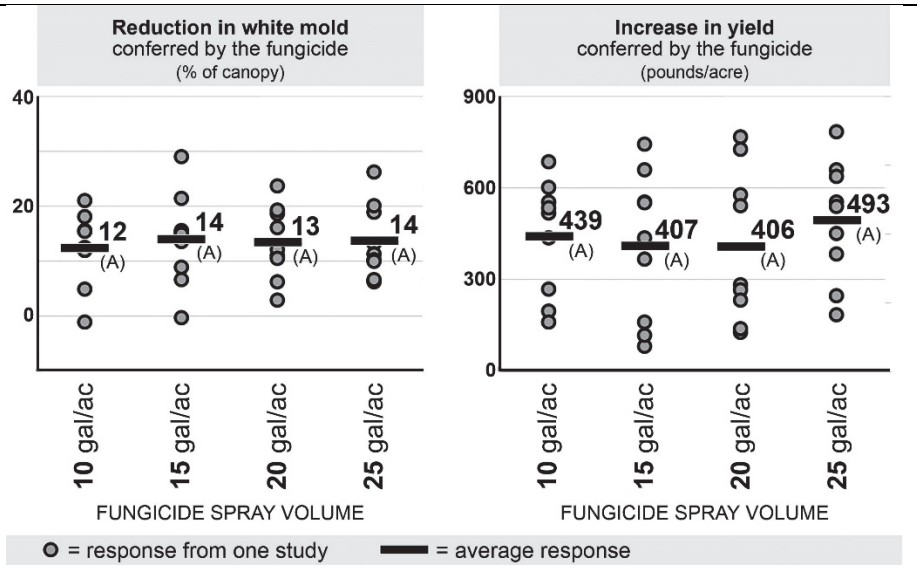


Figure 5. White mold and yield response to fungicide spray volume in dry edible beans. Fungicides were applied twice, 11-12 days apart. In 2020, Endura (8 oz/ac) was applied twice; in 2021-2022, Topsin (40 fl oz) was applied first followed by Endura (8 oz). Within-column means followed by different letters are significantly different ($P < 0.05$; Tukey procedure).

Figure 6. Reduction in white mold and increase in yield conferred by applying fungicides with 10 to 25 gal/ac spray volume fungicide applications to pinto, black, navy, and kidney beans; Carrington, ND (2020-2022). In 2020, Endura (8 oz) was applied twice; in 2020 and 2021, Topsin (40 fl oz) was applied first followed by Endura.



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

Winter Rye Cover Crop Preceding Soybean: Fall Planting Dates and Rates Study Overview

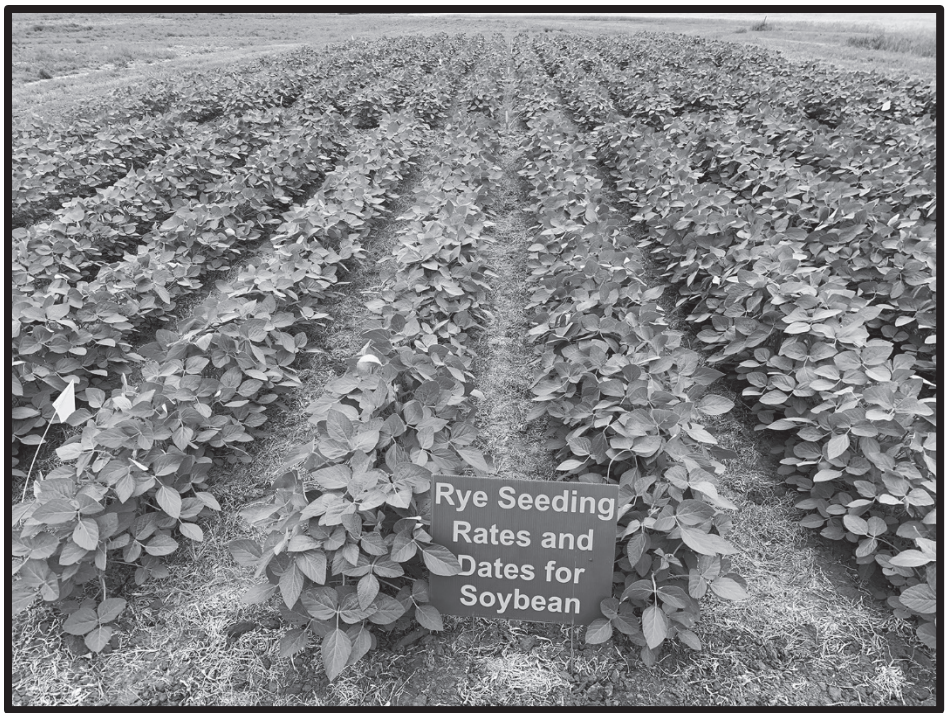
Greg Endres

Each fall, questions exist regarding winter rye planting dates and rates as farmers establish the cover crop preceding soybean production for the following year. Rye cover crop planting dates can range from August to November, and planting rates may range from 20 to 90 lbs/acre. Farmer goals with the cover crop are an important consideration, and likely include protection from soil erosion, weed suppression, and long-term improvement of soil productivity. A study was conducted by the Carrington Research Extension Center, with partial financial support from the North Dakota Soybean Council, to help determine the optimum rye seeding rate and resulting established stand, based on fall seeding dates and following season factors affecting soybean production.

The field study commenced during the fall of 2018 with two planting dates and three planting rates of winter rye. Initial rye planting dates ranged from September 17 to October 2, and second planting dates ranged from October 8 to November 1. Planting rates were 25, 50 and 75 lbs per acre. Rye was direct-seeded with a no-till drill and terminated by glyphosate near soybean planting time.

Four years (2019-22) of data have been collected. Data includes rye plant population, ground cover, weed suppression and soybean performance. The following is a summary of preliminary data:

- Averaged across years, rye plant density and ground cover measured during May (prior to soybean planting) ranged from 137,800 to 598,300 plants per acre, and 9 to 27%, respectively, among combinations of rye seeding dates and rates. The greatest rye plant density (598,300 plants per acre; 14 plants per square ft) and ground cover (27%) resulted from the first planting date and 75 lbs per acre planting rate.
- Averaged across three years (2020-22), green and yellow foxtail suppression ranged from 51-73% among the six rye treatments, with the greatest suppression (73%) occurring with the first rye planting date and 75 lbs per acre planting rate. In 2020, kochia suppression was greatest (79-83%) with the early rye planting date and 50 or 75 lbs per acre planting rates.
- Averaged across four years, soybean plant density and development, and seed yield (average of 52 bu per acre) and quality were similar among rye treatments.



Rye seeding rates and dates for soybean.

Current study data indicate planting winter rye as a cover crop during the last-half of September versus later in the fall at 75 lbs per acre provides the best potential for optimizing factors measured. Soybean performance, with proper management using rye cover crop, will be consistent with traditional production methods.

Efficiency of Sulfur Fertilizer Affected by Nitrogen Availability in Canola

Szilvia Yuja and Jasper Teboh

Like most other crops, canola needs nitrogen to maximize its yield, but it is also very responsive to sulfur fertilization. There are about 2 lbs of nitrogen and 0.2 lbs of sulfur in a bushel of canola seed. The ratio of nitrogen to sulfur in the seed is known to affect oil content and quality. The ratio of available nitrogen to available sulfur in the soil is known to affect nitrogen use efficiency especially at higher rates of nitrogen. However, the availability of nitrogen could also affect sulfur use efficiency. The North Dakota recommendation is 150 lbs of available nitrogen coming from a combination of soil nitrates and fertilizer nitrogen for canola. For sulfur the recommendation is to apply 20 lbs of sulfur in a sulfate form on heavier soil and 30 lbs on lighter soil irrespective of soil test, because soil test sulfur is not a reliable predictor of sulfur yield response. Therefore, recommended sulfur is a flat rate while the nitrogen rate applied varies with soil test nitrogen levels. This means that, even while following recommendations, the ratio of sulfur to nitrogen applied can vary from year to year. Most of the time, this is not a problem, but in some cases, there is only a low amount of residual nitrogen in the immediate vicinity of the seedlings, even though the soil test levels for the 0-6 inches are high. In that instance the ratio of available sulfur to available nitrogen can be higher than intended, which can lower yield.

At the CREC we had studies, partially funded by the Northern Canola Growers Association, in which nitrogen and sulfur were applied at different rate combinations. The studies were initially intended to focus on nitrogen rates, but there were noteworthy results involving sulfur rates.

In the 2020 trial year, besides fertilizer rates, timing of application was also a factor. In 2022, all the fertilizer was applied at planting. In 2021, the trials were severely affected by drought, therefore data from that year is excluded.

In the 2020 study there were two nitrogen rates (75 and 105 lbs/a) that were either applied at planting or as a split application. Based on soil test, the total amount of available nitrogen at the 105 lb N rate was 150 lbs and 120 at the 75 lb N rate. In the split-applied nitrogen treatments, 40 lbs of nitrogen was applied at bolting, and starter was applied at either 35 or 65 lbs N. Each of the nitrogen treatments were also fertilized with either 15 or 30 lbs of sulfur at planting (Table 1).

Table 1. Treatment structure in 2020.

Trt #	Starter fertilizer	fertilizer applied at bolting
1	75 lbs N, 15 lbs S	
2	75 lbs N, 30 lbs S	
3	105 lbs N, 15 lbs S	
4	105 lbs N, 30 lbs S	
5	35 lbs N, 15 lbs S	40 lbs N
6	35 lbs N, 30 lbs S	40 lbs N
7	65 lbs N, 15 lbs S	40 lbs N
8	65 lbs N, 30 lbs S	40 lbs N

While yields were not significantly different from each other, yields with the higher rate of sulfur applied at planting were lower in all but the highest rate of starter nitrogen. (Figure 1.)

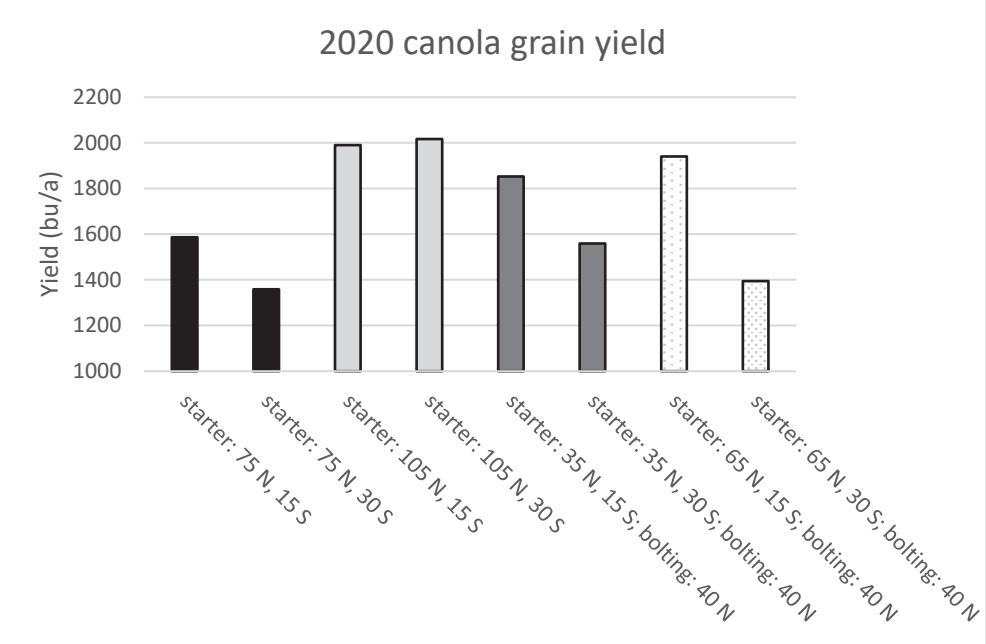


Figure 1. 2020 canola grain yields in response to fertilizer treatments applied at planting and at bolting.

In 2022, the trial was replicated under irrigation and on dryland. There were three nitrogen rates (60, 90 and 120 lbs/a), all applied at planting, with two rates of sulfur, also applied at planting (Table 2). At the dryland site residual soil nitrogen was 27 lbs/a. Under irrigation it was 15.

Table 2. Treatment structure in 2022.

Trt #	N-rate applied (lbs/a)	S-rate applied (lbs/a)
1	0	0
3	60	10
4	60	20
5	90	10
6	90	20
7	120	10
8	120	20

At the lowest rate of nitrogen (60 lbs N/a), the higher rate of sulfur (20 lbs S), produced a lower yield at both trial sites (Figures 2 and 3).

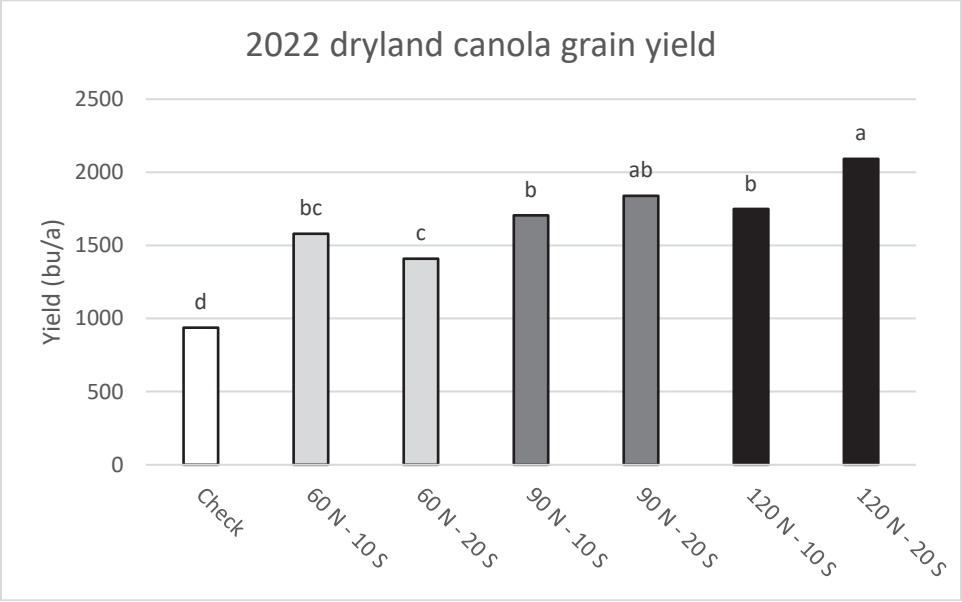


Figure 2. 2022 dryland canola grain yield in response to starter applied fertilizer treatments.

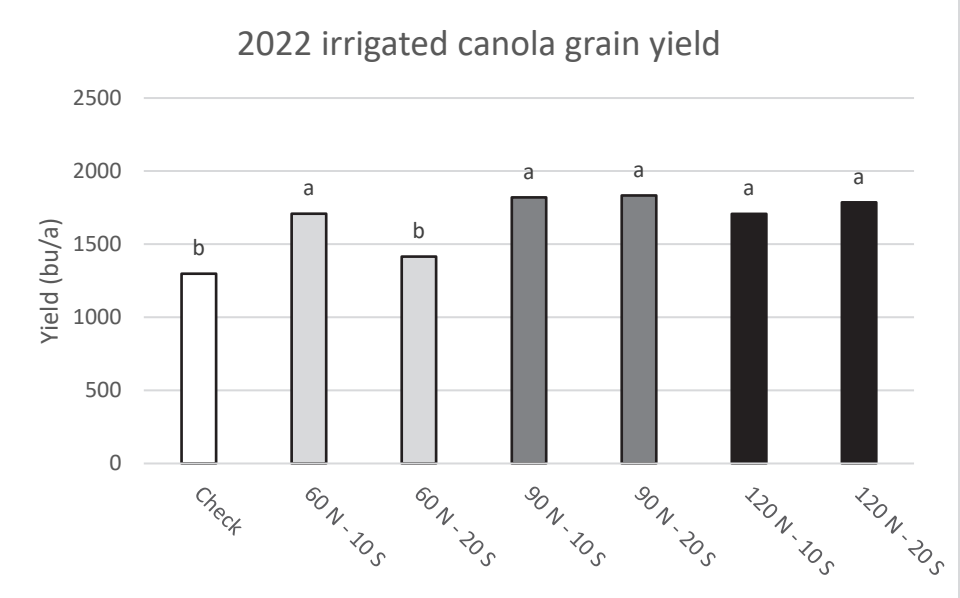


Figure 3. 2022 irrigated canola grain yield in response to starter applied fertilizer treatments.

Discussion

At all three trial sites, the higher rate of sulfur was detrimental to canola yields when nitrogen was applied at 75 lbs or less, regardless of residual soil nitrogen levels. Because there were only two sulfur rates in each of the studies, the maximum beneficial rate of sulfur at each nitrogen rate and where yields would have started declining could not be determined. Additionally, timing mattered. When the full rate of nitrogen was applied as a starter at 105 lbs N, the additional sulfur did not decrease yield, but when the same nitrogen rate was split, yields were lower with the higher rate of sulfur (Figure 1). This is likely because the ratio of available sulfur to nitrogen was high initially, even though the plots received more nitrogen later in the season. Interaction effects on yield between nitrogen and sulfur fertilizer rates seemed to be limited to rates that were applied at the same time.

It seems that though sulfur improves nitrogen use efficiency of canola up to a point, a rate that is too high in relation to the nitrogen rate can lower yields.

Rate Response of MES and MESZ as a Starter Fertilizer for Spring Wheat

Mike Ostlie and Jasper Teboh

Introduction

Starter fertilizer is a good way to boost early-season vigor and often gain a few bushels of grain. Over the last few years there are more in-furrow fertilizers and specialty products available to try than ever before. However, a starter that contains phosphorous is still going to be the most recommended practice for a majority of situations.

One of the reasons for evaluating starter fertilizers is to examine if over-loading certain nutrients may negatively impact other nutrients. Phosphorous and zinc are a good example of nutrients that can be antagonistic to each other. The research question becomes whether too much phosphorous could be counter productive to the plants' uptake of zinc and whether it impacts yield

Methods

Between 2020 and 2022 research trials were conducted to compare two starter fertilizers in spring wheat, MES (Mosaic) and MESZ (Mosaic). The reason for the comparison was to evaluate the contribution of zinc to the mix. The addition of zinc in MESZ is the primary difference between the two products. The studies were conducted on low testing Zn and P soils each year of the study. The goals

of the study were, 1) test for a rate response of starter fertilizer and 2) test whether increasing phosphorous concentration reduces zinc uptake in the plant (related to the research from the 'Biofortification strategies in spring wheat' article on page 7). The products were each tested at 0, 25, 50, and 100 lbs total product in-furrow. This is roughly equivalent to 10, 20, and 40 lbs/a phosphorous. The entire sites also received 120 lbs/a of nitrogen through broadcast and incorporated urea. The study was conducted as a randomized complete block design (RCBD) with four replicates of each treatment each year. Zinc sulfate was included as an additional check treatment which was equivalent to the zinc provided by the 50 lb MESZ rate.

Results

Plant stand was not affected by the addition of any product or rate any year (Table 1). Grain protein content was reduced at the highest rates of both MES and MESZ compared to some of the treatments. But only MES at the highest rate reduced protein to lower than the check. Test weight was the highest with the highest rates of both products. When it came to yield, there were no differences between the two products. However, there was a nice rate response observed in which there was a 4-5 bu increase from adding 25 lbs/a of either product, followed by 1-3 bushel increase for the 50 lb rates and another 1-3 bushel increase for the highest rates. The zinc sulfate on its own did not differ from the check treatment in any way. The very low application rate likely explains this.

Table 1. Comparison of in-furrow rates of MES and MESZ in spring wheat.

Treatment	Rate	Stand	Protein	Test Weight	KWT	Yield
	lb/a	plant/a	%	lb/bu	g/1000	bu/a
MES	25	1196026	16.19	61.6	29.2	39.8
MESZ	25	1147198	16.28	61.5	29.4	38.1
MES	50	1153117	16.19	61.6	29.0	42.8
MESZ	50	1184682	16.01	61.5	30.0	39.4
MES	100	1225125	15.66	61.8	29.7	42.5
MESZ	100	1147692	15.94	61.7	29.0	44.4
check	0	1096347	16.21	61.3	29.1	34.1
Zn Sulfate	1.5	1126977	16.34	61.0	29.4	34.7
Mean		1159645	16.10	61.5	29.3	39.5
LSD (0.05)		NS	0.34	0.4	NS	4.4

Nitrogen content in the grain did not differ by any treatment combination (Table 2), even though protein differences existed. Grain phosphorous concentration increased above the check values only when 50 lbs of MESZ was applied. Zinc concentrations decreased with the highest rate of MES. The addition of zinc in MESZ raised the zinc level higher than MES and statistically not different than the check. It appears there 'could' be a slight penalty to the highest MESZ rates if tested across more locations.

Table 2. Changes in the concentration of nutrients following in-furrow MES and MESZ applications.

Treatment	Rate	Nitrogen	Phosphorous	Zinc
	lb/a	%	%	ppm
MES	25	3.13	0.413	57.4
MESZ	25	3.13	0.418	57.5
MES	50	3.14	0.415	55.4
MESZ	50	3.16	0.443	56.6
MES	100	3.15	0.419	48.1
MESZ	100	3.21	0.419	53.4
check		3.20	0.403	57.9
Zn Sulfate	1.41	3.13	0.406	57.4
LSD (0.05)		NS	0.038	4.9
C.V. (%)		3.4	9.1	10.3

Using 100 lbs of either product is not likely to be economical. In this study, even the lower rates provided a nice boost to yield. Yields were further increased by increasing the rate, but that may not be the case on more normal testing phosphorous locations. These trials were conducted on soils with phosphorous concentrations less than 5 ppm. There does appear to be a risk of reducing zinc concentration with the high rates of phosphorous starter fertilizer, but this is only a concern if the grain were to be marketed specifically for nutrient content. The plants did not lose any productivity as a result of the decreased zinc, as the zinc concentration was still more than sufficient for growth and development.

Partial support for this research was provided by the National Wheat Foundation and the Grain Foods Foundation.

Effects of Ground Hybrid Rye as a Partial or Complete Replacement of Corn as the Concentrate Source in Backgrounding and Finishing Rations

Colin Tobin and Karl Hoppe

Introduction

In the Midwest and Northern Great Plains, corn (*Zea mays* L.) and soybeans (*Glycine max* L.) are the typical cash crops grown as either monoculture or two-crop rotation (Rorick and Kladivko, 2017). Methods to enhance sustainability and resilience by improving soil properties include changes in management (i.e. no-till vs conventional tillage; Alhameid et al., 2017; Alhameid et al., 2019), increasing crop diversity (i.e. cover crops; Rorick and Kladivko, 2017), and grazing (Tobin et al., 2020; Bansal et al., 2022).

Cereal rye (*Secale cereale* L.) offers flexibility to producers when included in crop rotations. Rye can be grazed by livestock in an integrated-crop livestock system, harvested for forage as hay or ensiled, or as grain and straw. The use of winter rye can alleviate labor during the growing season as it can be planted at differing times during the fall and harvested prior to other small grains during late spring (Rusche et al., 2020).

The objective of this experiment was to determine the effects of hybrid rye inclusions on DMI, growth performance, and feed efficiency in beef steers through the backgrounding and finishing phases. The hypothesis was that hybrid rye can be substituted for or replace dry-rolled corn (DRC) in backgrounding beef diets.

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 Carrington Research Extension Center (CREC) near Carrington, North Dakota.

Four treatments were used in a completely randomized block design to evaluate animal performance during backgrounding when fed partial or complete replacement of corn with rye as the concentrate source. Ground hybrid rye was substituted for dry rolled corn (DRC) as follows: a basal diet formulated with 20% DRC: 0% ground hybrid rye (CON), 13.5% DRC: 6.5% ground hybrid rye (RYE1), 6.5% DRC: 13.5% ground hybrid rye (RYE2), or 0% DRC:20% ground hybrid rye (RYE3) on a dry matter (DM) basis (Table 1). All rye grain used was from the same hybrid (KWS Bono, KWS Cereals, LLC: Champaign, IL).

Table 1. Composition of backgrounding diet treatments, Day 1 - 55.

	Treatments			
Ingredient, % DM of diet	CON	RYE1	RYE2	RYE3
Corn	20	13.5	6.5	0
Hybrid rye	0	6.5	13.5	20
Corn silage	30	30	30	30
Wheat straw	25	25	25	25
Modified corn distillers grains with solubles	20	20	20	20
Supplement	5	5	5	5

Two hundred cross-bred steers (initial BW = 617 ± 64 pounds) were used in this experiment. One hundred-sixty steers were collected from the Dakota Feeder Calf Show, Turtle Lake, North Dakota. The steers were vaccinated against infectious bovine rhinotracheitis, bovine viral diarrhea types 1 and 2, parainfluenza-3 virus, *Mannheimia haemolytica* and bovine respiratory syncytial virus (Pyramid 5 + Presponse SQ; Boehringer Ingelheim Animal Health, Duluth, GA; Inforce 3, Zoetis, Parsippany, NJ). They were administered clostridial species (Bar-Vac 7/Somnus; Boehringer Ingelheim) pour-on moxidectin (Cydectin, Bayer, Shawnee Mission, KS), oxytetracycline injection (Noromycin 300 LA, Norbrook Inc., Lenexa, KS) and a steroidal implant (200 mg progesterone and 20 mg estradiol benzoate; Synovex S, Zoetis). Steers ranged from freshly weaned to preconditioned. The remaining 40 steers were sourced from the CREC herd and administered similar processing protocol. Steers were fed in 12 dirt and eight cement-surfaced pens (n = 20). Body weights were collected on two consecutive days, averaged for initial body weights, and calves were sorted into pens. Steers where stratified into four groups by weight and randomly assigned to treatment, resulting in five replications and 50 steers per treatment.

The experiment was initiated on October 25, 2021 after steers were adapted to the control ration. Steers were fed a high forage backgrounding ration for the first 56 d. On December 20, 2021 (day 56), all steers were administered a steroidal implant (100 mg trenbolone acetate and 14 mg estradiol benzoate; Synovex Choice, Zoetis) and received a parasiticide pour-on (Clean-up II; Bayer Animal

Health, Shawnee Mission, KS), and began an 18 d adaptation period to a 136 day finishing period. Steers on trial were fed for 210 days total.

Steers were continued from backgrounding treatments onto finishing diets of increasing levels of rye (Table 2). During the finishing period, rye was reduced in the diet monthly at weigh periods (Table 2). Steer BW were recorded at the time of study initiation, days 28, 56, 93, 127, 157, 185, 210, and the morning of study termination on day 211.

Table 2. Composition of initial finishing diet treatments, Day 56 - 210.

	Treatments									
Ingredient, % DM of	CON	RYE1		RYE2			RYE3			
Day of study	56-210	56-92	93-210	56-92	92-126	127-210	56-92	92-126	127-156	157-210
Corn	68.3	60.2	68.3	52	60.2	68.3	43.9	52	60.2	68.3
Hybrid rye	0	8.1	0	16.2	8.1	0	24.4	16.2	8.1	0
Corn silage	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Wheat straw	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Modified corn distillers grains with solubles	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
Supplement	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

Statistical Analysis

Feedlot data, including weight gain, average daily gain (ADG), dry matter intake (DMI), and ratio of grain per pound of gain (G:F), were analyzed using the repeated measures procedure of PROC MIXED of SAS 9.4 (SAS Ins. Inc., Cary, N.C.). All data were analyzed, with pen serving as the experimental unit. The model included the fixed effect of feed ration (CON, RYE1, RYE2, RYE3), linear, quadratic, and cubic function of month (1 to 8), and the interaction of feed ration by month. If the quadratic and cubic functions of month were not significant, they were dropped from the model. The covariance structure with the lowest Akaike information criterion was used. Least squares means were generated using the LSMEANS statement.

Results, Discussion, and Conclusions

No differences in steer weight were detected throughout the study ($P = 0.99$). Throughout the study, steers on the CON, RYE1, RYE2, and RYE3 diets gained on average 714 lbs, 721 lbs, 722 lbs, and 720 lbs, respectively (Table 3). No interaction of feed ration by month was detected ($P = 0.99$). There was a significant quadratic ($P < 0.0001$) and cubic function of month ($P < 0.0001$). No differences in ADG were detected throughout the study ($P = 0.67$). No interaction of feed ration by month was detected for ADG, DMI or G:F. No differences in DMI were detected throughout the study ($P = 0.84$). No differences in G:F were detected throughout the study ($P = 0.89$).

Table 3. Feedlot performance of steers fed varying levels of hybrid rye.

	DRC:Rye grain inclusion, % DM basis					
	CON	RYE1	RYE2	RYE3	SEM	*P*-value
Initial BW, lbs	614	622	614	617	-	
Final BW, lbs	1330	1343	1334	1336	22.27	0.99
ADG, lbs	3.1	3.0	3.1	3.1	0.075	0.67
DMI, lbs	19.6	19.7	20.2	19.4	0.304	0.84
G:F, lbs	0.35	0.34	0.34	0.36	0.010	0.89

Results from the study suggest that steers fed rye as a partial or sole grain source during the feedlot period weighed similar to those fed corn as the sole grain source. Rusche et al., (2020) found that steers finished on a ration including 40% DRC:20% rolled hybrid rye on a DM basis had similar feedlot performance and carcass characteristics to steers fed 60% DRC:0% rolled hybrid rye. Feeding of hybrid rye during backgrounding and early stages of finishing may increase producers the ability to incorporate differing feedstuffs when more conventional concentrate sources are less available. With improved rye germplasms which decrease ergot levels, grain processing level and inclusion rates through finishing need to be researched to optimize feed efficiencies of beef steers fed in North Dakota.

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Discovering Performance and Value in North Dakota Calves: Dakota Feeder Calf Show Feedout 2021-2022

Karl Hoppe, Colin Tobin, and Dakota Feeder Calf Show Livestock Committee

Cow-calf producers need to remain competitive in high feed cost situations. 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.

Knowing production and carcass performance can lead to profitable decisions for North Dakota-born and fed calves. This ongoing feedlot project provides cattle producers with an understanding of cattle feeding and cattle selection in North Dakota.

The Dakota Feeder Calf Show was developed for cattle producers willing to consign steer calves to a show and feedout project. The calves were received in groups of three or four on October 16, 2021, at the Turtle Lake Weighing Station, Turtle Lake, N.D., for weighing, tagging, veterinary processing and showing. The calves were evaluated for conformation and uniformity, with the judges providing a discussion to the owners at the beginning of the feedout. The number of cattle consigned was 165, of which 146 competed in the pen-of-three contest.

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

Calves were sorted and placed on corn-based receiving diets. After an eight-week backgrounding period, the calves were transitioned to a 0.62 megacalorie of net energy for gain (Mcal NEg) per pound finishing diet. Cattle were weighed every 28 days, and updated performance reports were provided to the owners. Cattle were reimplanted with Synovex-Choice on January 26, 2022.

An 'open house' was held February 7, 2022, where cattle owners could view calves, assess performance, and discuss marketing options.

The cattle were harvested on May 25, 2022 (162 head). The cattle were sold to Tyson Fresh Meats, Dakota City, Neb., on a grid basis, with premiums and discounts based on carcass quality. One calf was harvested locally due to lameness. Carcass data were collected after harvest.

Ranking in the pen-of-three competition was based on the best overall score. The overall score was determined by adding the index values for feedlot average daily gain (25 percent of score), marbling score (25 percent of score) and profit (25 percent of score) and subtracting index value for calculated yield grade (25 percent of score). The Dakota Feeder Calf Show provided awards and recognition for the top-ranking pen of steers.

Cattle consigned to the Dakota Feeder Calf Show feedout project averaged 580.1 pounds upon delivery to the Carrington Research Extension Center Livestock Unit on October 16, 2021. After an average 220-day feeding period, cattle averaged 1,290.3 pounds (at plant, shrunk weight). Death loss was 1.21 percent (two head) during the feeding period.

Average daily feed intake per head was 36.3 pounds on an as-fed basis and 24.0 pounds on a dry-matter basis. Pounds of feed required per pound of gain were 11.5 on an as-fed basis and 7.60 pounds on a dry-matter basis.

The overall feed cost per pound of gain was $0.894. The overall yardage cost per pound of gain was $0.124. The combined cost per pound of gain, including feed, yardage, veterinary, trucking and other expenses except interest, was $1.219.

Calves were priced by weight upon delivery to the feedlot. The pricing equation ($ per 100 pounds = (-0.03939045* initial calf weight, pounds) + 190.7454305) was determined by regression analysis on local livestock auction prices reported for the weeks before and after delivery.

Overall, the carcasses contained U.S. Department of Agriculture Quality Grades at 4.3 percent Prime, 76.0 percent Choice (including 25.3 percent Certified Angus Beef), 18.5 percent Select, 1.2 percent ungraded, and USDA Yield Grades at 3.7 percent YG1, 40.1 percent YG2, 49.4 percent YG3, and 6.8 percent 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 25, 2022, was $228.90 Choice YG3 base with premiums: Prime $15, CAB $6, YG1 $6.50 and YG2 $3, and discounts: Select minus $13, Standard (ungraded - no roll) minus $15, YG4 minus $8, dark cutter minus $55 and carcasses lighter than 650 pounds minus $20.

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

Table 1. Feeding performance - 2021-2022 Dakota Feeder Calf Show Feedout

Pen of three	Best Three Score Total	Average Birth Date	Average Weight per Day of Age, lbs	Average Harvest Weight, lbs.	Average Daily Gain, lbs.	Average Marbling Score (1)	Ave Calculated Yield Grade	Ave Feeding Profit or Loss / Head
1	2.780	21-Mar-21	2.9	1259	3.1	689	3.39	$ 169.71
2	2.773	27-Mar-21	3.1	1320	3.5	625	3.22	$ 149.57
3	2.500	13-Mar-21	3.1	1363	3.4	538	3.03	$ 118.99
4	2.469	6-Apr-21	3.4	1397	3.6	509	3.20	$ 122.27
5	2.426	14-Mar-21	3.2	1373	3.4	495	2.55	$ 77.81
Average Top 5 herds	2.59	22-Mar-21	3.2	1343	3.4	571	3.08	$ 127.67
6	2.381	19-Apr-21	3.5	1402	3.7	467	2.86	$ 79.16
7	2.336	12-Apr-21	3.3	1344	3.6	506	3.12	$ 78.32
8	2.251	9-Apr-21	3.2	1290	3.4	455	2.39	$ 39.30
9	2.248	4-Mar-21	2.9	1296	3.5	538	3.88	$ 108.00
10	2.245	8-Mar-21	3.0	1327	3.3	619	3.17	$ 23.22
11	2.201	25-Apr-21	3.3	1312	3.5	469	2.82	$ 41.05
12	2.194	1-Apr-21	3.1	1288	3.3	540	2.78	$ 20.79
13	2.182	5-Mar-21	2.8	1263	3.1	579	3.33	$ 60.20
14	2.162	20-Mar-21	3.3	1407	3.4	520	3.32	$ 55.89
15	2.148	30-Mar-21	2.9	1232	3.2	610	3.66	$ 46.73
16	2.032	15-Mar-21	3.1	1343	3.4	515	3.38	$ 27.24
17	1.999	21-Apr-21	3.3	1323	3.3	498	2.85	$ (10.38)
18	1.975	25-Mar-21	3.1	1306	3.4	473	3.54	$ 50.11
19	1.969	3-Apr-21	3.2	1346	3.0	423	3.12	$ 76.34
20	1.966	25-Apr-21	3.2	1275	3.2	490	3.48	$ 52.22
21	1.960	7-Apr-21	3.2	1304	3.5	405	2.90	$ 25.53
22	1.918	2-Apr-21	3.1	1307	3.1	466	3.68	$ 72.08
23	1.898	3-Apr-21	2.9	1222	3.1	455	2.82	$ 4.39
24	1.880	24-Mar-21	3.0	1266	3.1	570	3.49	$ (11.85)
25	1.834	28-Mar-21	3.0	1246	3.2	449	3.29	$ 17.05
26	1.786	25-Apr-21	3.3	1299	3.4	361	2.67	$ (14.99)
27	1.76	19-Mar-21	3.2	1360	3.1	559	4.08	$ 14.86
28	1.54	25-Apr-21	3.0	1182	3.1	452	3.56	$ (28.09)
29	1.49	14-Mar-21	2.9	1263	2.9	452	2.95	$ (82.37)
30	1.47	27-Mar-21	3.1	1296	3.2	493	3.57	$ (78.68)
31	1.18	2-Apr-21	3.1	1311	2.8	490	4.03	$ (86.04)
Average bottom 5 herds	1.49	29-Mar-21	3.1	1282	3.0	489	3.64	$ (52.06)
Overall average - pens of three	2.06	30-Mar-21	3.13	1,307.22	3.29	506.73	3.23	$ 39.30
Standard deviation		15.6	0.2	53.0	0.2	69.6	0.4	62.0
number		31	31	31	31	31	31	31

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

Overall, the pen-of-three calves averaged 420.8 days of age and 1,307.2 pounds per head at harvest. The overall pen-of-three feedlot average daily gain was 3.29 pounds, while weight gain per day of age was 3.13 pounds. The overall pen-of-three marbling score was 506.7 (average choice, modest marbling).

The top-profit pen-of-three calves with superior genetics returned $169.71 per head, while the bottom pen-of-three calves returned an average of $86.04 per head. The average of the five top-scoring pens of steers averaged $127.67 per head, while the average of the bottom five scoring pens of steers averaged a loss of $52.06 per head.

For the pen-of-three competition, average profit was $39.30 per head. The spread in profitability between the top and bottom five herds was $179.66 per head.

Cattle consignors are reviewing their calves at the CREC Livestock Unit during the February 2022 open house tour.

Calf value is improved with superior carcass and feedlot performance. Exceptional 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.

Exploring Feeding Performance of Heavy Yearling Angus Cattle - 2022 North Dakota 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 can benchmark performance and identify superior genetics of cattle fed with common feedlot management.

Black Angus yearling cattle were consigned by five producers for feeding to slaughter weight. Feeding performance and carcass characteristics were measured and shared with owners. Feed conversion by owner ranged from 8.63 to 11.16 pounds of feed per pound of gain. Profitability ranged from $218.88 to ($89.67) per head for the 2022 feeding period.

Calves (68 head) were received in groups ranging from 5 to 23 head from five owners prior to June 13, 2022. Upon delivery to the Carrington Research Extension Center Livestock Unit, calves were weighed, tagged, and veterinary processed.

Calves were penned by owner and provided a corn-based receiving diet. After a 10-day ration adaptation, 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 5, 2022 (45 head) and the second group was harvested on October 21, 2022 (23 head). The cattle were sold to

Tyson Fresh Meats, Dakota City, Nebraska on a grid basis, with premiums and discounts based on carcass quality. Carcass data were collected after harvest.

Cattle consigned averaged 937.8 pounds upon delivery to the Carrington Research Extension Center Livestock Unit on June 13, 2022. After an average 118-day feeding period, cattle averaged 1482.8 pounds (at plant, shrunk weight). Death loss was 0 percent (0 head) during the feeding period.

Average daily feed intake per head was 47.1 pounds on an as-fed basis and 31.1 pounds on a dry-matter basis. Pounds of feed required per pound of gain were 10.2 on an as-fed basis and 6.7 pounds on a dry-matter basis.

The overall feed cost per pound of gain was $0.85. The overall yardage cost per pound of gain was $0.09. The combined cost per pound of gain, including feed, yardage, veterinary, trucking and other expenses except interest, was $1.14.

Calves were priced by weight upon delivery to the feedlot. The pricing equation ($ per 100 pounds = (-0.13652* initial calf weight, pounds) + 285.1283) was determined by regression analysis on local livestock auction prices reported for the weeks before and after delivery.

Overall, the carcasses contained U.S. Department of Agriculture Quality Grades at 10.3 percent Prime, 77.9 percent Choice (including 47.0 percent Certified Angus Beef), 11.8 percent Select, and 0 percent no roll. USDA Yield Grades for the carcasses were 7.4 percent YG2, 61.8 percent YG3, 29.4 percent YG4 and 1.4 percent YG5. Two carcasses weighed greater than 1050 pounds.

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 6, 2022, was $235.19 Choice YG3 base with premiums: Prime $15, CAB $6, YG2 $3, and discounts: Select $24, YG4 $8, YG5 $20 and carcasses greater than 1050 pounds $20. The grid price received for October 22, 2022, was $242.94 Choice YG3 base with similar premiums and discounts except for Select $28/cwt.

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

Table 1. North Dakota Angus University Feedout 2022.

Pen	no. head	no. died	weight in	weight out	Average Daily Gain	Dry matter Feed/gain	Feed cost of gain/lb.	Total cost of gain/ lb.	% prime	% CAB	Profit/head
1	9	0	941.3	1476.4	4.735	5.700	0.718	0.999	11.1	22.2	$ 84.94
2	5	0	977	1451.6	4.200	6.800	0.856	1.282	0.0	60.0	$ 80.65
3	10	0	1000.4	1534.5	4.727	6.673	0.839	1.132	20.0	80.0	$ 218.88
4	21	0	979.7	1544.6	5.000	6.604	0.831	1.115	19.0	47.6	$ 170.16
5	23	0	862.52	1413.26	4.269	7.375	0.928	1.238	0.0	8.7	$ (89.67)
overall	68	0	937.8	1482.8	4.600	6.770	0.852	1.143	10.6	48.5	$ 78.19
std dev	7.9	0.0	54.4	55.5	0.3	0.6	0.1	0.1	9.78	28.66	117.7
number	5	5	5	5	5	5	5	5	5	5	5

The top-profit pen of calves returned $218.88 per head, while the bottom calves returned ($89.67) per head. The spread between the top profit pen and the lowest profit pen was $308.55 per head.

Yearling Angus steer performance varied between owners. Feed conversion ranged from 5.7 to 7.37 pounds dry matter fed per pound of gain. Average daily gain ranged from 7.20 to 5.00.

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

Developing a Cyberinfrastructure for Integrated Pest Management of Soybean Crops in North Dakota

David Kramar and Janet Knodel

Introduction

As the proliferation of geospatial technologies continues to evolve, it is becoming more and more necessary to move management practices into a digital framework. Integrated pest management is an area that has seen increased adoption of spatial and digital technologies for real-time collection and presentation of pest information. Application frameworks such as ESRI's ArcGIS Online (AGOL), QField (QGIS), and EpiCollect5 are well-suited for these applications due to the ease of development, rapid deployment, and integrated mapping technologies. By far, the most robust framework is in AGOL, and it offers numerous ways in which to collect, visualize, and report on the spatial distributions of pests in agricultural fields.

Some of the first digital applications for field data collection occurred in 2002 and were based on the original Blackberry architecture (Kaur et al. 2004). Additional applications were subsequently developed using Compaq Ipaqs and Sprint DBPro between 2003-2006 (Kramar et al. unpublished data). As ESRI developed the AGOL framework, many of these legacy field data applications became outdated. The current AGOL (and ArcGIS Enterprise) framework provides an integrated set of tools that streamline the process of moving from digital field applications to fully integrated dashboards and interactive web maps providing real-time updates for decision makers and policy makers. In summer of 2022, the NDSU IPM "SoyScout" application was tested in North Dakota soybean fields.

Methods

The application was developed using Survey123 Connect and AGOL. The initial survey was developed in collaboration with NDSU's IPM program and migrated the original survey cards into the Survey123 framework. The survey consists of five pests typically found in North Dakota fields, several common diseases, and several weeds of concern (Table 1).

Table 1: Pests, diseases, weeds, and abiotic limiting factors associated with the SoyScout application.

Pests	Diseases	Weeds	Abiotic Limiting Factors
Grasshopper	Frogeye Leafspot	Absinth	Low pH
Aphid	Bacterial Blight	Wormwood	Lodging
Spider Mite	Soybean Rust	Canada Thistle	Flooding
Soybean Gall Midge	Brown Stem Rot	Common Vetch	Drought
Bean Leaf Beetle	Fusarium Root Rot and Wilt	Kochia	Frost
	Stem Canker	Palmer Amaranth	Hail
	White Mold	Water Hemp	Lightning
	Soybean Cyst Nematode	Other	Sunscald
	Other		Soil Crusting
			Herbicide Injury
			Fungicide Injury
			Growth Regulator
			Foliar Fertilizer Injury

The SoyScout field application interface consists of individual sections pertaining to each pest. As the surveys are conducted, the final totals and averages are automatically calculated (Figure 1).

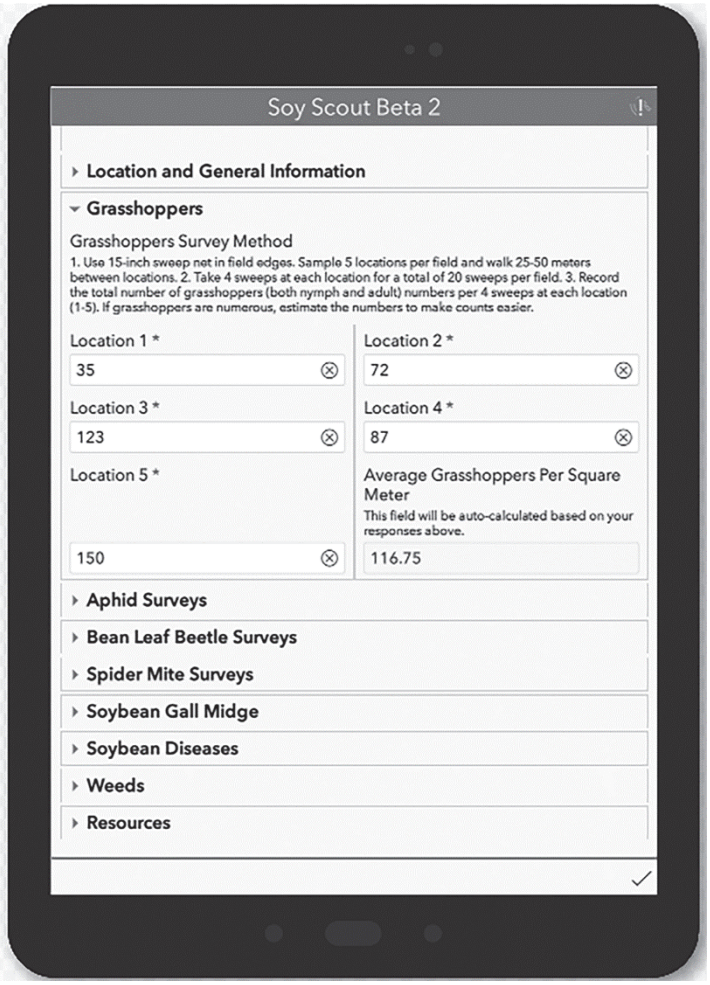


Figure 1: Survey locations are automatically calculated to determine the final average per field. This minimizes the possibility of incorrect information being transcribed as the data are stored and immediately uploaded to the database once the survey is submitted.

The addition of soybean diseases, abiotic limiting factors, and weeds allow researchers to better understand how these factors affect pest presence within fields via spatial analysis. In addition, these data provide a mechanism to indirectly assess where yields are reduced by tracking the presence and severity of these factors and comparing the locations to yield monitor information.

The web component of this project displays in real time the locations of surveys and provides a graphical quantification of pest presence. The web application was developed using ESRI's Storymaps and feature layer views that are derived directly from the input survey data (Figure 2). The online maps reduce the personnel required to produce weekly reports and map updates by automating the process. The web application can be found here:
https://storymaps.arcgis.com/stories/0ecc91527d32404ba065c4cafbfca66b

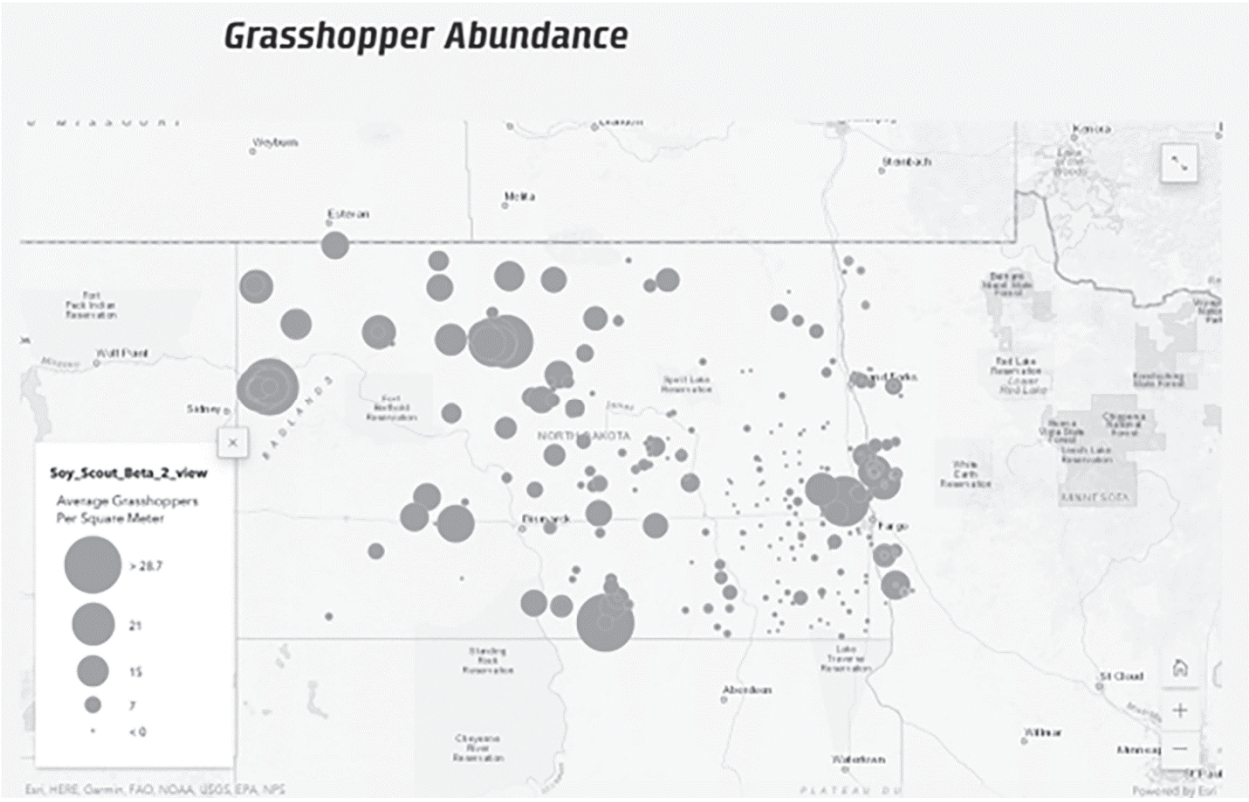


Figure 2: Extract from the Storymaps application that shows statewide distribution and abundance of grasshoppers in North Dakota. These maps are updated in real-time as new information is submitted by the field scouts.

Results

The application and framework were well-received by the scouts during the beta-testing phase. NDSU IPM scouts collected information for over 400 locations using the application. In one instance, we found that if a scout saved a draft, it would fail during upload at a later time. The issue was found to be associated with a known bug that affected the IOS operating system. Subsequent workarounds were developed; however, this is an issue that should be addressed in more detail moving forward. Overall, the application provided a rapid method to collect the required IPM information and will likely improve the accuracies and quality of the information moving forward.

The resources section of the SoyScout field application provides graphics of the common pests, weeds, and diseases common in North Dakota and is meant as a resource to aid scouts in identifying these factors. The report that is generated provides both a spatial representation as well as a numeric analysis of the trends at the time of report generation. It is expected that moving forward, more of the scouting needs will be incorporated into this type of online framework.

2022 Getting-it-Right Crop Production Program

Greg Endres, Hans Kandel and Linda Schuster

NDSU Extension, in cooperation with commodity organizations, has been conducting educational crop production programs titled “Getting-it-Right” (GIR) during the past decade. Targeted audience is North Dakota farmers and crop advisers, and the information is presented primarily by NDSU crop specialists and researchers. The program’s basic objective is to provide updates on crop production research and recommendations.

The GIR program continued in 2022, with a series of live webinars on dry bean, soybean, sunflower and canola. The webinars were based out of the Carrington Research Extension Center using Zoom. In addition, a face-to-face meeting was conducted on dry bean production in Traill County (Portland, ND). The following table lists general information about the meetings.

2022 Getting-it-Right Crop Production meetings

Crop	Date	Delivery method	Cooperating commodity group
Dry bean	6-Jan	Face-to-face	Northarvest Bean Growers Association
	22-Mar	Live webinar	
Soybean	25-Jan		ND Soybean Council
Sunflower	1-Feb		National Sunflower Association
Canola	15-Feb		Northern Canola Growers Association

Getting It Right meeting in Portland, ND.

General topic areas were cultivar selection, plant establishment, plant nutrition and soil management, plant protection (disease, insect and weed management), market update and commodity organization overview. Following webinar presentations, the audience had the opportunity to submit written questions, which were answered orally or written by presenters. Presentations were recorded, edited and posted for future reference by program participants as well as other interested persons https://www.ndsu.edu/agriculture/ag-hub/getting-it-right.

Program participants totaled over 650 people, primarily from North Dakota, but also the Midwest and beyond. Participants were requested to complete meeting evaluations. For example, participants were asked to place a value on knowledge received when applied to their business and the average among meetings ranged from $10 to14 per acre. Also, participants were asked to numerically rate “plan to take action based on what I learned” using the following scale: 6 = Strongly agree; 5 = Agree; 4 = Somewhat agree; 3 = Somewhat disagree; 2 = Disagree; or 1 = Strongly disagree. Among meetings, the average ranged from 4.7 to 4.8 with 67 to 75% indicating agree or strongly agree.

During the 2022-23 winter meeting season, GIR webinars are being planned for canola, corn, dry bean, soybean and sunflower.

Northern-Hardy Fruit Evaluation Project: Orchard Update

Kathy Wiederholt

In 2022, the Northern Hardy Fruit Evaluation Project provided educational information to over 900 people with video conference programs, tours, meetings and personal phone calls. Field Day was attended by 55 people who listened to local winemaker Bruce Gussiaas and later visited the winery. In addition to North Dakota, we provided information to people in South Dakota, Iowa, Alaska and Minnesota.

After several years of drought, significant rain and good snowfall helped to correct our local conditions. In fall 2021, we received 8.2” of rain followed by 49” of snow throughout the winter. In April 2022, an additional 21” of snow set spring work back in the orchard and fields. We then received 10.4” of rain from April through June, almost six inches above average. The spring temperatures were cool, too, (6.2^{o}F below average) and all plant development was delayed.

The orchard was not irrigated this year, but it would have been a good idea. There was 5.3” of rain from June 1 to August 15 and only 1.05” of additional rain through the end of October. However, all is not lost: A blizzard on November 10, 2022, produced about 12” of snow over unfrozen ground, which should slowly melt into the plant root area.

The spray program for spotted wing drosophila (SWD) fruit flies began on June 21, as cool weather delayed plant and fly development. Juneberries were protected as were most of the haskaps, although a few drops of juice were seen to leak from some of the later berries. In general, control was good.

Black currants have been losing fruit during early development for the past few years. This was thought to be due to both SWD and drought, but now realize it is most likely due to the currant fruit fly, aka gooseberry maggot, *Euphranta canadensis.* Another grower within 7 miles of CREC has also been losing currant fruit at the green-berry stage.

A second insect, currant borer, *Synanthedon tipuliformis,* has bothered the CREC planting for over a decade. It is managed by pruning, but this year, *Trichogramma* wasps were deployed for 6 weeks as well as weekly applications of *Beauveria* fungus and Bt-k insecticide that would not hurt the wasps. Traps and lures were also used, but no borer adults were caught. Observing pruned canes next spring will show if the treatments were successful.

Notable events in the fruit orchard:

- All crops were delayed 7-14 days by the April blizzard and lingering rainy, cool weather.
- Good apple production: 163 lbs of ‘Zestar!’, 165 lbs ‘Hazen’, 165 lbs ‘Haralred’, 151 lbs ‘Sweet 16’ and 232 lbs of ‘Honeycrisp’. Some water was applied in 2021.
- One Honeycrisp tree will be removed because of a blackrot and/or *Schizophyllum commune* infection.

- All pear trees have produced fruit now. ‘Nova’ is especially good.

Northern Hardy Fruit Project - Yearly Production Records

		No. of plants	2019		2020		2021		2022	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Aronia	Nero	4	17-Sep	19.4	19-Sep	26.3	15-Sep	70.5	12-Sep	42.0
	Raintree Seedling	4	18-Sep	11.8	10-Sep	15.1	15-Sep	47.6	19-Sep	54.0
	Raintree Select	4	13-Sep	23.0	11-Sep	14.4	12-Sep	95.4	9-Sep	26.0
	Viking	4	16-Sep	27.8	14-Sep	NA	8-Sep	104.5	12-Sep	32.0
	McKenzie	4	16-Sep	37.0	14-Sep	NA	14-Sep	78.6	14-Sep	59.3
	Galicjanka	4	13-Sep	23.9	12-Sep	4.3	8-Sep	49.1	9-Sep	36.3
				142.9		**apx. 90**		**445.7**		**249.6**
			Hail, SWD loss		*Drought, fruit dropped*		*Drought, irrigated*		*Wet then drought*	
Hardy Cherrie	Evans / Bali	2	30-Jul	53.5	29-Jul	*SWD loss*	*Removed*	*Removed*	*Removed*	*Removed*
	SK Romeo	3	31-Jul	11.5	26-Jul	*Birds*	26-Jul	*Birds*	5-Aug	*Birds*
	SK Juliet	5	17-Jul	46.2	13-Jul	41.0	16-Jul	73.8	19-Jul	19.2
				111.2		**41.0**		**73.8**		**19.2**
			SWD loss		*Still SWD loss in all*		*Drought, No SWD*		*Wet early; disease*	
New	*Blackcomb*	7	14-Aug	61.7	13-Aug	48.2	*did not pick*	NA	19-Aug	27.9
Black Currant	*Cheakamus*	7	7-Aug	63.9	5-Aug	19.2	*did not pick*	NA	10-Aug	17.5
Variety Trial	*Stikine*	7	7/31-8/5	58.1	8-5	12.4	*did not pick*	NA	15-Aug	11.5
	Tahsis	8	7/31-8/6	76.9	30-Jul	47.6	*did not pick*	NA	15-Aug	13.8
	Tiben	8	16-Aug	79.2	14-Aug	64.0	*did not pick*	NA	16-Aug	15.0
	Nechako - 2 ft spa	7	20-Aug	14.4	13-Aug	6.8	*did not pick*	NA	*did not pick*	x
	Nechako - 3 ft spa	7	20-Aug	25.4	13-Aug	9.4	*did not pick*	NA	*did not pick*	x
				379.6		**207.6**		**0.0**		**85.7**
			Pruning Summer		*SWD, sum'r pruning*		*Borer pruning*		*Wet then insect*	
Black Currant	Ben Lomand	4	30-Jul	7.2	27-Jul	3.4	*did not pick*	NA	9-Aug	2.8
	Blackcomb	4	15-Aug	38.3	12-Aug	19.8	*did not pick*	NA	19-Aug	10.9
	Champion	4	30-Jul	9.6	30-Jul	6.4	*did not pick*	NA	15-Aug	2.0
	Minaj Smyriou	4	x	*SWD loss*	27-Jul	6.6	*did not pick*	NA	8-Aug	8.6
				55.1		**36.2**		**0.0**		**24.3**
			SWD losses		*SWD losses in all*		*Borer pruning*		*Wet then insect*	
Red Currant	Jhonkheer Van T	4	24-Jul	39.5	*x*	*x*	*did not pick*	*NA*	8-Aug	4.5
	Rosetta	4	2-Aug	37.8	*2019 fall freeze; no fruit*		*did not pick*	NA	8-Aug	24.1
	Rovada	4	8/1	56.3	*2019 fall freeze; no fruit*		*did not pick*	NA	9-Aug	10.0
				133.4		**133.4**		**0.0**		**38.6**
			SWD losses		*SWD losses*		*Borer pruning*		*Wet then drought*	
Juneberry	*Honeywood*	20/15[2021]	15-Jul	14.0	8-Jul	NA	6-Jul	NA	6-Jul	NA
Variety Trial	*JB30*	20/15[2021]	15-Jul	14.0	6-Jul	NA	30-Jun	NA	30-Jun	NA
	Martin	20/15[2021]	15-Jul	14.0	6-Jul	NA	30-Jun	NA	30-Jun	NA
	Smoky	20/15[2021]	x	x	10-Jul	NA	6-Jul	NA	6-Jul	NA
	Thiessen	20/15[2021]	15-Jul	14.0	6-Jul	NA	30-Jun	NA	30-Jun	NA
				Est 4-500 lbs		**EST. 5-600 lbs**		**EST. 4-500 lbs**	**Total wt**	**769.2**
			Early SWD. Lost		*Covid; open picking*		*Remv'd 1/4, open pick*		*Open pick*	

The Project was planted in 2007, except Juneberries 2006.

Northern Hardy Fruit Project - Yearly Production Records (cont.)

Japanese		No. of plants	2019		2020		2021		2022	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Haskap	21-20	3/1 2021	12-Jul	NA	*did not pick*	x	30-Jun	2.4	x	x
2012	22-14	3/1 2021	10-Jul	4.8	*did not pick*	x	16-Jul	1.5	x	x
	22-26	3/1 2021	12-Jul	NA	*did not pick*	x	15-Jul	2.1	x	x
	41-75	3/1 2021	8-Jul	10.3	*did not pick*	x	27-Jun	2.3	x	x
	44-19	3/1 2021	12-Jul	NA	*did not pick*	x	19-Jul	2.5	x	x
	57-49	3/1 2021	10-Jul	21.8	*did not pick*	x	9-Jul	2.4	x	x
	88-92	3/1 2021	8-Jul	5.8	*did not pick*	x	27-Jun	1.5	x	x
	88-102	3/1 2021	5-Jul	12.9	*did not pick*	x	27-Jun	2.6	10-Jul	5.0
	108-23	3/1 2021	5-Jul	18.0	*did not pick*	x	27-Jun	5.2	x	x
	131-08	3/0 2021	12-Jul	NA	*Removed*	x	*Removed*	x	*Removed*	x
	142-30	3/1 2021	10-Jul	9.5	*did not pick*	x	6-Jul	1.6	26-Jul	1.9
	78-89	2	10-Jul	4.7	*did not pick*	x	6-Jul	5.3	21-Jul	5.8
				87.8	*Covid &*	**0.0**		**29.6**		**12.7**
			NA: quick pick, SWD		*Heavy prune, left to birds*		*Drought, irrigated*		*Wet then drought*	
Japanese	21-17	2			13-Jul	0.5	19-Jul	1.5	28-Jul	2.3
Haskap	67-95	2			13-Jul	1.7	19-Jul	3.0	27-Jul	7.0
2017	100-22	1			29-Jun	1.3	21-Jun	2.2	12-Jul	2.1
	108-42	2			2-Jul	3.3	27-Jun	5.1	18-Jul	11.1
	110-26	2			2-Jul	1.4	30-Jun	3.5	18-Jul	6.4
	120-10	2			2-Jul	1.0	11-Jul	2.3	7/18-25	6.3
	120-14	2			29-Jun	1.6	27-Jun	2.1	14-Jul	2.1
	120-16	2			5-Jul	2.7	2-Jul	2.9	7/20-25	5.2
	122-03	2			11-Jul	0.9	4-Jul	5.6	27-Jul	1.9
	122-12	2			7-Jul	1.4	15-Jul	2.7	28-Jul	5.7
	122-16	1			29-Jun	0.2	9-Jul	0.4	13-Jul	1.7
	123-05	2			7-Jul	2.3	15-Jul	3.5	28-Jul	2.8
	125-04	1			NA	x	4-Jul	0.4	7/10-13	2.0
	132-09	2			29-Jun	0.2	21-Jun	2.5	7-Jul	4.3
	132-10	1			6-Jul	x	27-Jun	1.0	12-Jul	2.1
	132-13	1			29-Jun	0.5	4-Jul	1.0	17-Jul	1.1
	132-14	2			29-Jun	1.2	27-Jun	1.4	10-Jul	7.9
	139-24	5			5-Jul	8.0	7-Jul	9.6	7/20-21	15.3
	142-31	2			13-Jul	0.5	13-Jul	2.0	7/21-28	5.5
	144-04	1			2-Jul	0.5	30-Jun	1.1	17-Jul	2.9
	145-10	2			7-Jul	x	6-Jul	0.6	7/21-25	1.4
						24.4		**54.5**		**97.0**
					1st year of production		*Drought, irrigated*		*Wet then drought*	
Japanese	111-12	2					11-Jul	0.8	25-Jul	3.6
Haskap	124-16	2					11-Jul	0.5	25-Jul	1.6
2018	124-19	1					19-Jul	0.6	29-Jul	3.1
	125-13	2					19-Jul	1.5	29-Jul	6.4
	129-06	2					30-Jun	0.5	14-Jul	4.6
	130-09	2					19-Jul	0.3	29-Jul	1.2
	135-03	2					9-Jul	0.2	25-Jul	0.6
								4.4		**21.1**
							1st year of production		*Wet then drought*	

Northern Hardy Fruit Project - Yearly Production Records (cont.)

		No. of plants	2019		2020		2021		2022	
			Date	pounds	Date	pounds	Date	pounds	Date	pounds
Japanese	119-08	2							28-Jul	1.8
Haskap	120-15	2							29-Jul	4.7
2019	122-26	2							20-Jul	2.0
	129-06	1							13-Jul	0.5
	123-05	2							25-Jul	1.7
	133-07	2							21-Jul	2.9
	133-09	2							26-Jul	3.1
	134-08	2							28-Jul	0.6
	135-01	2							26-Jul	1.2
	136-17	2							28-Jul	1.6
	138-18	1							*birds*	x
	140-14	2							5-Aug	1.1
	140-16	2							27-Jul	0.2
	141-04	1							*birds*	x
	141-05	2							*birds*	x
	141-06	2							5-Aug	0.1
	141-07	2							*birds*	x
	144-17	2							*birds*	x
										21.5
									1st year of production	
Haskaps	Boreal Beast	1					7/6	0.6	26-Jul	2.5
Canadian	Boreal Beauty	2					7/4-13	1.7	14-Jul	3.9
2018	Boreal Blizzard	1					4-Jul	0.4	12-Jul	*missing*
	Aurora	2					>7/20	x	7/21-26	3.8
				0.0		**0.0**		**2.7**		**10.2**
			Left for birds		*Left for birds*		*1st year of production*		*Wet then drought*	

Japanese haskaps.

2022 Research at the Oakes Irrigation Research Site Robert Titus Research Farm

Kelly Cooper

The 2022 growing season was unusual with cool spring temperatures and above-normal precipitation. The weather switched over to dry and warm beginning in June. The season ended with corn and beans maturing easily. Little rain in September (0.37 inches) and October (0.06 inches), resulted in harvest without weather interruptions. The Oakes site did not experience any severe crop damaging storms. One wind event with a small amount of hail caused slight goose necking and some green snap. An early lightning storm did substantial damage to the linear move irrigation system, requiring the replacement of several electrical components. Studies evaluated white mold control in soybeans and dry beans; cultivar performance trials in corn, soybeans, dry beans, onions, and potatoes; potato trials with fertility and herbicides; onion herbicide regimes; corn trials evaluating drought resistance and symbiotic nitrogen fixation organisms; and an irrigation scheduling study in watermelon, muskmelon, and squash.

Specialty potatoes grown at Oakes

A demonstration trial included non-traditional/specialty potatoes. Breeders have utilized genetics from native potatoes to produce different flesh and skin colorations. On the subject of potatoes, congratulations to Dr. Susie Thompson on the approval of “Dakota Russet” by McDonald’s Corporation for use in its French fries. Dakota Russet is a variety Dr. Thomson developed at NDSU. This is a monumental achievement for a potato breeder as only eight varieties are accepted in North America. Dr. Thompson has conducted research at the Oakes site for many years.

This was the second year of a drought-tolerant corn at Oakes. In 2021, a demonstration was planted with several varieties with drought tolerance grown with and without irrigation. The linear irrigator has the ability to apply variable amounts of water in specific areas. This feature was used in 2022 to have replicated trials in three watering regimes where one regime received no irrigation water, the second received half of the rate and the third area received the full amount of irrigation. Like 2022, 2021 started out with adequate soil moisture, but the lack of rain during the growing season brought on drought conditions resulting in extreme differences between the irrigated and non-irrigated parts of the study. The 2022 study was partially funded by the North Dakota Corn Utilization Council.

Robert Titus passed away this fall. Bob was instrumental in the development of the Oakes site which bears his name as the Oakes Irrigation Research Site Robert Titus Research Farm. Bob and his wife Elsie made the generous donation of the land for the site in 2015. NDSU rented the site at its establishment in 1970. Bob was always helpful to the crew providing labor, machinery, tools, and a storage building. Bob will always be remembered as a strong advocate for agricultural research and a mechanical innovator. Bob built and rebuilt much of the machinery he used for his own farm. Bob installed his own wells for one of the first irrigators installed in the Oakes area.

State of the Carrington Research Extension Center: 2022

Mike Ostlie – Director

2022 brought many new challenges and opportunities to the Carrington Research Extension Center. The spring began and carried on with snow storms. This made animal care and calving especially difficult. It also meant a late start to spring planting, with one of our latest first planting dates recorded. However, in contrast to recent years, it also meant that we had plentiful moisture to get the crops off to a good start. Although the rains stopped in July, it was enough to keep the crops moving until harvest. Overall, crop yields were slightly above average, with a few enjoying nice yields.

During the 2021 legislative session the CREC was appropriated funds for capital improvements to our Livestock Unit. This expansion includes a combined-use shop and lab facility, pen expansion with monoslope, and a commodity storage shed. These are all items that are needed to modernize our research capabilities and allow for some additional research project types, as well as have a heated space to store and fix the feedlot equipment during the winter. We have put out bid requests for all three components of the capital request, however the bids have thus far been too high or we have received no bids. We will be requesting an extension of funding this winter so we can continue to work towards completing these critical needs for CREC.

At the Oakes Irrigation Research Site, we have been preparing for a new shop, office, and work space to serve as a headquarters facility at that location. This building will be placed on the north end of the grounds on space currently owned by The Garrison Diversion Conservancy District. Garrison Diversion is currently working with architects to finalize the plans for the building. Garrison Diversion will be managing and financing the construction of the building shell. To make room for this building two small storage sheds will be removed. Construction is expected to commence sometime in 2023.

We are currently in the midst of renovating our conference spaces. Visitors to CREC can already enjoy expanded access to internet and power for computers. The chairs and many of the tables have also been changed out to provide guests with more comfortable and roomy seating. In the coming months many improvements are planned for audio and acoustics in these spaces as well. Coming to the CREC for a business meeting or workshop should be more attractive than ever!

Over the course of the last year, we have had a number of personnel changes. We had retirements for team members Todd Ingebretson (agronomy research), Kelly Cooper (Oakes Irrigation Research Site), and Steve Zwinger (agronomy research). Combined, they had over 70 years of experience at the CREC and ag research. We wish them the best in their retirement! Jasper Teboh (soil science) and David Kramar (precision ag) also moved on to new opportunities. We will be working to refill these positions in the coming months. Also, over the past year we welcomed three new team members: Spencer Eslinger (Oakes Irrigation Research Site), Aaron Fauss (plant pathology), and Kristin Simons (agronomy research).

This marks my first report as Director of CREC. I officially started in this role in March of 2022. This first year has been both exciting and challenging in different ways. We cannot say for certain how things will be in 2023, but our current staff is eager and ready to address the needs of the state and region. We have many good research and outreach projects planned for next season and beyond! If you are in the neighborhood stop in to see what we are up to. We hope to see you soon!

Weather Summary

Monthly Temperatures (°F) and Normals

	Max Temp				Min Temp				Monthly Avg. Temp			
Month	2022	Norm*	2021	2020	2022	Norm*	2021	2020	2022	Norm*	2021	2020
Apr	40	53	54	48	25	29	27	26	33	41	40	37
May	63	67	66	63	44	42	40	41	53	54	53	52
June	76	76	83	81	54	53	55	55	65	65	69	68
July	80	81	86	81	59	57	60	60	70	69	73	71
Aug	79	81	83	79	56	54	56	56	68	67	69	67
Sept	73	72	75	70	47	45	49	44	60	58	62	57
Avgs:	69	72	74	70	48	47	48	47	58	59	61	59

*Normals = 1991-2020 averages

Monthly Precipitation (in) and Normals

	2022 Monthly Precipitation*				
Month	NDAWN	NOAA	Normal[1]	2021	2020
Apr	3.76	2.41	1.25	0.51	0.45
May	6.66	7.72	2.76	1.35	1.18
June	2.86	3.16	3.78	1.82	1.23
July	1.46	1.50	3.60	0.13	5.00
Aug	1.23	1.22	2.33	2.56	1.06
Sept	0.62	0.73	1.97	1.96	0.13
Totals:	16.59	16.74	15.69	8.34	9.04

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

Monthly Growing Degree Days and Normals

	Wheat GDD				Sunflower GDD				Corn GDD			
Month	2022	Norm*	2021	2020	2022	Norm*	2021	2020	2022	Norm*	2021	2020
Apr	124	311	328	274	---	---	---	---	---	---	---	---
May	665	694	671	641	341	360	362	333	226	258	249	222
June	1005	982	1107	1081	647	622	754	721	474	461	556	536
July	1169	1159	1265	1193	798	787	894	821	605	583	672	625
Aug	1106	1098	1151	1097	734	726	782	725	551	540	573	539
Sept	831	792	895	762	492	445	548	434	353	322	397	312
Totals	4900	5036	5417	5048	3012	2940	3340	3034	2209	2164	2447	2234

*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
2020	Sept 8	29	2002	Sept 9	27	2496
2021	Oct 16	32	2566	Oct 21	22	3321
2022	*Sept 22	30	2135	**Oct 6	25	2907
*Normal Corn GDD for date =		2098		**Normal Sunflower GDD for date =		2797
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

As you look through this report and feel that there are things we are missing or want to provide 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

Dry Bean: Dry bean cover crop herbicide tolerance
Soybean: Rye cover crop planting date and rate preceding soybean; *North Dakota Soybean Council*
Wheat: Cover crop timing
Wheat: Legume interseeding

Crop Fertility

Canola: Canola nitrogen response by planting date - dryland; *Northern Canola Growers Assoc.*
Canola: Canola nitrogen response by planting date - irrigated; *Northern Canola Growers Assoc.*
Canola: Canola yield reponse to sulfur fertilizer products; *Sulvaris*
Canola: Optimizing nitrogen and sulfur application strategies to improve canola production - dryland; *Northern Canola Growers Assoc.*
Canola: Optimizing nitrogen and sulfur application strategies to improve canola production - irrigated; *Northern Canola Growers Assoc.*
Corn: Corn response to PSZn fertilizer and application methods; *ICL/North Dakota Corn Utilization Council/Novozyme*
Corn: ESN applied in-furrow at corn planting
Corn: Evaluation of biological additives in their ability to supplement N to corn; *North Dakota Corn Utilization Council*
Corn: Impact of fall N soil test on N recommendation for corn - dryland
Corn: Impact of fall N soil test on N recommendation for corn - irrigated
Corn: Preplant phosphorus in corn/soybean rotation; *North Dakota Soybean Council/Bortolo (North Central REC)*
Dry bean: Pinto bean response to Zn fertilizer; *Northarvest Bean Growers Assoc.*
Soybean: Preplant phosphorus in corn/soybean rotation; *North Dakota Soybean Council/Bortolo (North Central REC)*
Wheat: Wheat yield response to sulfur fertilizer products; *Sulvaris*

Crop Management

Barley: Cropping systems experiment - rotation, tillage, and fertility
Barley: SHARE farm - tillage and soil health; *Wick (Soil Science)*
Corn: Cropping systems experiment - rotation, tillage, and fertility
Corn: Jump starting corn mycorrhizal colonization (corn year)
Durum: Intensive management with post N and foliar fungicides; *North Dakota Wheat Commission/Bortolo (North Central REC)*
Fababean: Evaluation of yield components of fababean; *AGRALYTICA-RMA/Hanson (Langdon REC/Eriksmoen (North Central REC)*
Field Pea: Cropping systems experiment - rotation, tillage, and fertility
Field Pea: Organic winter pea date of planting; *Moore (USDA)*
Intercropping: Field pea and canola intercropping planting date
Intercropping: Soybean and canola intercropping seeding rates

Intercropping: Soybean and flax intercropping seeding rates
Misc: Soil moisture measurements with hydroprobe and drone mounted camera
Soybean: Cropping systems experiment - rotation, tillage, and fertility
Sunflower: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Fungicide treatments under different nitrogen management in wheat; *Bais/Keene (Plant Sciences)*
Winter Wheat: Cropping systems experiment - rotation, tillage, and fertility

Crop Quality
Wheat: Organic quality evaluations of FBC Dylan and Bolles; *Row 7 Seed Company/Horsley (Plant Sciences)*
Wheat: P x Zn antagonism in wheat

Inoculants and Plant Health Promotors
Misc: Pulse crop rhizobia quantification - high; *Precision Ag/Geddes (Microbiological Sciences)*
Misc: Pulse crop rhizobia quantification - low; *Precision Ag/Geddes (Microbiological Sciences)*

Product Evaluation
Corn: Corn foliar nutrition; *CHS*
Field Pea: Field pea inoculation study; *BASF*
Soybean: Soybean inoculation trial (2); *BASF*
Soybean: Soybean inoculants; *Novozymes*
Soybean: Soybean foliar biological treatments; *CHS*
Soybean: Soybean foliar nutrition; *CHS*
Soybean: Evaluation of iron supplying products for alleviating iron deficiency chlorosis; *Earth Science Labs*
Soybean: Seed treatments; *Fortgreen*
Soybean: Soybean foliar amendments; *Valent*
Sunflower: Effect of fertility on biologicals performace in oil sunflowers; *Germains*
Sunflower: Effect of seed coating on stand establishment and yield in oil hybrids; *Germains*
Wheat: Wheat seed treatment comparison; *CHS*

Plant Pathology
Alfalfa: Efficacy of fungicide seed treatments, Rhizoctonia root rot (2); *McGregor & Co*
Alfalfa: Impact of foliar fungicides on winter survival; *Corteva*
Barley: Evaluation of foliar fungicides, management of Fusarium head blight; *BASF*
Canola: Breeder's nursery, white mold; *Cibus*
Canola: Evaluation of foliar fungicides, plant health; *BASF*
Canola: Fungicide efficacy evaluation, white mold (2); *BASF*
Canola: Fungicide efficacy evaluation, white mold; *Valent*
Canola: Management of white mold with bee-vectored Clonostachys rosea; *Northern Canola Growers Assoc.*
Chickpea: Fungicide efficacy evaluation, Ascochyta blight; *Certis Biologicals*
Chickpea: Fungicide efficacy evaluation, Ascochyta blight; *Corteva*
Chickpea: Fungicide efficacy evaluation, Ascochyta blight; tank-mixes with Bravo WS; *USDA Specialty Crop Block Grant*
Chickpea: Fungicide efficacy evaluation, Ascochyta blight: tank-mixes with Bravo WS - Williston study location; *USDA Specialty Crop Block Grant Program*
Chickpea: Fungicide efficacy evaluation, Ascochyta blight: Optimizing tank-mix strategies with chlorothalonil; *USDA Specialty Crop Block Grant Program*
Chickpea: Fungicide efficacy, Ascochyta blight; *BioSafe*
Chickpea: Optimizing fungicide droplet size for improved management of Ascochyta blight of chickpeas, TeeJet nozzles; *USDA Specialty Crop Block Grant Program*

Chickpea: Optimizing fungicide droplet size for improved management of Ascochyta blight of chickpeas, Wilger nozzles; *USDA Specialty Crop Block Grant Program*
Corn: Goss's wilt evaluation; *North Dakota Corn Utilization Council/Friskop (Plant Pathology)*
Dry bean: Breeders nursery, resistance to white mold; *USDA National Sclerotinia Initiative*
Dry bean: Evaluation of in-furrow fungicides for management of Rhizoctonia root rot; *Bayer*
Dry bean: Evaluation of seed treatments for management of Fusarium root rot (3); *Albaugh*
Dry bean: Evaluation of seed treatments for management of Rhizoctonia root rot; *McGregor*
Dry bean: Fungicide efficacy evaluation, white mold management in kidney beans; *BASF*
Dry bean: Fungicide efficacy evaluation, white mold management in pinto beans; *BASF*
Dry bean: Fungicide efficacy evaluation, white mold management in pinto beans; *Bayer*
Dry bean: Fungicide efficacy evaluation, white mold management in pinto beans; *Gowan/Monty's*
Dry bean: Fungicide efficacy evaluation, white mold management in pinto beans; *NuFarm*
Dry bean: Optimizing fungicide application timing for white mold management in black beans; *Northarvest Bean Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*
Dry bean: Optimizing fungicide application timing for white mold management in navy beans; *Northarvest Bean Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*
Dry bean: Optimizing fungicide application timing for white mold management in pinto and kidney beans; *Northarvest Bean Growers Association and ND Crop Protection Product Harmonization & Registration Board*
Dry bean: Optimizing fungicide droplet size for improved management of white mold - Oakes study location; *North Dakota Soybean Council*
Dry bean: Optimizing fungicide spray droplet size for white mold management; *USDA Specialty Crop Block Grant Program*
Dry bean: Optimizing fungicide spray volume for white mold management; *Northarvest Bean Growers Assoc./ND Crop Protection Product Harmonization & Registration Board*
Durum: Prosaro Pro efficacy in durum; *Bayer CropSciences*
Faba bean: Fungicide efficacy, Botrytis; *BASF*
Field pea: Breeders nursery, powdery mildew resistance screening; *Bandillo (Plant Sciences)*
Field pea: Fungicide application timing evaluation, management of powdery mildew; *SBARE New & Emerging Crops/ND Crop Protection Production Harmonization & Registration Board*
Field pea: Fungicide efficacy evaluation, management of Ascochyta blight; *FMC/BASF*
Field pea: Fungicide efficacy evaluation, management of powdery mildew; *SBARE New & Emerging Crops/ND Crop Protection Production Harmonization & Registration Board*
Field pea: Impact of spray droplet size, management of Ascochyta blight - Langdon study location; *USDA Specialty Crop Block Grant Program*
Field pea: Impact of spray droplet size, management of Ascochyta blight - TeeJet nozzles; *USDA Specialty Crop Block Grant Program*
Field pea: Impact of spray droplet size, management of Ascochyta blight - Wilger nozzles; *USDA Specialty Crop Block Grant Program*
Field pea: Impact of spray droplet size, management of powdery mildew - Minot study location; *USDA Specialty Crop Block Grant Program*
Field pea: Impact of spray droplet size, management of powdery mildew - TeeJet nozzles; *USDA Specialty Crop Block Grant Program*
Field pea: Impact of spray droplet size, management of powdery mildew - Wilger nozzles; *USDA Specialty Crop Block Grant Program*
Field pea: Management of root rot in field peas with crop rotation; *Northern Pulse Growers Assoc.*
Field pea: Seed treatment evaluation, Fusarium root rot; *Rizobacter*
Field pea: Seed treatment evaluation, management of Fusarium root rot under native root rot pressure; *Corteva*
Field pea: Seed treatment evaluation, management of native root rot pressure; *Bayer CropScience*
Field pea: Seed treatment evaluation, Rhizoctonia root rot; *Rizobacter*
Lentil: Anthracnose and white mold fungicide evaluation; *BASF*
Lentil: Anthracnose fungicide evaluation; *Corteva/BASF*
Lentil: Breeders nursery, anthracnose resistance screening; *Bandillo (Plant Sciences)*

Lentil: Seed treatment evaluation, Fusarium; *Syngenta*
Snap bean: Evaluation of foliar fungicides for management of Botrytis gray mold; *BASF*
Soybean: Fungicide efficacy evaluation, white mold; *BASF*
Soybean: Fungicide efficacy evaluation, white mold; *Bayer CropSciences*
Soybean: Fungicide efficacy evaluation, white mold; *Certis Biologicals*
Soybean: Fungicide efficacy evaluation, white mold; *Syngenta*
Soybean: Optimizing fungicide application interval for improved management of white mold - Oakes study location; *USDA Specialty Crop Block Grant Program*
Soybean: Optimizing fungicide application interval, white mold; *North Dakota Soybean Council*
Soybean: Optimizing fungicide spray volume for improved management of white mold - Oakes study location; *North Dakota Soybean Council*
Soybean: Optimizing fungicide spray volume, white mold; *North Dakota Soybean Council*
Spring wheat: Evaluation of foliar fungicides, management of Fusarium head blight; *BASF*
Spring wheat: Evaluation of seed treatments; *BASF*
Spring wheat: Evaluation of seed treatments, management of common root rot; *Bayer*
Spring wheat: Evaluation of seed treatments, management of Fusarium root rot; *Valent*
Sunflower: Efficacy of bee-vectored Clonostachys rosea for management of Sclerotinia Head Rot; *USDA Specialty Crop Block Grant Program*
Sunflower: Efficacy of bee-vectored Clonostachys rosea for management of Sclerotinia Head Rot - Langdon study location; *USDA Specialty Crop Block Grant Program*
Sunflower: Impact of bagging heads on severity of Sclerotinia head rot; *USDA Specialty Crop Block Grant Program*
Wheat: Foliar fungicide; *Tri-County agents*
Wheat: Prosaro Pro efficacy in spring wheat; *Bayer CropSciences*
Wheat: Prosaro Pro ergot evaluation; *Bayer*
Winter wheat: Field evaluation of seed treatments for management of Rhizoctonia root rot in winter wheat; *Indigo Ag*

Seed Increase
Buckwheat: Experimental increase
Crambe: Meyer seed increase
Crambe: Westhope seed increase
Field Pea: Experimental increase (3); *Bandillo (Plant Sciences)*

Salinity
Canola: Canola hybrid tolerance to salinity; *Croplan/Winfield*
Field Pea: Field pea saline gene regulation; *USDA Specialty Crop Block Grant Program/Nonoy (Plant Sciences)*
Sunflower: Sunflower hybrid tolerance to salinity; *Croplan/Winfield*

Germplasm Evaluation/Cultivar Development
Barley: Barley breeder nursery; *Horsley (Plant Sciences)*
Barley: Barnes County (Dazey) variety trial
Barley: Drill strip demonstration plots
Barley: Dryland variety trial
Barley: Irrigated variety trial
Barley: Organic variety trial
Barley: Tri-County (Wishek) variety trial
Buckwheat: Buckwheat nursery; *Ganiger (MinnDak Growers, Ltd.)*
Buckwheat: Dryland variety trial
Buckwheat: Organic variety trial with cover crop as preceding crop
Buckwheat: Organic variety trial recrop
Canola: Canola breeder nursery; *Rahman (Plant Sciences)*
Canola: Liberty Link performance test; *Industry*

Canola: Roundup Ready performance test; *Industry*
Chickpea: Chickpea variety trial and advanced yield trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Corn: Dryland corn silage 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 corn silage performance test; *Industry*
Corn: Irrigated hybrid performance test; *Industry*
Corn: Oakes dryland hybrid performance test; *Industry*
Corn: Oakes irrigated hybrid performance test; *Industry*
Corn: Organic hybrid performance test
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)*
Einkorn: Organic variety trial
Emmer: Organic variety trial
Field Pea: Breeder nursery – advanced yield trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Field Pea: Breeder nursery – preliminary yield trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Field Pea: Field pea protein management; *Pulse Crop Health Initiative/Miller (Montana State Univ.)*
Field Pea: Organic winter pea nursery; *Moore (USDA)*
Field Pea: Variety trial - primary statewide evaluation; *Industry*
Flax: Breeder nursery; *Rahman (Plant Sciences)*
Flax: Organic variety trial
Flax: Variety trial; *AmeriFlax/Rahman (Plant Sciences)*
Forages: Wishek cool-season forage evaluation; *Sedevic (Central Grasslands REC)*
Forages: Wishek warm-season forage evaluation; *Sedevic (Central Grasslands REC)*
Hemp: Hemp dryland variety trial; *Industry/Hanson (Langdon REC)*
Kernza: Kernza demonstration plot
Lentil: Breeder nursery - advanced yield trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Lentil: Breeder nursery - preliminary yield trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Lentil: Core variety trial; *Bandillo (Plant Sciences)/Worral (North Central REC)*
Lentil: Lentil germplasm screening; *Specialty Crop Research Initiative/Miller (Montana State Univ.)*
Lupin: Evaluation of advanced lupin selections; *USDA Specialty Crop Block Grant Program*
Lupin: Lupin drill strip increases; *USDA Specialty Crop Block Grant Program*
Lupin: Lupin variety evaluation; *USDA Specialty Crop Block Grant Program*
Oats: Drill strip demonstration plots
Oats: Dryland variety trial
Oats: Oat breeder nursery; *McMullen (Plant Sciences)*
Oats: Oat Uniform Midseason Oat Performance Nursery; *McMullen (Plant Sciences)*
Oats: Organic advanced yield trial breeder nursery; *Richter (General Mills)*
Oats: Organic oat nursery; *Jackson (25:2)*
Oats: Organic oat rust nursery; *Richter (General Mills)*
Oats: Organic variety trial
Rye: Organic winter variety trial
Rye: Spring hybrid rye variety trial; *KWS*
Sorghum: Forage sorghum nursery; *SBARE New & Emerging Crops*
Sorghum: Grain sorghum nursery; *SBARE New & Emerging Crops*

Soybean: Breeder Nursery: 22 Expt.19 - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.20 - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.23 - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.24 - irrigated; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.13 - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.19 - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.20 - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.23 - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.24 - dryland; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.20 - Dazey; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.23 - Dazey; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.24 - Fingal; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.20 - Wishek; *Miranda (Plant Sciences)*
Soybean: Breeder Nursery: 22 Expt.24 - Wishek; *Miranda (Plant Sciences)*
Soybean: Dryland conventional performance test; *Industry*
Soybean: Dryland Roundup Ready variety performance test; *Industry*
Soybean: Dryland soybean agronomic performance trial - Carrington; *BASF*
Soybean: Dryland soybean agronomic performance trial - Oakes; *BASF*
Soybean: Irrigated conventional variety performance test; *Industry*
Soybean: Irrigated Roundup Ready variety performance test; *Industry*
Soybean: Irrigated soybean agronomic performance trial - Carrington; *BASF*
Soybean: Irrigated soybean agronomic performance trial - Oakes; *BASF*
Soybean: Soybean agronomic performance trial - Barnes County (Dazey); *BASF*
Soybean: Soybean agronomic performance trial - Fingal; *BASF*
Soybean: Soybean agronomic performance trial - Tri-County (Wishek); *BASF*
Soybean: Soybean planting date demonstration; *BASF*
Soybean: Barnes County (Dazey) Roundup Ready variety performance test; *Industry*
Soybean: LaMoure Roundup Ready variety performance test; *Industry*
Soybean: Oakes conventional variety performance test; *Industry*
Soybean: Oakes irrigated Roundup Ready variety performance test; *Industry*
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*
Spelt: Organic variety trial
Sunflower: Non-oil sunflower hybrid performance test; *Industry*
Sunflower: Oil sunflower hybrid performance test; *Industry*
Sunflower: Hybrid nursery; *Sunrich Products*
Wheat: Barnes County (Dazey) variety trial; *Industry*
Wheat: Wheat variety tolerance to salinity; *Croplan/Winfield*
Wheat: Drill strip demonstration plots
Wheat: Dryland variety trial
Wheat: Irrigated variety trial
Wheat: Organic variety trial
Wheat: Spring wheat breeder nursery; *Green (Plant Sciences)*
Wheat: Tri-County (Wishek) variety trial; *Industry*
Wheat: Uniform Regional Spring Wheat Nursery; *Blecha (USDA)*
Winter Wheat: Elite Breeder's Nursery; *Marais (Plant Sciences)*
Winter Wheat: Variety trial

Weed Science
Canola: Canola comparison of glufosinate treatments; *BASF*
Canola: Glufosinate timing in canola; *AMVAC*

Corn: Corn herbicide by cover crop evaluation; *North Dakota Corn Utilization Council/Ikley (Plant Sciences)*
Misc: Detection of herbicide resistance through sensor technologies; *Zhang (Ag and Biosystems Engineering)*
Misc: Hail insurance demo in soybean, wheat, corn, canola, and dry bean; *NAU*
Hemp: Hemp herbicide tolerance; *ND Crop Protection Product Harmonization & Registration Board/Mettler (Plant Sciences)*
Misc: Herbicide demo; *BASF*
Misc: Herbicide site of action demonstration
Misc: Plant-back following quizalofop application; *AMVAC*
Misc: Vida burndown combinations; *Gowan*
Soybean/Pinto bean/Sunflower: Response to low-rate preplant-applied dicamba; *North Dakota Soybean Coucil/Northarvest Bean Growers Assoc./Ikley (Plant Sciences)/Jenks (North Central REC)*
Soybean: Burndown options for soybeans; *BASF*
Soybean: Glufosinate and PPO synergy in soybean; *Ikley (Plant Sciences)*
Soybean: Soybean PRE safety evaluation; *UPL*
Wheat: Fall herbicide options for green foxtail; *BASF*
Wheat: Foxtail control with Varro + fluroxypyr; *Bayer CropSciences*
Wheat: Kochia control with Huskie FX; *Bayer CropSciences*
Wheat: Broadleaf weed control in wheat; *UPL*
Wheat: Grass weed control in wheat; *UPL*

Dryland dry bean variety trial.

Variety	Days to Heading	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		inch	0-9	%		gram	lb/bu	bu/a		
SY Ingmar	49.3	28.5	0.5	13.3	15.8	26.5	62.8	50.4	52.3	46.6
SY Valda	49.0	29.4	0.8	11.3	14.4	29.5	62.4	55.2	56.4	53.9
WB9590	47.5	27.2	1.0	12.0	--	31.2	62.6	56.7	56.5	--
AP Murdock	48.5	26.8	0.8	12.1	14.7	27.0	61.0	54.5	54.2	51.6
Glenn	47.3	35.0	2.3	12.5	15.5	28.8	65.1	47.3	50.9	45.8
Faller	50.5	32.3	2.0	11.7	14.5	32.8	62.3	59.4	58.2	56.7
Shelly	50.3	30.9	1.0	12.3	14.8	32.4	64.1	65.0	61.9	59.0
Bolles	51.0	28.3	1.3	14.1	17.0	29.4	62.4	46.1	51.9	45.7
AAC Brandon	48.3	31.2	1.8	13.9	--	29.8	63.3	56.8	60.3	--
AAC Starbuck	48.0	32.4	1.0	13.7	--	29.9	63.6	60.7	59.0	--
AAC Wheatland	48.8	32.1	0.0	12.9	--	31.2	63.5	54.8	54.8	--
AP GunsmokeCL2	48.3	29.7	2.3	12.0	15.2	31.5	62.3	57.7	57.7	54.0
AP Smith	49.5	27.3	0.3	12.5	15.2	25.6	61.5	53.4	54.2	48.9
Ascend-SD	49.5	34.2	1.3	12.4	--	25.3	62.7	60.3	--	--
CAG Justify	50.3	32.0	1.5	11.1	--	31.2	61.4	60.7	60.6	--
CAG Reckless	49.3	32.6	1.5	13.0	--	27.3	62.3	53.3	53.8	--
CAG Recoil	55.3	29.3	1.0	12.6	--	30.9	62.3	53.2	--	--
CP3099A	52.0	31.6	1.3	11.6	--	32.1	60.7	59.7	58.5	--
CP3188	48.5	29.3	2.8	11.2	--	28.2	61.0	66.2	62.0	--
CP3530	50.3	33.4	2.0	12.7	15.4	29.4	61.6	58.7	59.2	54.4
Dagmar	47.0	29.9	1.8	13.1	15.1	31.2	62.3	62.8	61.0	56.0
Driver	50.0	31.1	1.0	12.0	14.5	28.2	63.6	58.3	60.3	56.6
Lanning	51.0	30.4	0.5	12.6	16.0	31.4	61.9	49.2	52.9	47.5
LCS Ascent	45.5	29.1	2.0	11.5	--	26.5	62.5	51.4	--	--
LCS Buster	53.5	32.0	1.5	10.9	14.1	31.2	61.1	57.6	53.2	50.3
LCS Cannon	44.8	29.1	2.3	12.4	15.5	29.0	63.6	55.5	53.9	48.6
LCS Dual	47.0	29.5	1.8	12.3	--	28.9	63.2	65.9	--	--
LCS Hammerax	46.0	27.5	2.3	12.0	--	30.4	62.9	63.2	--	--
LCS Rebel	46.3	34.5	2.0	12.4	15.1	31.3	63.6	64.4	61.2	55.4
LCS Trigger	53.5	33.1	1.0	11.0	14.0	29.3	62.7	58.6	58.7	55.4
Mean	49.2	30.1	1.3	12.4	--	29.3	62.6	56.3	--	--
C.V. (%)	1.3	6.1	44.1	7.7	--	7.1	1.5	9.9	--	--
LSD (0.05)	0.9	2.6	0.8	1.3	--	2.9	1.3	7.8	--	--
LSD (0.10)	0.8	2.2	0.7	1.1	--	2.4	1.1	6.6	--	--

Planting Date = May 23; Harvest Date = August 25; Previous Crop = Flax

Variety	Days to Heading	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		inch	0-9	%		gram	lb/bu	bu/a		
MN Rothsay	51.0	27.7	0.5	12.0	--	28.4	62.7	51.0	--	--
MN Torgy	50.8	33.0	0.5	13.2	14.9	29.6	63.0	62.3	62.7	60.6
MN Washburn	50.8	30.7	1.3	12.8	15.2	28.0	63.0	51.1	52.7	49.2
MS Charger	47.0	30.0	1.8	10.2	--	28.4	61.5	60.9	--	--
MS Cobra	47.0	29.0	1.3	11.9	--	28.0	63.1	60.6	58.6	--
MS Ranchero	53.8	33.2	1.3	11.9	14.3	30.2	62.2	55.6	57.8	55.4
NDFrohberg	48.3	33.7	2.0	12.7	15.0	32.1	63.4	59.5	61.0	56.5
ND Heron	45.8	32.7	1.3	11.8	15.7	30.7	64.5	54.9	56.2	48.2
ND Vitpro	47.5	30.3	2.0	13.0	16.3	29.4	64.1	48.5	50.5	42.8
SK Rush	50.8	30.5	0.8	12.8	--	27.3	62.1	46.9	50.4	--
SY611CL2	48.0	28.5	1.5	11.9	15.7	27.5	63.0	57.3	58.4	48.8
SY Longmire	49.0	28.0	1.5	13.5	--	28.3	62.7	48.9	55.6	--
SY McCloud	47.8	28.2	0.3	14.6	16.3	28.6	62.6	52.2	57.4	50.5
TCG Heartland	46.8	26.4	1.0	13.5	16.3	27.8	62.6	45.0	47.8	44.3
TCG Spitfire	50.8	28.6	0.8	12.8	15.0	29.9	62.1	58.2	58.9	55.2
TCG Wildcat	49.3	28.9	1.0	13.3	15.6	29.8	62.4	54.8	52.8	49.1
MS Barracuda	44.5	26.9	1.8	13.4	15.8	31.9	62.7	53.0	54.8	48.3
WB9479	47.0	27.7	1.3	13.9	--	29.4	62.7	62.0	61.3	--
Mean	49.2	30.1	1.3	12.4	--	29.3	62.6	56.3	--	--
C.V. (%)	1.3	6.1	44.1	7.7	--	7.1	1.5	9.9	--	--
LSD (0.05)	0.9	2.6	0.8	1.3	--	2.9	1.3	7.8	--	--
LSD (0.10)	0.8	2.2	0.7	1.1	--	2.4	1.1	6.6	--	--

Planting Date = May 23; Harvest Date = August 25; Previous Crop = Flax

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Variety	Days to Heading	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Test Weight	Yield 2022	Yield 3-yr. Avg.
		inch	0-9	%		gram	lb/bu	bu/a	
SY Ingmar	54.0	29.7	1.5	12.9	14.1	32.6	63.2	58.7	75.8
SY Valda	52.8	29.3	1.8	11.8	13.3	36.6	62.6	66.5	84.2
WB9590	51.8	27.6	1.3	12.3	--	36.9	62.3	63.4	--
AP Murdock	52.0	28.3	1.8	11.5	12.9	31.4	61.0	68.9	79.0
Glenn	51.3	33.1	2.8	13.3	14.4	32.5	64.5	57.7	72.1
Faller	54.8	30.1	2.8	11.1	12.8	38.2	62.1	69.7	86.5
Shelly	55.0	27.0	2.0	12.1	13.3	34.1	62.4	66.8	80.6
Bolles	54.8	31.6	2.0	13.2	15.4	36.0	62.6	61.6	73.5
AAC Brandon	53.0	30.2	2.3	12.8	--	34.4	62.9	69.1	--
AAC Starbuck	53.3	31.4	1.5	13.2	--	34.8	63.4	65.4	--
AAC Wheatland	53.8	29.9	0.8	12.6	--	35.6	63.4	67.0	--
AP GunsmokeCL2	52.3	29.8	3.0	11.6	--	34.3	61.6	68.3	--
AP Smith	54.3	27.0	0.8	13.0	--	32.4	62.5	67.6	--
Ascend-SD	52.0	35.5	1.8	11.9	--	30.1	62.7	74.3	--
CAG Justify	55.0	32.0	2.0	10.8	--	33.7	60.3	75.2	--
CAG Reckless	53.8	31.6	2.0	12.1	--	34.0	63.3	66.6	--
CAG Recoil	58.5	30.9	1.0	12.0	--	35.9	62.1	72.3	--
CP3099A	56.8	32.3	1.8	10.5	--	39.2	61.9	78.2	--
CP3188	53.8	31.5	3.5	10.7	--	31.9	60.6	68.4	--
CP3530	54.3	33.7	2.8	12.3	13.4	34.7	61.9	64.6	82.2
Dagmar	51.3	30.7	2.5	12.9	14.2	35.5	62.6	58.4	79.5
Driver	54.5	33.1	1.5	12.2	13.3	32.1	62.9	66.9	78.5
Lanning	53.8	27.0	1.5	12.7	14.1	36.0	60.4	52.6	73.2
LCS Ascent	49.5	30.3	2.8	11.6	--	32.4	62.4	73.7	--
LCS Buster	56.3	31.5	1.5	11.3	11.9	35.3	62.2	71.5	88.2
LCS Cannon	49.0	29.4	2.5	12.0	13.7	32.4	63.0	68.4	82.1
LCS Dual	51.3	31.1	1.8	11.6	--	33.3	63.4	65.0	--
LCS Hammerax	51.3	27.6	2.3	12.0	--	33.3	62.0	61.2	--
LCS Rebel	50.0	31.7	3.0	12.3	13.9	36.3	63.5	61.2	79.7
LCS Trigger	58.0	31.9	2.0	11.0	11.9	35.9	63.7	82.0	88.2
Mean	53.3	30.3	1.9	12.1	--	34.4	62.4	66.3	--
C.V. (%)	1.5	5.1	25.9	4.4	--	4.3	0.8	8.1	--
LSD (0.05)	1.1	2.2	0.7	0.8	--	2.1	0.7	7.5	--
LSD (0.10)	0.9	1.8	0.6	0.6	--	1.7	0.6	6.3	--

Planting Date = May 16; Harvest Date = August 26; Previous Crop = Winter Rye

Variety	Days to Heading	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Test Weight	Yield 2022	Yield 3-yr. Avg.
		inch	0-9	%	%	gram	lb/bu	bu/a	bu/a
MN Rothsay	55.3	27.0	1.3	12.7	--	32.0	62.6	62.1	--
MN Torgy	53.5	31.5	1.0	12.5	13.9	33.9	62.9	72.1	82.3
MN Washburn	54.8	30.5	2.0	12.0	13.4	32.4	62.9	64.1	77.0
MS Charger	50.3	30.0	2.0	11.1	--	35.2	61.9	82.3	--
MS Cobra	52.0	27.7	1.3	12.6	--	32.6	62.8	60.3	--
MS Ranchero	54.5	33.4	2.5	10.8	12.7	37.0	62.3	78.1	86.0
ND Frohberg	52.5	33.6	2.3	12.5	14.0	38.7	63.1	65.5	75.2
ND Heron	50.3	30.3	2.3	12.9	14.1	32.9	63.8	55.1	73.8
ND Vitpro	51.5	31.4	2.3	12.8	14.2	34.2	63.9	58.7	71.6
SK Rush	53.3	31.3	2.0	12.1	--	33.2	62.0	67.4	--
SY611CL2	51.8	29.8	1.3	12.0	13.2	34.0	63.4	67.8	82.2
SY Longmire	54.0	30.1	2.0	13.0	--	33.3	62.4	68.1	--
SY McCloud	52.0	30.5	1.5	12.9	--	38.1	63.6	61.4	--
TCG Heartland	51.0	27.8	1.8	13.2	14.5	33.0	62.9	55.0	75.0
TCG Spitfire	55.3	30.0	1.3	12.1	13.2	36.3	62.2	68.1	84.4
TCG Wildcat	53.0	29.7	1.0	12.4	14.1	35.7	62.6	62.9	78.8
MS Barracuda	50.0	27.8	2.8	13.0	14.3	37.0	62.3	62.5	77.8
WB9479	51.3	27.0	1.5	13.8	--	33.4	62.6	58.5	--
Mean	53.3	30.3	1.9	12.1	--	34.4	62.4	66.3	--
C.V. (%)	1.5	5.1	25.9	4.4	--	4.3	0.8	8.1	--
LSD (0.05)	1.1	2.2	0.7	0.8	--	2.1	0.7	7.5	--
LSD (0.10)	0.9	1.8	0.6	0.6	--	1.7	0.6	6.3	--

Planting Date = May 16; Harvest Date = August 26; Previous Crop = Winter Rye

Hard Red Spring Wheat **Barnes County - Dazey**

Variety	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	inch	0-9	%		lb/bu	bu/a		
SY Ingmar	31.1	0.0	14.7	15.0	62.9	78.9	68.7	65.4
SY Valda	31.5	0.8	14.0	14.4	62.4	83.8	71.4	69.7
WB9590	30.1	0.0	14.6	--	62.7	81.3	69.9	--
AP Murdock	31.7	0.5	14.0	14.6	62.0	84.9	73.6	73.4
Glenn	34.1	1.3	15.6	15.4	64.9	70.4	62.0	56.9
Faller	32.7	1.0	14.1	14.4	62.2	82.5	72.9	72.1
Shelly	30.1	0.5	13.8	14.7	62.8	83.7	67.7	61.3
Bolles	33.7	0.0	16.4	17.0	62.5	67.9	59.9	54.8
LCS Ascent	31.3	1.0	13.9	--	62.2	80.6	--	--
LCS Cannon	30.9	0.5	14.4	14.8	63.1	79.1	73.3	66.9
LCS Dual	32.9	1.3	13.6	--	63.6	67.8	--	--
LCS Trigger	34.4	0.0	11.9	13.3	63.0	85.8	70.3	68.2
TCG Heartland	31.9	0.0	15.6	15.5	63.6	64.7	61.6	60.3
TCG Spitfire	30.9	0.0	13.8	14.4	62.1	83.3	70.7	67.3
TCG Wildcat	32.5	0.0	15.2	15.1	62.8	82.7	68.9	68.8
ND Heron	30.1	2.0	15.5	15.5	63.0	70.8	65.5	62.2
ND Frohberg	32.1	0.8	14.3	14.7	63.2	72.2	64.8	62.7
AAC Brandon	32.1	0.8	16.0	--	62.7	74.2	--	--
AAC Starbuck	32.3	2.5	16.4	--	62.9	63.1	--	--
AAC Wheatland	33.9	0.3	15.2	--	63.0	75.0	--	--
Ascend-SD	34.4	1.8	15.4	--	62.7	81.1	--	--
MN Rothsay	31.1	0.0	14.6	--	62.5	78.3	--	--
MN Torgy	33.7	0.0	15.2	15.3	62.8	79.8	70.1	66.7
MN Washburn	32.9	0.0	15.0	15.0	63.3	74.4	65.6	63.5
ND Vitpro	32.5	0.8	15.4	15.4	63.9	69.0	63.9	63.7
SK Rush	38.6	1.5	15.9	--	62.2	73.9	--	--
Boost	33.7	0.3	14.9	--	61.6	63.7	--	--
Mean	32.4	0.6	14.7	--	62.5	75.4	--	--
C.V. (%)	5.8	--	2.1	--	0.5	8.0	--	--
LSD (0.05)	2.6	--	0.4	--	0.5	8.5	--	--
LSD (0.10)	2.2	--	0.4	--	0.4	7.1	--	--

Planting Date = May 27; Harvest Date = August 31; Previous Crop = Soybean

Hard Red Spring Wheat **Tri-County - Wishek**

Variety	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
SY Ingmar	31.1	0.0	15.6	15.7	62.2	64.8	50.0	53.0
SY Valda	32.3	0.0	15.5	15.4	61.4	64.3	48.6	52.5
WB9590	28.1	0.0	15.9	--	61.3	59.5	49.3	--
AP Murdock	30.5	0.0	15.6	15.3	62.0	71.9	55.3	57.6
Glenn	35.2	0.0	16.1	15.7	64.2	61.9	51.0	53.2
Faller	38.0	0.3	14.8	14.8	62.5	75.6	56.1	57.8
Shelly	29.9	0.0	15.0	14.8	63.2	64.8	53.2	53.4
Bolles	34.8	0.0	17.6	17.7	61.1	60.9	48.4	50.2
LCS Ascent	30.1	0.0	14.5	--	63.8	65.6	--	--
LCS Cannon	30.9	0.0	16.0	15.3	64.3	60.1	46.5	51.4
LCS Dual	33.3	0.0	14.8	--	63.2	64.9	--	--
LCS Trigger	34.8	0.0	13.3	13.8	61.6	70.4	48.5	55.4
TCG Heartland	30.3	0.0	16.4	16.4	61.7	57.5	42.4	46.6
TCG Spitfire	34.3	0.0	14.5	15.0	59.1	64.7	51.6	53.7
TCG Wildcat	31.9	0.0	15.9	16.0	62.3	68.2	48.6	50.0
Driver	34.4	0.0	15.3	15.3	62.2	67.3	48.9	53.4
Dagmar	32.9	0.3	16.1	--	61.9	65.0	--	--
AAC Brandon	33.1	0.0	16.4	--	62.8	63.0	--	--
AAC Starbuck	35.2	0.0	16.8	--	62.8	62.4	--	--
AAC Wheatland	35.2	0.0	16.4	--	62.0	64.4	--	--
Ascend-SD	35.4	0.0	15.9	--	63.2	74.5	--	--
Lanning	34.3	0.3	15.8	--	58.3	53.8	--	--
MN Rothsay	30.9	0.0	15.5	--	61.6	67.9	--	--
MN Torgy	36.4	0.0	15.9	16.1	62.2	60.8	44.0	49.9
MN Washburn	34.8	0.0	15.7	--	62.2	60.4	--	--
ND Heron	31.1	0.0	16.1	15.9	64.2	59.6	42.7	48.9
ND Frohberg	33.5	0.0	15.5	15.7	62.4	56.5	48.7	52.4
ND Vitpro	31.9	0.0	16.0	15.8	63.7	55.2	48.1	53.8
SK Rush	40.2	0.0	16.3	--	62.0	57.5	--	--
Mean	33.1	0.0	15.5	--	61.9	62.9	--	--
C.V. (%)	5.8	--	2.0	--	1.0	8.9	--	--
LSD (0.05)	2.6	--	0.4	--	0.9	7.9	--	--
LSD (0.10)	2.2	--	0.4	--	0.7	6.6	--	--

Planting Date = June 3; Harvest Date = September 8; Previous Crop = Soybean

Hard Red Spring Wheat - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Seeds/ Pound	Test Weight	Yield 2022	Yield 3-yr. Avg.
		0-9	inch	%	%	gram		lb/bu	bu/a	bu/a
Glenn	49.0	0.0	26.0	12.5	12.8	27.3	16632	60.8	15.5	17.5
Faller	51.0	0.3	24.9	11.2	12.1	29.6	15340	58.3	20.5	21.0
Bolles	52.7	0.0	24.4	12.7	13.7	27.6	16479	58.5	16.2	16.8
Shelly	52.3	0.0	22.0	11.1	12.2	26.7	17031	59.4	17.2	17.5
Elgin-ND	50.0	1.0	27.3	12.4	12.8	27.1	16813	58.5	19.6	19.9
ND VitPro	50.3	0.0	23.9	12.6	13.4	27.9	16301	61.1	17.5	16.8
Barlow	49.3	0.7	25.5	12.9	13.3	26.8	16948	60.3	16.3	17.3
Linkert	50.0	0.0	23.1	14.2	--	31.2	14577	59.4	19.9	--
Prosper	52.3	0.3	24.7	11.3	--	29.9	15238	58.1	20.3	--
ND Frohberg	52.0	0.3	26.0	13.0	13.0	28.7	15842	59.6	15.8	19.6
MN-Torgy	50.7	0.0	23.4	11.7	--	26.3	17285	58.5	17.8	--
MN Washburn	52.7	0.0	22.3	11.7	12.6	25.5	17834	59.1	17.1	16.3
Lang-MN	52.0	0.0	24.1	11.9	12.1	24.3	18723	59.4	19.1	20.3
Driver	51.7	0.0	25.5	12.1	--	27.8	16392	59.5	19.0	--
Dagmar	50.0	0.0	23.1	12.7	12.7	29.5	15441	59.1	16.7	20.1
Lanning	51.0	0.0	22.3	13.1	12.6	29.9	15205	57.7	16.0	20.5
MN Rothsay	52.3	0.0	22.0	12.9	--	24.5	18537	58.1	14.8	--
ND Heron	48.7	0.0	23.6	13.2	--	28.3	16075	61.4	17.0	--
Dapps	50.7	0.3	28.1	13.8	14.2	28.0	16221	58.4	17.5	15.7
Mida	53.0	1.7	33.6	12.6	13.2	32.0	14336	57.2	12.6	16.4
Ceres	52.3	1.7	29.7	12.3	12.7	29.9	15429	57.4	11.5	15.3
FBC Dylan	50.7	0.0	23.6	11.2	12.2	27.5	16530	57.8	14.6	17.5
Red Fife	57.0	1.0	34.6	10.6	10.7	30.4	14946	57.3	16.4	22.2
Mean	51.4	0.3	25.4	12.3	--	28.1	16267	58.9	16.9	--
C.V. (%)	1.1	--	4.5	4.4	--	5.9	5.3	0.7	9.6	--
LSD 0.10	0.7	--	1.6	0.7	--	2.3	1175	0.5	2.2	--
LSD 0.05	0.9	--	1.9	0.9	--	2.7	1410	0.6	2.7	--

Planting Date = May 17; Harvest Date = August 22; Previous Crop = Cover Crop (lentil, crimson clover, turnip)

Variety	Heading Date	Plant Height inch	Lodging 0-9	Harvest Moisture %	Gluten %	Protein %	1000 KWT gram	Test Weight lb/bu	Yield bu/a
Jerry	6/19	37.6	2.8	14.7	35.1	13.7	34.8	61.7	83.7
ND Noreen	6/19	36.6	2.3	16.5	34.3	13.9	34.8	63.5	86.0
Northern	6/20	31.3	1.8	14.7	31.6	13.4	31.8	61.8	85.9
Ray	6/21	34.0	2.3	16.0	32.0	13.5	36.9	59.5	78.5
SD Midland	6/18	33.8	2.0	14.6	33.0	13.0	38.5	63.3	91.4
Winner	6/16	32.4	2.0	13.9	33.2	13.2	34.6	62.3	88.0
Draper	6/17	30.7	1.3	14.2	32.4	13.1	27.6	61.4	81.5
SD Andes	6/18	31.8	1.8	15.2	32.0	12.9	34.8	63.3	89.5
AAC Wildfire	6/22	32.3	1.8	15.7	31.3	13.3	30.3	60.8	76.7
AAC Vortex	6/19	34.4	0.0	14.7	33.2	13.7	30.8	61.6	83.8
AC Emerson	6/19	34.7	2.0	14.7	35.3	14.5	27.6	62.4	79.0
MS Iceman	6/16	27.4	1.0	14.5	38.9	15.2	27.4	62.6	65.2
MS Maverick	6/17	30.0	1.8	14.7	31.4	13.1	36.0	63.6	91.0
AP Bigfoot	6/16	30.0	2.5	14.3	31.5	12.8	28.6	62.2	90.4
SY Monument	6/18	32.0	1.5	14.4	31.8	12.8	31.8	61.1	83.9
SY Wolverine	6/16	28.1	2.8	14.0	33.7	13.3	29.5	61.7	74.2
WB4510CLP	6/18	31.6	2.0	15.3	32.3	13.3	34.1	64.0	84.7
Keldin	6/19	32.9	1.8	14.5	30.7	13.1	38.5	62.8	94.3
WB4309	6/16	30.3	2.3	14.2	35.4	13.0	30.1	62.3	87.7
Mean	6/18	32.2	1.9	14.8	32.8	13.3	32.5	62.2	84.7
C.V (%)	0.7	5.5	33.9	5.4	4.1	3.1	5.5	0.8	6.6
LSD (0.05)	0.9	2.5	0.9	1.1	1.9	0.6	2.5	0.7	7.8
LSD (0.10)	0.7	2.1	0.8	0.9	1.6	0.5	2.1	0.6	6.6

Planting Date = September 16; Harvest Date = August 3; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Durum - Dryland **Carrington**

Variety	Days to Heading	Plant Height	Lodging	Protein 2022	Protein 3-yr. Avg.	1000 KWT	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		inch	0-9	%		gram	lb/bu	bu/a		
Rugby	53.0	40.5	2.8	14.0	15.4	37.0	62.3	43.4	48.4	45.2
Maier	52.3	34.7	3.8	14.5	16.6	39.0	62.3	51.1	47.5	41.1
Montrail	52.5	41.7	4.0	14.4	15.6	36.6	61.9	56.2	56.1	48.6
Alkabo	51.5	36.8	2.5	14.6	15.4	39.0	62.4	47.6	47.3	42.2
Divide	54.5	37.6	2.8	13.9	15.8	37.6	61.8	48.1	47.6	41.8
Tioga	53.5	41.3	4.0	13.9	15.6	40.8	62.1	49.9	50.0	43.6
Carpio	53.3	36.5	3.8	14.2	15.6	40.8	62.2	57.7	52.2	47.8
Joppa	52.8	38.0	3.3	13.0	14.9	38.5	63.1	51.8	52.6	44.5
ND Grano	52.8	37.5	2.5	13.6	15.4	38.4	63.2	52.5	50.1	46.0
ND Riveland	53.3	34.3	2.8	14.4	15.5	37.7	62.2	47.6	49.1	46.7
ND Stanley	53.3	37.9	1.0	15.1	15.9	37.5	62.4	45.8	49.9	45.0
Strongfield	52.3	37.0	4.0	14.0	16.2	37.7	62.7	55.2	55.1	47.5
CDC Verona	54.3	34.6	3.3	14.3	15.8	37.8	61.9	53.3	52.0	47.2
TCG-Webster	50.0	30.9	4.0	14.0	14.8	36.4	61.2	37.8	43.6	41.0
T17C12D	52.0	37.9	2.0	13.7	--	39.7	62.8	53.9	55.0	--
AAC Stronghold	53.0	35.9	1.0	15.1	--	37.0	61.7	47.9	50.3	--
AAC Spitfire	52.0	36.2	3.0	13.8	--	36.5	61.0	53.0	54.2	--
CDC Defy	51.3	37.6	3.3	14.6	--	37.4	62.5	52.9	53.8	--
CDC Vantta	58.0	30.2	0.3	15.1	--	34.0	59.0	40.7	--	--
Mean	53.3	36.6	2.6	14.2	--	38.9	62.2	52.2	--	--
C.V. (%)	1.3	9.7	38.4	5.3	--	4.1	0.9	14.0	--	--
LSD (0.05)	1.0	4.9	1.4	1.1	--	2.3	0.8	10.2	--	--
LSD (0.10)	0.8	4.1	1.1	0.9	--	1.9	0.6	8.5	--	--

Planting Date = May 23; Harvest Date = August 30; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Durum - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	1000 KWT	Protein	Test Weight	Yield
		0-9	inch	gram	%	lb/bu	bu/a
Maier	52.8	0.0	20.1	30.3	12.3	58.8	16.4
Mountrail	53.3	0.0	20.9	29.7	10.4	58.3	23.3
Alkabo	52.3	0.0	19.9	30.0	11.4	59.7	19.9
Divide	52.8	0.0	21.1	30.6	10.7	59.2	24.7
Tioga	52.5	0.0	21.9	31.2	10.6	58.9	22.8
Carpio	54.3	0.0	22.6	29.8	10.2	58.1	22.7
Joppa	53.5	0.0	23.6	32.4	10.4	58.0	20.0
ND Grano	54.5	0.0	21.7	30.6	10.6	58.6	23.4
ND Riveland	52.3	0.0	20.1	30.3	10.3	59.1	21.3
ND Stanley	53.3	0.0	20.9	28.7	10.9	59.4	22.5
Strongfield	52.5	0.0	24.0	30.6	10.8	59.3	24.0
Mean	53.1	0.0	21.5	30.4	10.8	58.9	21.9
C.V. (%)	1.4	--	7.5	3.4	3.7	0.5	8.2
LSD 0.10	0.9	--	1.9	1.2	0.5	0.3	2.2
LSD 0.05	1.0	--	2.3	1.5	0.6	0.4	2.6

Planting Date = May 17; Harvest Date = August 22; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Spring wheat variety trial, July 2022.

Barley - Dryland **Carrington**

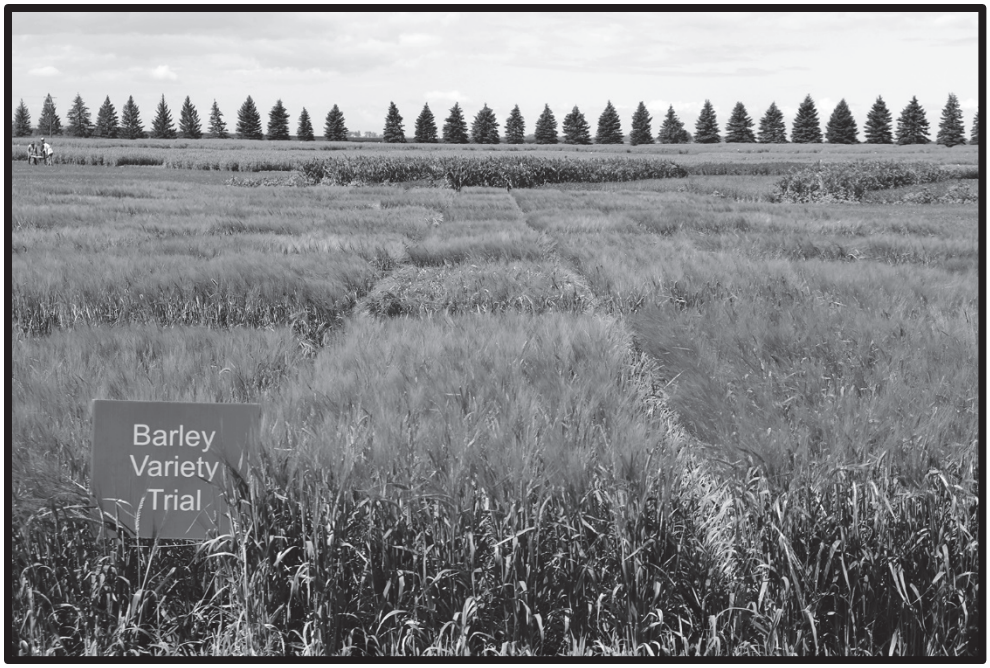
Variety	Days to Heading	Plant Height	Lodging	Plump	Thin	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		inch	0-9	%	%	%		lb/bu	bu/a		
Two Row											
Conlon	46.3	30.6	6.3	96.4	0.5	11.7	13.4	48.4	78.6	61.4	67.1
Pinnacle	47.5	32.2	2.8	95.9	0.9	10.2	11.9	48.2	78.5	64.4	70.7
ND Genesis	49.5	33.0	2.0	94.7	0.8	10.1	12.0	46.4	87.0	68.8	71.6
AAC Synergy	51.0	32.4	2.8	95.7	0.6	10.9	13.2	48.8	94.0	73.2	77.1
CDC Fraser	52.0	28.3	2.3	94.9	0.7	11.1	--	47.2	81.4	66.4	--
Explorer	49.5	26.7	3.0	93.2	0.7	10.8	13.3	47.7	85.5	68.1	73.2
AAC Connect	50.3	30.6	3.3	89.7	1.6	11.1	13.3	46.9	86.7	69.4	74.3
Brewski	50.0	31.7	2.3	96.4	0.5	10.9	--	46.7	87.8	69.3	--
ABI Cardinal	51.0	31.1	2.8	95.4	0.6	10.7	--	48.1	85.3	71.6	--
CDC Austenson	53.5	33.2	2.8	92.1	0.8	10.8	--	52.6	89.7	71.4	--
Six Row											
Tradition	47.0	33.3	2.0	95.3	0.8	11.8	13.6	48.5	81.9	67.5	73.6
Mean	48.9	31.4	2.6	94.7	0.8	10.7	--	47.6	85.9	--	--
C.V. (%)	1.6	5.9	29.2	2.1	39.8	4.5	--	2.1	8.6	--	--
LSD (0.05)	1.1	2.6	1.1	2.8	0.4	0.7	--	1.4	10.5	--	--
LSD (0.10)	1.0	2.2	0.9	2.4	0.4	0.6	--	1.2	8.8	--	--

Planting Date = May 23; Havest Date = August 17; Previous Crop = Soybean

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Variety	Days to Heading	Plant Height	Lodging	Plump	Thin	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 3-yr. Avg.
		inch	0-9	%	%	%	%	lb/bu	bu/a	bu/a
Two Row										
Conlon	51.0	29.5	3.3	97.8	0.3	11.0	12.6	49.0	70.3	90.4
Pinnacle	54.0	29.3	1.0	96.7	0.6	9.8	10.9	48.4	85.0	102.3
ND Genesis	54.8	32.4	2.0	96.5	0.5	10.2	11.3	47.8	99.7	113.5
AAC Synergy	58.0	30.6	2.8	95.0	0.5	10.3	12.2	48.1	91.5	110.6
CDC Fraser	57.8	30.8	2.3	95.7	0.6	10.4	--	47.6	92.5	--
Explorer	57.5	27.4	2.0	94.9	0.5	10.4	12.1	48.0	91.3	105.3
AAC Connect	56.8	29.7	2.8	90.9	1.0	10.6	12.3	47.1	87.8	102.9
Brewski	58.8	31.8	2.8	96.6	0.5	10.5	--	47.5	91.8	--
ABI Cardinal	58.3	30.3	2.8	94.2	0.7	10.3	--	46.9	94.9	--
CDC Austenson	58.0	31.9	2.5	92.8	0.7	9.9	--	52.0	103.7	--
Six Row										
Tradition	52.3	32.0	1.5	96.4	0.4	11.5	12.9	48.1	79.9	105.6
Mean	55.1	30.6	2.3	95.7	0.5	10.4	--	48.0	90.6	--
C.V. (%)	2.4	4.8	25.9	0.9	22.0	2.6	--	0.9	7.2	--
LSD (0.05)	1.9	2.1	0.8	1.3	0.2	0.4	--	0.6	9.2	--
LSD (0.10)	1.6	1.7	0.7	1.1	0.1	0.3	--	0.5	7.7	--

Planting Date = May 16; Harvest Date = August 22; Previous Crop = Winter Rye



Barley variety trial.

Barley **Barnes County - Dazey**

Variety	Plant Height	Lodging	Plump	Thin	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	inch	0-9	%	%	%		lb/bu	bu/a		
Two Row										
Conlon	30.5	8.5	66.8	5.2	14.6	14.0	43.5	72.0	66.1	66.8
Pinnacle	30.7	7.8	77.4	3.8	12.8	12.3	43.4	76.4	76.8	75.2
ND Genesis	30.9	6.8	79.0	3.0	12.1	12.1	44.9	84.6	82.5	79.0
AAC Synergy	30.7	5.5	77.2	2.5	13.2	13.7	47.4	80.5	76.2	74.7
CDC Fraser	30.9	4.0	84.1	1.4	14.2	--	47.2	65.4	70.9	--
Explorer	28.5	5.3	75.8	3.3	12.5	13.1	44.7	81.0	75.4	69.6
AAC Connect	29.9	6.0	74.5	4.2	13.5	13.6	44.7	80.0	79.5	76.0
Brewski	29.5	6.8	83.4	2.3	12.8	--	45.7	82.0	79.7	--
ABI Cardinal	29.3	6.3	77.9	3.5	14.3	--	45.2	66.0	73.1	--
Six Row										
Tradition	32.1	6.0	79.1	2.0	13.1	13.9	46.7	90.4	84.3	83.2
Mean	30.4	6.4	76.4	3.2	13.2	--	45.1	79.1	--	--
C.V. (%)	4.3	18.8	8.7	54.4	4.9	--	2.9	9.1	--	--
LSD (0.05)	1.8	1.7	9.6	2.5	0.9	--	1.9	10.4	--	--
LSD (0.10)	1.6	1.4	8.0	2.1	0.8	--	1.6	8.6	--	--

Planting Date = May 23; Harvest Date = August 17; Previous Crop = Soybean

Variety	Plant Height	Lodging	Plump	Thin	Protein 2022	Protein 3-yr. Avg.	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	inch	0-9	%	%	%		lb/bu	bu/a		
Two Row										
Conlon	27.0	4.5	87.5	1.1	14.3	14.5	48.7	45.4	39.1	45.1
Pinnacle	27.8	2.5	80.0	3.1	13.3	13.7	46.1	48.3	41.8	47.5
ND Genesis	32.7	2.0	88.9	0.8	12.1	13.2	48.2	74.2	50.3	55.9
AAC Synergy	30.1	1.5	88.1	1.7	14.3	14.5	47.9	66.0	49.6	62.1
CDC Fraser	31.3	1.5	88.4	1.6	14.9	--	47.3	53.4	43.7	--
Explorer	24.6	4.5	72.5	3.8	14.8	14.8	44.4	45.8	37.0	44.9
AAC Connect	28.4	2.3	79.4	3.6	13.7	14.5	47.4	73.2	51.7	56.5
Brewski	28.5	1.5	87.7	1.5	12.4	--	48.0	81.1	56.4	--
ABI Cardinal	29.3	2.5	86.2	1.5	14.8	--	47.3	56.8	44.1	--
Six Row										
Tradition	30.1	1.5	87.4	1.0	14.6	14.5	47.8	76.6	54.2	56.4
Mean	28.9	2.2	85.6	1.8	13.8	--	47.5	63.1	--	--
C.V. (%)	4.4	36.4	3.5	35.1	3.2	--	2.1	8.3	--	--
LSD (0.05)	1.8	1.1	4.3	0.9	0.6	--	1.4	7.5	--	--
LSD (0.10)	1.5	0.9	3.6	0.7	0.5	--	1.2	6.3	--	--

Planting Date = May 23; Harvest Date = August 17; Previous Crop = Soybean

Off-station research trials near Wishek.

Variety	Days to Heading	Lodging	Plant Height	Plump >6/64	Thin <5/64	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.
		0-9	inch	%	%	%	lb/bu	bu/a	bu/a
Two Row									
Conlon	50.5	2.3	17.7	91.5	1.2	12.1	43.3	39.4	34.6
Pinnacle	52.5	2.3	17.5	90.2	0.9	10.6	42.9	44.6	42.6
ND Genesis	53.3	0.8	21.9	82.4	1.7	10.1	40.1	52.3	46.7
AAC Synergy	54.8	1.0	18.3	80.1	1.8	11.4	38.7	40.6	37.8
CDC Fraser	55.0	0.5	15.9	80.0	2.1	11.6	38.2	31.2	33.0
Explorer	54.5	1.3	16.7	81.0	2.2	11.8	41.3	40.8	39.8
AAC Connect	54.5	0.8	16.5	72.1	3.4	12.5	37.2	38.3	34.6
Brewski	53.5	0.8	18.5	88.7	1.3	10.2	41.2	52.3	46.5
Six Row									
Tradition	50.5	0.3	19.3	88.9	0.6	12.9	43.6	51.6	42.5
Mean	52.9	1.0	18.1	84.3	1.7	11.4	40.9	44.4	--
C.V. (%)	1.6	74.1	11.7	6.4	39.4	5.1	2.4	20.7	--
LSD 0.10	1.0	0.9	2.6	6.5	0.8	0.7	1.2	11.1	--
LSD 0.05	1.2	1.1	3.1	7.8	1.0	0.8	1.4	13.3	--

Planting Date = May 17; Harvest Date = August 17; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Organic barley variety trial.

Oat - Dryland **Carrington**

Variety	Days to Heading	Plant Height	Lodging	1000 KWT	Test Weight	Yield 2022	Yield 3-yr. Avg.[1]
		inch	0-9	gram	lb/bu	bu/ac	bu/ac
Beach	45.3	33.4	1.0	30.9	37.4	39.4	95.3
CS Camden	48.5	30.4	1.0	31.6	35.5	72.9	113.1
Deon	50.0	33.3	1.3	32.6	38.4	70.1	109.3
ND Heart	48.0	32.6	1.8	30.8	35.0	51.1	100.5
HiFi	49.3	33.5	1.8	29.3	34.8	48.6	90.7
Jury	49.3	38.1	3.0	31.9	36.5	77.3	107.7
Killdeer	46.8	27.7	1.3	26.9	34.6	54.1	91.1
Leggett	48.5	32.0	0.3	34.1	37.9	61.7	97.2
Minstrel CDC	47.5	30.6	1.0	29.8	33.8	52.8	96.4
Newburg	50.5	35.2	1.5	31.8	35.3	70.9	107.3
Otana	49.5	35.9	3.0	26.4	36.9	65.3	104.6
Rockford	49.5	35.7	2.0	27.4	35.9	53.3	93.9
Warrior	45.5	31.8	1.3	31.4	38.8	63.4	99.4
Paul	51.5	33.6	1.8	27.4	45.1	38.1	51.1
MN-Pearl	49.5	32.8	1.0	33.1	38.0	81.7	--
SD Buffalo	45.8	35.6	1.8	35.6	39.7	73.0	--
AAC Douglas	46.5	34.1	1.8	34.4	37.4	88.6	--
Mean	48.9	33.1	1.6	32.1	37.5	62.8	--
C.V. (%)	2.6	6.6	32.4	6.8	3.6	15.5	--
LSD (0.05)	1.8	3.0	0.7	3.1	1.9	13.6	--
LSD (0.10)	1.5	2.5	0.6	2.6	1.6	11.4	--

Planting Date = May 24; Harvest Date = August 22; Previous Crop = Soybean

[1] Three-year average is for 2019, 2020 and 2022 as 2021 trial was lost due to drought.

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Oat - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	1000 KWT	Protein	Test Weight	Yield 2022	Yield 3-yr. Avg.
		0-9	inch	gram	%	lb/bu	bu/a	bu/a
Beach	51.8	0.8	35.0	37.7	13.6	36.5	110.6	68.9
CS Camden	54.0	0.8	32.9	33.4	11.5	32.7	119.9	81.1
Deon	54.8	0.0	33.5	31.9	11.7	35.2	128.9	84.9
ND Heart	52.5	0.3	33.5	33.2	13.1	34.9	103.1	70.1
HiFi	54.5	1.8	33.7	29.7	11.6	33.9	99.2	69.8
Hytest	49.8	0.5	35.4	32.7	14.1	37.2	77.1	61.0
Jury	54.3	4.0	37.0	30.9	10.9	33.3	121.7	82.9
Killdeer	51.3	2.0	29.7	29.2	10.7	32.9	119.4	80.4
Leggett	54.8	0.0	30.5	32.6	12.4	35.7	107.7	70.4
CDC Minstrel	53.0	0.0	29.9	32.1	10.5	32.3	101.7	71.3
Newburg	55.3	0.3	31.5	31.5	9.4	33.3	117.1	76.4
Otana	54.3	4.0	36.2	25.8	11.4	33.8	107.2	75.2
Rockford	54.3	0.8	36.6	27.8	10.2	35.9	102.8	70.5
Warrior	49.5	0.0	29.3	33.1	12.8	35.1	95.1	67.9
Paul	57.5	0.0	39.0	26.6	15.6	40.2	52.7	37.6
Streaker	50.8	1.3	34.4	28.6	15.3	46.1	65.9	49.1
Jerry	52.3	0.3	33.9	31.8	12.9	34.8	82.8	56.7
Morton	54.0	0.8	36.0	29.8	12.1	35.1	101.4	--
Mean	53.2	1.0	33.8	31.0	12.2	35.5	100.8	--
C.V. (%)	1.0	72.3	4.7	5.5	4.1	2.0	9.3	--
LSD 0.10	0.6	0.8	1.9	2.0	0.6	0.9	11.1	--
LSD 0.05	0.7	1.0	2.3	2.4	0.7	1.0	13.4	--

Planting Date = May 17; Harvest Date = August 17; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Einkorn - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		0-9	inch	lb/bu	lb/a	lb/a	lb/a
CDC Marvel	54.0	3.8	37.2	31.9	2365	1742	1554
CDC Aixe	54.0	2.5	35.6	30.5	1837	1310	1122
TM23	54.5	2.5	37.2	35.3	2343	1675	1439
Mean	54.2	2.9	36.7	32.6	2182	--	--
C.V. (%)	1.2	22.1	2.5	2.5	5.6	--	--
LSD 0.10	NS	0.9	1.2	1.1	167	--	--
LSD 0.05	NS	1.1	1.6	1.4	210	--	--

Planting Date = May 17; Harvest Date = August 22; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Emmer - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		0-9	inch	lb/bu	lb/a	lb/a	lb/a
CDC Tatra	55.8	2.3	34.3	32.9	835	1171.8	1131.6
CDC Yon	55.5	2.3	35.6	34.0	1070	1408.4	1312.3
Lucille	55.8	3.5	36.4	37.0	2188	1985.2	1711.6
Mean	55.7	2.7	35.4	34.6	1364	--	--
C.V. (%)	1.2	30.0	5.8	2.0	17.0	--	--
LSD 0.10	NS	1.1	NS	1.0	318	--	--
LSD 0.05	NS	NS	NS	1.2	400	--	--

Planting Date = May 17; Harvest Date = August 22; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Spelt - Organic **Carrington**

Variety	Days to Heading	Lodging	Plant Height	Test Weight	Yield 2022	Yield 2-yr. Avg.
		0-9	inch	lb/bu	lb/a	lb/a
CDC Silex	58.3	0.5	40.6	23.9	1684	1257
Jim	61.8	1.0	37.4	26.9	2684	2086
Mean	60.0	0.8	39.0	25.4	2184	--
C.V. (%)	0.7	54.4	3.1	4.1	3.6	--
LSD 0.10	0.7	NS	2.0	1.7	131	--
LSD 0.05	0.9	NS	2.7	2.3	178	--

Planting Date = May 17; Harvest Date = August 22; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Management of white mold in canola with bee-vectored *Clonostachys rosea*.

Canola - Liberty Link Cultivars **Carrington**

Brand	Hybrid	Blackleg Resistance	Clubroot Resistance	Herbicide Trait	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Lodging	Oil	1000 KWT	Test Weight	Yield
						days		inch	0-9	%	gram	lb/bu	lb/a
CROPLAN	CP7130LL	R	Yes	LL	42.8	14.5	83.5	46.5	2.0	42.9	2.5	54.8	2074
CROPLAN	CP7144LL	R	Yes	LL	42.0	14.8	85.8	43.5	2.3	45.2	3.1	54.4	2123
Pioneer Brand	P505MSL	R	Yes	LL	41.5	14.8	84.8	44.4	3.3	43.1	2.9	54.3	2505
Dekalb	DKTFLL21SC	R	No	TFLL	40.0	15.8	80.3	38.9	4.0	43.9	2.6	55.4	1907
Dekalb	DKLL82SC	R	No	LL	41.3	15.5	83.0	38.8	3.0	45.0	2.6	54.9	2145
Dekalb	DKLL83SC	R	No	LL	39.0	16.0	81.0	37.6	3.5	43.9	2.7	54.7	2169
BASF	InVigor L233P	R	No	LL	42.8	14.5	85.3	43.0	3.0	44.0	2.6	54.8	2122
BASF	InVigor L340PC	R	Yes	LL	41.0	16.0	85.8	41.0	2.5	43.2	2.9	54.3	2921
BASF	InVigor L343PC	R	Yes	LL	42.3	14.3	87.5	42.8	2.0	44.0	2.8	53.7	2928
BASF	InVigor LR344PC	R	Yes	TFLL	44.0	13.5	88.3	41.1	3.3	44.1	2.6	54.5	2302
BASF	InVigor L345PC	R	Yes	LL	42.5	15.5	88.8	42.4	3.0	44.5	2.8	54.5	2862
Mean					41.7	15.0	84.9	41.8	2.9	44.0	2.7	54.6	2369
C.V. (%)					1.3	4.9	1.7	9.0	27.6	1.3	4.7	0.4	9.6
LSD (0.05)					0.8	1.1	2.1	5.4	1.2	0.8	0.2	0.3	327
LSD (0.10)					0.7	0.9	1.7	4.5	1.0	0.7	0.2	0.3	272

Planting Date = May 18; Harvest Date = August 17; Previous Crop = Soybean

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Canola - Roundup Ready Cultivars **Carrington**

Brand	Hybrid	Blackleg Resistance	Clubroot Resistance	Herbicide Trait	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Lodging	Oil	1000 KWT	Test Weight	Yield
						days		ich	0-9	%	gram	lb/bu	lb/a
CROPLAN	CP9978TF	R	No	TF	41.7	15.0	82.7	36.0	4.0	43.6	2.8	54.7	1594
Pioneer Brand	45M35	MR	No	RR	41.7	15.0	80.0	36.0	1.3	44.2	2.5	54.8	2044
Dekalb	DKTF99SC	R	No	TF	41.3	15.7	80.7	34.9	2.3	41.7	2.7	55.6	2155
Dekalb	DKTFLL21SC	R	No	TFLL	39.3	15.7	80.3	29.8	3.3	42.9	2.6	55.7	1720
Brett Young	BY 6211TF	R	No	TF	41.7	15.0	81.3	36.7	1.3	43.0	2.7	55.3	1897
Integra	7361RC	R	Yes	TF	44.0	14.3	84.7	39.9	2.7	44.3	3.0	54.3	1764
Victory (Cargill)	V25-3T	R	Yes	TF	45.3	13.3	83.0	36.1	1.3	43.1	2.7	54.4	1820
Victory (Cargill)	V25-5T	R	Yes	TF	46.7	13.3	87.0	44.4	1.7	43.7	2.6	53.9	1734
Victory (Cargill)	H5280	R	Yes	TF	47.0	12.7	87.3	42.7	0.7	46.0	2.8	53.0	1855
Victory (Cargill)	H4389	R	Yes	TF	46.7	12.7	85.7	36.9	1.7	43.1	2.7	54.3	1558
Nuseed	NC155 TF	R	No	TF	41.3	15.3	81.7	34.9	1.7	41.4	2.5	55.7	1742
Nuseed	NC471 TF	R	No	TF	44.0	14.0	85.7	38.3	2.7	42.6	2.4	54.7	1603
Nuseed	NC527CR TF	R	Yes	TF	42.7	14.7	81.7	32.9	1.3	43.4	2.6	54.7	1768
Mean					43.3	14.4	83.2	36.9	2.0	43.3	2.7	54.7	1789
C.V. (%)					2.1	7.3	1.8	13.6	45.8	3.4	6.3	0.9	8.6
LSD (0.05)					1.5	1.8	2.5	8.4	1.5	2.5	0.3	0.9	258
LSD (0.10)					1.3	1.5	2.1	7.0	1.3	2.1	0.2	0.7	214

Planting Date = May 18; Harvest Date = August 17; Previous Crop = Soybean

Brand	Hybrid	Trait	Oil Type	Days to Bloom	Days to Maturity	Plant Height	Harvest Moisture	Oil	Test Weight	Yield 2022*	Yield 2-yr. Avg.
						inch	%	%	lb/bu	lb/a	lb/a
CROPLAN	CP3845	Conv	HO	64.3	117.3	60	6	43.4	28.8	1938	1448
CROPLAN	CP432E	EX	NS	60.8	120.3	59	6	40.2	29.8	2137	1642
CROPLAN	CP450E	EX	HO	65.3	121.8	65	6	40.7	28.5	1600	1456
CROPLAN	CP455E	EX	HO	64.5	121.3	66	6	41.6	28.8	1751	1453
CROPLAN	CP4909E	EX	NS	65.8	117.5	63	7	41.6	29.6	1615	1427
CROPLAN	CP545CL	CL	NS	67.3	120.5	59	7	42.1	28.4	2191	--
CROPLAN	CP5045CL	CL	NS	66.5	120.3	62	7	42.5	28.7	2219	1736
CROPLAN	CP7919CL	CL	HO	66.3	121.5	63	7	42.3	28.3	2609	1903
RAGT Semences	AC2101	CP	HO	65.5	118.0	66	6	39.9	27.0	1753	1351
RAGT Semences	AC2201	CL	HO	66.0	122.0	68	7	41.1	28.7	1915	--
Pioneer Brand	P63HE920	EX	HO	66.3	120.0	62	6	40.5	30.5	1862	--
Pioneer Brand	P64HE101	EX	HO	66.8	120.8	66	8	40.1	29.3	2074	1657
Proseed	12G25	CL	HO	64.0	117.8	61	7	43.4	28.4	2180	1655
Proseed	50016	CP	HO	66.8	117.8	65	6	42.8	28.0	2146	1471
Proseed	E-91	EX	HO	67.8	115.3	68	6	41.1	27.8	1881	1403
Dyna-Gro	H42HO18CL	CL	HO	62.5	118.8	56	6	41.2	28.8	1432	1132
Dyna-Gro	H49HO19CL	CL	HO	69.0	120.8	62	6	42.2	27.0	2438	1700
Dyna-Gro	H50HO20CP	CP	HO	67.3	121.8	63	6	43.6	28.7	2265	--
Dyna-Gro	H45HO10EX	EX	HO	63.0	116.5	58	6	41.3	27.4	1981	1478
Dyna-Gro	H47HO11EX	EX	HO	65.5	122.8	69	7	43.2	31.1	2446	1871
Dyna-Gro	H45NS16CL	CL	NS	62.3	116.8	57	6	42.6	28.8	1746	1370
Dyna-Gro	H49NS14CL	CL	NS	68.0	120.0	61	8	41.6	28.4	2841	1943
Dyna-Gro	XH81N62EX	EX	NS	67.8	122.3	64	7	40.8	29.5	1728	1448
Dyna-Gro	XH21H58CL	CL	HO	65.8	114.0	59	6	41.2	26.6	1563	--
Dyna-Gro	XH21H57EX	EX	HO	67.3	116.5	61	6	42.3	27.1	1484	--
Dyna-Gro	XH82H65EX	EX	HO	64.0	117.0	64	6	41.3	28.5	1479	--
Dyna-Gro	XH22H66EX	EX	HO	63.5	123.0	66	7	42.2	30.4	2248	--
Proseed	EXP 2300 CP	CP	HO	66.0	120.5	71	7	42.9	28.1	2046	--
Proseed	EXP 2346-E	EX	HO	69.5	116.5	68	7	41.1	25.6	1876	--
Nuseed	Falcon	EX	NS	65.3	118.5	56	6	42.9	29.1	2404	1757
Nuseed	N4H302 E	EX	HO	63.0	117.0	65	6	41.6	26.5	2084	1500
Mean				65.5	119.6	63.4	6.6	41.5	28.5	2026	--
C.V. (%)				2.2	1.9	5.8	11.0	3.3	2.8	13	--
LSD (0.05)				2.1	3.2	5.2	1.0	1.9	1.1	279	--
LSD (0.10)				1.7	2.7	4.3	0.8	1.6	0.9	234	--

Planting Date = June 6; Harvest Date = October 19; Previous Crop = Spring Wheat

Brand	Hybrid	Trait	Oil Type	Days to Bloom	Days to Maturity	Plant Height	Harvest Moisture	Oil	Test Weight	Yield 2022*	Yield 2-yr. Avg.
						inch	%	%	lb/bu	lb/a	lb/a
Nuseed	N4H470 CP	CP	HO	67.8	120.8	65	7	44.1	28.3	1629	1281
Nuseed	N4H422 CL	CL	HO	65.3	121.3	65	6	41.1	27.8	2434	1812
Nuseed	N4H521 CL	CL	HO	67.5	123.3	63	7	42.4	28.2	2532	--
Dairyland Seed	D687HO	EX	HO	64.3	123.0	64	7	41.7	29.8	2157	--
Dairyland Seed	D690MO	EX	MO	68.0	123.0	69	6	42.8	29.2	2258	--
Dairyland Seed	D670CL	CL	HO	63.3	119.8	65	7	42.7	28.9	2405	--
Sunrich	4415 HO/DM/CLP	CP	HO	65.0	115.8	64	6	40.7	27.3	1993	1410
Sunrich	4425 CL	CL	MO	64.8	121.0	67	7	39.0	28.0	2065	1616
Sunrich	GP25 CL	CL	MO	64.8	121.3	65	6	38.9	27.7	2495	--
USDA	Hybrid 894	Conv	Trad	65.0	118.3	65	6	40.9	29.0	2250	1489
USDA	559CL	CL	HO	67.5	119.0	64	6	41.9	28.5	2299	1684
USDA	8N270CLDM	CL	NS	63.5	118.8	60	7	42.6	29.8	1912	--
USDA	Honeycomb NS	Conv	NS	62.5	117.3	58	7	38.0	28.9	1645	1238
USDA	Hybrid 924	Conv	Trad	65.8	119.0	67	7	36.9	28.0	2198	--
Mean				65.5	119.6	63.4	6.6	41.5	28.5	2026	--
C.V. (%)				2.2	1.9	5.8	11.0	3.3	2.8	13	--
LSD (0.05)				2.1	3.2	5.2	1.0	1.9	1.1	279	--
LSD (0.10)				1.7	2.7	4.3	0.8	1.6	0.9	234	--

Planting Date = June 6; Harvest Date = October 19; Previous Crop = Spring Wheat

*Yield reported as BLUEs (Best Linear Unbiased Estimates)

Oil sunflower performance test with busy pollinators.

Non-Oilseed Sunflower **Carrington**

Brand	Hybrid	Trait	Days to Bloom	Days to Maturity	Plant Height	Harvest Moisture	Test Weight	Seeds >22/64*	Seeds >20/64*	Seeds >18/64*	Yield 2022*	Yield 2-yr. Avg.
					inch	%	lb/bu	%	%	%	lb/a	lb/a
Nuseed	Panther DMR	Conv	61.3	115.5	58	23	23.6	41	33	18	1749	--
Nuseed	NDKM15700	CL	60.3	110.0	61	23	22.6	55	29	11	1435	--
Nuseed	NDKM16761	CL	61.0	111.8	60	24	23.5	55	22	10	1279	--
Nuseed	NJKM65823	CL	63.5	118.5	62	25	25.3	40	32	16	1615	--
Valia Genetics	Valia 41	Conv	67.5	118.3	69	24	24.0	59	24	11	1912	1663
Valia Genetics	NTC99 CL	CL	66.3	120.0	71	23	23.2	66	22	6	2245	--
Valia Genetics	NTC418 XL	Conv	64.5	119.3	69	21	21.6	75	16	7	2819	--
Valia Genetics	H9015EXP	Conv	67.3	122.3	68	22	22.0	73	11	8	1560	--
Valia Genetics	H8016EXP	Conv	72.3	123.5	77	21	22.3	66	18	7	2822	--
Valia Genetics	H8117EXP	Conv	69.3	124.3	73	21	22.8	69	17	8	2721	--
Valia Genetics	H9118EXP	Conv	68.3	123.8	71	22	22.8	78	11	7	2565	--
Sunrich	SS90	Conv	61.3	122.3	65	26	26.5	27	32	22	2122	1629
Sunrich	SS91	Conv	66.0	122.5	71	24	24.8	44	30	18	2567	1916
Royal Hybrid	RH609CLP	CP	66.8	117.5	70	23	23.1	71	17	6	1899	1689
Royal Hybrid	21-EXP01	EX	63.8	122.0	66	22	22.9	64	20	10	2794	1928
Royal Hybrid	20-EXP03	EX	62.3	121.0	65	23	23.2	71	15	6	1911	1574
Mean			65.1	119.5	67.3	23.0	23.4	60	21.7	10.7	2126	--
C.V. (%)			1.8	0.8	6.2	4.9	4.9	13.8	21.0	16.4	19	--
LSD (0.05)			1.6	1.4	5.9	1.6	1.6	7.2	4.2	1.8	410	--
LSD (0.10)			1.4	1.2	4.9	1.3	1.3	6.0	3.5	1.5	342	--

Planting Date = June 6; Harvest Date = October 20; Previous Crop = Spring Wheat

*Seed sizing and yield reported as BLUEs (Best Linear Unbiased Estimates)

Variety	Seed Color	Days to Flower	Days to Maturity	Plant Height	Lodging	Oil	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				inch	0-9	%	lb/bu	bu/a	bu/a	bu/a
Gold ND	Yellow	51.3	93.3	25.2	1.0	43.0	50.7	24.1	21.7	21.5
ND Hammond	Brown	47.7	88.0	24.3	1.0	40.6	50.3	20.5	19.8	22.7
York	Brown	45.3	87.7	21.9	0.0	42.6	50.5	20.7	20.2	23.3
Carter	Brown	49.7	91.0	22.8	0.7	41.9	50.1	18.7	19.3	23.8
Bison	Brown	46.7	90.3	22.8	0.0	42.6	50.4	19.7	19.0	21.7
Omega	Yellow	46.3	87.7	24.0	0.7	43.0	50.5	17.8	15.3	16.5
Webster	Brown	50.7	89.3	24.8	0.7	42.6	50.3	23.8	23.2	23.0
CDC Neela	Brown	49.0	89.3	21.8	0.3	42.4	50.2	25.3	24.0	26.6
AAC Bright	Yellow	50.3	88.7	23.2	0.7	44.7	48.7	23.3	24.2	26.9
AAC Marvelous	Brown	48.3	90.7	22.3	1.0	44.2	50.8	26.3	--	--
CDC Rowland	Brown	48.3	90.7	23.6	0.0	42.8	50.3	25.5	26.0	--
CDC Buryu	Brown	50.3	87.3	23.5	1.0	42.6	50.3	19.7	18.8	19.3
CDC Glas	Brown	48.7	88.0	22.2	1.7	45.2	50.0	20.3	20.8	25.6
CDC Kernen	Brown	50.0	89.0	22.4	0.3	43.5	50.3	22.6	--	--
Lion	Brown	47.3	89.7	21.4	2.0	44.3	49.9	22.7	26.2	--
Mean		49.4	90.8	23.5	0.8	43.2	50.4	22.7	--	--
C.V. (%)		2.2	1.9	6.7	80.1	2.3	0.6	11.2	--	--
LSD (0.05)		1.8	2.8	2.5	1.0	1.6	0.5	4.1	--	--
LSD (0.10)		1.5	2.3	2.1	0.9	1.3	0.4	3.5	--	--

Planting Date = May 26; Harvest Date = September 12; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plants lying flat.

AAC Bright golden flax.

Flax - Organic **Carrington**

Variety	Days to Bloom	Lodging	Plant Height	Seed Yield
		0-9	inch	bu/a
Omega	41.8	0.0	22.8	3.0
Gold ND	44.3	0.0	26.0	1.9
CDC Rowland	43.3	0.0	21.7	4.8
York	44.0	0.0	20.7	4.7
CDC Neela	43.0	0.0	23.0	4.2
ND Hammond	43.3	0.0	24.0	3.9
AAC Bright	45.0	0.0	21.3	3.6
Mean	43.5	0.0	22.8	3.8
C.V. (%)	0.9	NA	4.2	17.9
LSD 0.10	0.5	NS	1.2	0.8
LSD 0.05	0.6	NS	1.4	1.0

Planting Date = May 24; Harvest Date = September 13; Previous Crop = Barley

Hemp **Carrington**

Variety	Seedling Mortality	Days to Flower	Female Plant Height	Lodging	Test Weight	Oil	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	%		inch	0-9	lb/bu	%	lb/a	lb/a	lb/a
X-59	42.5	37.5	48.8	0.8	41.8	30.6	920	1065	1171
Katani	36.8	35.0	40.9	1.3	32.3	32.6	363	553	787
Henola	48.8	46.0	50.4	1.0	40.9	31.7	844	1055	1276
Bialobrzeskie	26.0	46.0	68.7	1.0	38.0	31.3	539	772	836
Yuma Crossbow	24.3	50.8	75.0	1.8	38.4	30.9	542	--	--
Glecia	45.7	49.0	62.5	1.5	39.2	31.9	508	--	--
Mean	41.3	50.6	64.3	1.2	38.4	31.5	619	--	--
C.V. (%)	33.2	1.6	8.7	34.9	6.4	2.4	10.3	--	--
LSD (0.05)	20.1	1.2	8.2	0.6	3.7	1.1	96	--	--
LSD (0.10)	16.7	0.9	6.8	0.5	3.1	0.9	79	--	--

Planting Date = June 6; Harvest Date = September 16; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Spring Rye **Carrington**

Variety	Days to Heading	Plant Height	Lodging	1000 KWT	Protein	Test Weight	Yield
		inch	0-9	gram	%	lb/bu	bu/a
WKWR01	51.5	27.0	1.5	16.1	10.9	50.5	9.5
XKWR01-T	52.5	28.7	1.8	16.5	10.8	50.2	9.4
WKWR04	52.3	28.9	1.3	17.1	11.0	50.4	9.7
XKWR03-T	51.5	29.5	1.5	18.4	10.2	49.9	13.2
Mean	51.9	28.5	1.5	17.0	10.7	50.3	10.5
C.V. (%)	2.1	3.2	47.1	5.6	4.8	0.8	10.1
LSD 0.10	NS	1.2	NS	1.2	0.7	0.5	1.4
LSD 0.05	NS	1.5	NS	1.5	0.8	NS	1.7

Planting Date = May 18; Harvest Date = September 2; Previous Crop = Barley

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Winter Rye - Organic **Carrington**

Variety	Heading Date	Lodging	Plant Height	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
		0-9	inch	%	lb/bu	bu/a	bu/a	bu/a
Spooner	6/2	1.5	65.6	9.5	56.5	54.7	38.7	37.7
Rymin	6/2	1.5	61.8	10.2	56.0	62.4	38.4	38.7
ND Dylan	6/4	2.5	68.3	8.6	55.9	66.9	46.7	45.1
Aroostok	5/30	1.8	68.3	10.5	55.8	46.5	30.8	31.9
Hazlet	6/3	0.0	61.6	8.5	56.6	67.0	47.1	45.2
ND Gardner	5/29	2.0	68.3	9.9	55.6	57.4	36.0	37.2
Danko	6/3	0.0	54.5	8.9	57.2	61.2	34.7	37.0
Serfanio	6/5	0.0	51.2	7.9	57.1	85.7	56.9	--
Mean	6/2	1.2	62.5	9.3	56.3	62.7	--	--
C.V. (%)	0.3	57.1	2.4	5.5	0.7	10.3	--	--
LSD 0.10	0.5	0.8	1.8	0.6	0.5	7.9	--	--
LSD 0.05	0.6	1	2.2	0.7	0.6	9.5	--	--

Planting Date = September 16; Harvest Date = July 26; Previous Crop = Cover Crop (lentil, crimson clover, turnip)

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Soybean - Dryland, Conventional Varieties **Carrington**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Seeds/ Pound	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%		lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	Conv	0.7	9/21	5.2	33.9	1.5	19.4	34.1	3791	58.4	53.3	35.8	40.8
NDSU	ND Rolette	Conv	0.9	9/14	3.3	31.7	1.5	19.4	34.4	4252	58.2	57.2	35.9	38.2
NDSU	ND Benson	Conv	0.4	9/19	4.2	33.5	1.0	18.9	36.2	3986	58.1	52.7	34.4	37.2
NDSU	ND Dickey	Conv	0.7	9/22	4.2	31.3	2.3	19.0	34.4	3258	57.7	62.3	42.2	42.1
Richland IFC	MK0249	Conv	0.2	9/20	4.4	30.9	1.5	19.1	32.8	5349	58.4	55.4	34.7	35.7
Richland IFC	MK0603	Conv	0.6	9/24	5.6	37.8	5.3	17.5	35.0	6067	57.9	46.4	33.4	33.9
Richland IFC	MK808CN	Conv	0.8	9/22	3.8	37.0	2.3	20.2	32.9	3949	59.0	57.2	38.3	38.3
Richland IFC	MK009	Conv	00.9	9/20	5.7	33.5	2.5	18.0	34.4	7200	59.0	44.9	--	--
	RR check 1			9/22	3.5	36.4	1.3	19.2	34.7	3580	58.1	58.0	--	--
	RR check 2			9/14	2.6	34.6	1.0	19.9	35.4	3055	59.5	55.8	--	--
Mean				9/20	4.3	34.1	2.0	19.1	34.4	4449	58.4	54.3	--	--
C.V. (%)				0.6	37.5	5.9	59.3	2.1	0.8	4.8	0.7	7.5	--	--
LSD (0.05)				2.1	2.3	2.9	1.7	0.6	1.0	309	0.6	5.9	--	--
LSD (0.10)				1.8	1.9	2.4	1.4	0.5	0.8	257	0.5	4.9	--	--

Planting Date = June 2; Harvest Date = October 4; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Soybean - Dryland, Roundup Ready Varieties **Carrington (Page 1 of 3)**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Seeds/ Pound	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%		lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	9/4	3.0	28.6	1.3	19.0	35.2	3359	57.5	53.1	35.5	42.2
NDSU	ND2108GT73	GT	0.8	9/19	5.1	29.3	0.8	19.3	35.0	3597	58.0	61.8	43.0	48.9
NDSU	ND17009GT	GT	00.9	9/6	4.1	28.3	1.5	19.2	37.7	3104	58.8	48.6	34.5	40.9
REA Hybrids	R0112XF	RR2XF	0.1	9/12	4.3	36.8	1.3	18.8	36.0	3214	57.5	57.1	39.3	--
REA Hybrids	R0422XF	RR2XF	0.4	9/15	3.5	28.3	1.5	19.1	36.1	3218	57.4	55.7	--	--
REA Hybrids	R0632XF	RR2XF	0.6	9/17	3.8	26.8	0.5	18.5	35.8	3432	57.3	61.1	44.6	--
REA Hybrids	RX0721	RR2X	0.7	9/17	4.5	33.4	1.5	18.8	35.3	3200	57.2	63.9	47.7	54.7
LG Seeds	LGS0400RX	RR2X	0.4	9/13	4.3	32.3	1.5	19.5	33.9	3113	57.3	60.1	--	--
LG Seeds	LGS0595RX	RR2X	0.5	9/15	3.8	27.5	1.5	19.4	35.0	2685	57.7	59.8	--	--
LG Seeds	LGS0660XF	RR2XF	0.6	9/17	4.9	28.7	2.0	18.0	37.7	3015	57.9	53.8	--	--
LG Seeds	LGS0701XF	RR2XF	0.7	9/17	5.5	31.7	1.5	17.8	36.1	3559	57.8	54.3	41.6	--
Dairyland Seed	DSR-0660E	E3	0.6	9/13	3.0	25.2	0.8	18.5	37.0	3063	57.4	56.4	41.4	--
Dairyland Seed	DSR-0757E	E3	0.7	9/17	4.1	27.2	0.8	19.0	35.6	3137	57.9	50.5	--	--
NK Seeds	NK02-T4E3	E3	0.2	9/13	3.7	25.2	0.8	18.1	37.0	2983	57.2	53.9	--	--
NK Seeds	NK03-V5E3	E3	0.3	9/11	4.5	25.8	2.0	17.3	37.2	3349	57.4	58.9	--	--
NK Seeds	SO4-Q7X	RR2X	0.4	9/12	3.9	26.1	0.5	18.1	38.2	3130	58.1	57.9	43.6	50.7
NK Seeds	NK05-W3XF	RR2XF	0.5	9/14	5.4	30.7	2.0	17.3	37.3	3549	58.8	61.0	45.3	--
NK Seeds	NK06-P2XF	RR2XF	0.6	9/14	3.9	29.6	1.0	18.4	37.5	3051	57.6	56.5	--	--
Mean				9/14	4.2	28.5	1.3	18.6	36.1	3312	57.6	59.1	--	--
C.V. (%)				0.6	28.4	9.7	60.5	2.3	1.9	5.2	0.5	11.8	--	--
LSD (0.05)				2.2	1.7	3.8	1.1	0.6	1.0	247	0.4	9.8	--	--
LSD (0.10)				1.9	1.4	3.2	0.9	0.5	0.8	207	0.4	8.2	--	--

Planting Date = May 26; Harvest Date = September 27; Previous Crop = Spring Wheat

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Seeds/ Pound	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%		lb/bu	bu/a	bu/a	bu/a
Integra	70212	RR2XF	0.2	9/12	2.8	37.4	1.8	18.9	35.9	3193	57.3	56.7	40.6	--
Integra	70622N	RR2XF	0.6	9/16	3.9	27.2	1.5	18.4	35.2	3558	57.5	61.8	46.0	--
Integra	40300N	E3	0.3	9/15	4.1	28.1	1.0	19.1	36.4	3215	57.5	59.9	42.9	49.8
Paloma Seed	PL2E061	E3	0.6	9/15	4.7	23.5	1.0	18.8	35.4	3669	57.8	67.6	--	--
Proseed	XF30-12	RR2XF	0.1	9/8	3.6	25.0	0.5	18.7	34.9	2707	57.1	59.4	--	--
Proseed	XF30-42N	RR2XF	0.4	9/13	3.6	28.1	1.0	19.0	36.4	3170	57.3	60.3	--	--
Proseed	EL30-33	E3	0.3	9/13	3.5	28.3	1.5	18.7	36.2	3474	57.1	56.4	--	--
Proseed	EL30-53	E3	0.5	9/15	5.4	26.0	1.5	18.3	36.5	3355	57.7	58.5	--	--
Dyna-Gro	S04XT91	RR2X	0.4	9/13	4.1	26.0	1.0	19.2	34.8	2902	57.9	65.6	45.1	51.2
Dyna-Gro	S05EN82	E3	0.5	9/16	4.1	27.0	1.5	18.4	36.4	3356	57.7	64.0	46.7	--
Dyna-Gro	S05XF73	RR2XF	0.5	9/15	5.1	30.2	0.5	19.0	35.6	3577	57.8	62.2	--	--
Legacy Seeds	LS-0320 E3	E3	0.3	9/8	4.5	23.4	1.3	18.4	35.6	3718	56.7	65.2	46.1	51.2
Legacy Seeds	LS032-22 E	E3	0.3	9/13	3.9	28.1	1.0	19.2	35.1	3417	56.9	58.6	--	--
Legacy Seeds	LS044-21 XF	RR2FX	0.4	9/14	3.3	42.2	1.0	18.8	35.5	3374	57.7	53.1	41.6	--
Legacy Seeds	LS064-22 XF	RR2XF	0.6	9/16	4.1	30.7	1.0	18.2	35.2	3694	57.7	62.8	--	--
Legacy Seeds	LS074-22 XF	RR2XF	0.7	9/15	3.7	29.2	1.0	18.7	36.1	3147	57.5	58.7	--	--
Legacy Seeds	LS072-21 E	E3	0.7	9/15	5.5	27.5	0.5	17.3	37.3	3379	58.1	61.6	44.7	--
Legacy Seeds	LS092-22E	E3	0.8	9/15	4.7	26.4	1.3	18.1	36.2	3850	57.9	60.0	--	--
Stine Seed	03EB02	E3	0.3	9/7	3.7	23.9	1.3	18.1	35.5	3603	56.3	65.0	43.3	--
Mean				9/14	4.2	28.5	1.3	18.6	36.1	3312	57.6	59.1	--	--
C.V. (%)				0.6	28.4	9.7	60.5	2.3	1.9	5.2	0.5	11.8	--	--
LSD (0.05)				2.2	1.7	3.8	1.1	0.6	1.0	247	0.4	9.8	--	--
LSD (0.10)				1.9	1.4	3.2	0.9	0.5	0.8	207	0.4	8.2	--	--

Planting Date = May 26; Harvest Date = September 27; Previous Crop = Spring Wheat

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Seeds/ Pound	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%		lb/bu	bu/a	bu/a	bu/a
Stine Seed	04EE06	E3	0.4	9/14	3.5	23.1	1.5	18.3	36.9	3609	57.9	54.3	--	--
Stine Seed	05EB23	E3	0.5	9/13	3.9	27.9	2.5	18.7	35.4	3205	57.1	57.3	41.3	--
Stine Seed	08EC32	E3	0.7	9/18	5.1	28.2	2.5	17.9	37.7	3182	58.3	54.2	--	--
Thunder	SB8903N	RR2X	0.3	9/10	3.6	30.3	3.0	18.3	34.9	3515	57.6	60.7	44.3	49.0
Thunder	SB8104N	RR2X	0.4	9/14	4.8	27.8	0.8	19.0	35.5	2988	57.9	72.1	48.4	53.3
Thunder	TX8304N	RR2XF	0.4	9/12	4.7	31.3	0.8	19.0	35.0	3829	57.5	64.3	--	--
Thunder	TE7304N	E3	0.4	9/11	4.1	26.2	0.0	18.4	36.6	3035	57.5	60.2	--	--
Thunder	TX8305N	RR2XF	0.5	9/17	4.5	28.2	1.0	18.0	37.7	3039	57.8	57.6	--	--
Champion Seed	0563XL	RR2XF	0.5	9/17	3.1	27.7	1.3	18.3	35.4	3612	57.6	62.2	--	--
Champion Seed	0692XL	RR2XF	0.6	9/18	4.1	30.5	1.8	18.9	35.5	3317	57.7	56.1	42.2	--
Champion Seed	0743XL	RR2XF	0.7	9/18	5.7	27.9	2.0	17.9	37.7	3161	58.1	56.3	--	--
Mean				9/14	4.2	28.5	1.3	18.6	36.1	3312	57.6	59.1	--	--
C.V. (%)				0.6	28.4	9.7	60.5	2.3	1.9	5.2	0.5	11.8	--	--
LSD (0.05)				2.2	1.7	3.8	1.1	0.6	1.0	247	0.4	9.8	--	--
LSD (0.10)				1.9	1.4	3.2	0.9	0.5	0.8	207	0.4	8.2	--	--

Planting Date = May 26; Harvest Date = September 27; Previous Crop = Spring Wheat

Soybean - Irrigated, Conventional Varieties **Carrington**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Seeds/ Pound	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%		lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	Conv	0.7	9/28	4.1	38.4	3.5	18.7	34.7	3342	58.8	69.3	71.0	67.6
NDSU	ND Rolette	Conv	0.9	9/18	4.1	37.2	2.0	18.5	35.7	3883	58.7	70.8	66.0	64.5
NDSU	ND Benson	Conv	0.4	9/25	3.3	36.0	2.8	17.8	38.1	3286	58.6	61.0	60.8	60.7
NDSU	ND Dickey	Conv	0.7	9/25	3.6	36.8	1.5	17.5	37.3	3045	58.1	62.1	67.1	65.7
Richland IFC	MK0249	Conv	0.2	9/26	4.4	34.8	5.5	17.6	35.4	5331	58.7	58.3	--	--
Richland IFC	MK0603	Conv	0.6	9/29	5.3	38.2	7.8	16.8	36.3	5312	58.0	57.6	--	--
Richland IFC	MK009	Conv	0.9	9/27	4.4	37.4	5.5	17.3	35.7	6307	59.4	51.3	--	--
	RR check 1			9/24	5.3	38.2	2.0	18.2	36.0	3190	58.4	67.6	--	--
	RR check 2			9/17	3.7	36.0	4.0	18.5	37.9	2786	60.4	64.9	--	--
NDSU	ND17009GT	GT	00.9	9/17	4.5	35.8	3.8	18.4	37.6	3005	59.9	61.9	--	--
Mean				9/23	4.3	36.9	3.8	17.9	36.5	3949	58.9	62.5	--	--
C.V. (%)				1.3	0.6	26.4	3.4	18.0	1.4	9.5	0.6	7.4	--	--
LSD (0.05)				2.2	1.7	1.8	1.0	0.4	0.7	543	0.5	6.7	--	--
LSD (0.10)				1.8	1.4	1.5	0.8	0.3	0.6	451	0.4	5.6	--	--

Planting Date = June 2; Harvest Date = October 10; Previous Crop = Winter Rye

Soybean - Irrigated, Roundup Ready Varieties **Carrington (Page 1 of 2)**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	1000 KWT	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	gram	lb/bu	bu/a	bu/a	bu/a
NDSU	ND21008GT20	GT	00.8	9/10	3.0	35.0	5.3	18.3	35.7	140.9	58.8	61.0	56.1	--
NDSU	ND2108GT73	GT	0.8	9/27	4.3	35.6	5.5	18.5	35.9	131.8	59.1	62.9	59.5	--
NDSU	ND17009GT	GT	00.9	9/10	3.5	35.2	5.0	18.2	38.6	152.8	60.3	56.3	53.5	55.6
REA Hybrids	R0112XF	RR2XF	0.1	9/20	2.6	42.5	5.5	18.3	36.6	157.3	58.1	64.6	57.7	--
REA Hybrids	R0422XF	RR2XF	0.4	9/19	4.7	37.8	3.3	18.4	37.1	154.0	58.0	67.0	--	--
REA Hybrids	R0632XF	RR2XF	0.6	9/21	4.7	34.8	2.5	17.6	37.1	130.1	57.8	70.6	62.4	--
REA Hybrids	RX0721	RR2X	0.7	9/20	3.5	38.0	4.3	18.0	36.7	144.3	57.8	65.8	64.3	65.0
LG Seeds	LGS0400RX	RR2X	0.4	9/19	3.9	39.0	4.8	18.9	34.8	156.1	57.8	68.9	--	--
LG Seeds	LGS0595RX	RR2X	0.5	9/20	2.8	32.3	1.8	18.7	35.7	171.9	58.7	66.4	--	--
LG Seeds	LGS0660XF	RR2XF	0.6	9/23	4.3	36.8	3.0	17.4	38.7	161.3	58.8	60.7	--	--
LG Seeds	LGS0701XF	RR2XF	0.7	9/23	4.5	38.2	4.3	17.3	36.9	138.7	58.6	69.5	67.2	--
Dairyland Seed	DSR-0660E	E3	0.6	9/19	3.0	31.7	2.3	17.7	37.9	143.0	58.1	69.8	64.3	--
Dairyland Seed	DSR-0757E	E3	0.7	9/24	5.7	33.7	4.5	18.9	35.8	149.6	59.1	65.0	--	--
Paloma Seed	PL2E061	E3	0.6	9/25	4.5	31.0	6.3	18.6	35.4	126.4	59.0	64.3	--	--
Proseed	XF30-12	RR2XF	0.1	9/13	2.6	35.2	2.8	18.0	36.1	178.2	57.8	66.0	--	--
Proseed	XF30-42N	RR2XF	0.4	9/18	3.7	38.4	3.5	18.2	37.5	150.5	57.9	66.0	--	--
Proseed	EL30-33	E3	0.3	9/19	4.9	32.9	5.0	18.7	35.9	136.0	57.3	63.9	--	--
Proseed	EL30-53	E3	0.5	9/21	3.7	31.1	4.0	17.8	37.2	134.2	58.3	65.3	--	--
Dyna-Gro	S04XT91	RR2X	0.4	9/19	4.3	35.0	1.8	18.5	35.8	161.3	58.9	69.8	64.1	65.3
Mean				9/20	4.0	35.4	4.2	18.1	36.6	143.7	58.3	65.5	--	--
C.V. (%)				0.3	33.0	5.0	17.8	1.4	1.3	3.6	0.4	7.8	--	--
LSD (0.05)				2.0	4.7	6.3	1.1	0.3	0.7	7.3	0.4	7.1	--	--
LSD (0.10)				1.7	3.9	5.3	0.9	0.3	0.5	6.1	0.3	6.0	--	--

Planting Date = June 2; Harvest Date = October 5; Previous Crop = Winter Rye

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	1000 KWT	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	gram	lb/bu	bu/a	bu/a	bu/a
Dyna-Gro	S05EN82	E3	0.5	9/20	4.1	31.9	4.8	16.9	38.8	134.7	58.2	61.6	57.1	--
Dyna-Gro	S05XF73	RR2XF	0.5	9/19	3.3	41.9	4.0	17.8	37.0	120.6	58.5	64.0	--	--
Legacy Seeds	LS-0320 E3	E3	0.3	9/18	3.5	34.3	3.3	17.6	36.3	121.5	57.3	65.9	61.6	62.6
Legacy Seeds	LS032-22 E	E3	0.3	9/20	3.1	33.7	4.5	18.9	35.3	141.5	57.0	68.0	--	--
Legacy Seeds	LS044-21 XF	RR2FX	0.4	9/24	3.0	46.9	7.0	18.6	35.5	144.7	58.4	64.3	61.6	--
Legacy Seeds	LS064-22 XF	RR2XF	0.6	9/22	3.3	36.0	4.5	17.7	36.3	132.4	58.4	63.3	--	--
Legacy Seeds	LS074-22 XF	RR2XF	0.7	9/21	3.9	36.0	2.8	18.3	36.4	165.3	58.0	70.4	--	--
Legacy Seeds	LS072-21 E	E3	0.7	9/23	6.1	33.1	4.8	17.5	36.9	146.5	58.7	67.0	62.5	--
Legacy Seeds	LS092-22E	E3	0.8	9/21	4.9	34.4	4.8	18.3	36.1	129.4	58.3	63.2	--	--
Stine Seed	03EB02	E3	0.3	9/19	3.3	32.7	3.8	18.1	36.0	129.1	57.0	70.6	--	--
Stine Seed	04EE06	E3	0.4	9/21	2.8	32.5	4.3	17.5	37.7	131.9	58.5	64.0	--	--
Stine Seed	05EB23	E3	0.5	9/18	4.3	32.7	4.5	17.9	36.8	140.8	57.6	66.6	--	--
Stine Seed	08EC32	E3	0.7	9/26	7.1	33.7	5.3	17.8	37.2	167.9	59.1	67.1	--	--
Mean				9/20	4.0	35.4	4.2	18.1	36.6	143.7	58.3	65.5	--	--
C.V. (%)				0.3	33.0	5.0	17.8	1.4	1.3	3.6	0.4	7.8	--	--
LSD (0.05)				2.0	4.7	6.3	1.1	0.3	0.7	7.3	0.4	7.1	--	--
LSD (0.10)				1.7	3.9	5.3	0.9	0.3	0.5	6.1	0.3	6.0	--	--

Planting Date = June 2; Harvest Date = October 5; Previous Crop = Winter Rye

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

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	Conv	0.7	9/9	5.7	35.4	0.0	19.83	33.9	58.4	64.7	52.0	53.2
NDSU	ND Rolette	Conv	0.9	9/2	5.3	35.2	0.3	19.21	35.3	58.2	61.9	48.2	49.5
NDSU	ND Benson	Conv	0.4	9/9	5.1	32.5	0.3	18.81	37.4	57.9	61.2	48.2	48.6
NDSU	ND Dickey	Conv	0.7	9/10	3.9	32.3	0.3	19.07	35.3	57.8	65.1	53.0	50.5
Richland IFC	MK0249	Conv	0.2	9/8	3.7	28.9	0.0	18.70	34.0	58.0	59.3	47.7	44.4
Richland IFC	MK0603	Conv	0.6	9/14	5.7	38.4	1.0	16.82	37.5	58.4	53.3	45.2	43.6
Richland IFC	MK009	Conv	0.9	9/10	5.1	34.4	0.5	17.94	35.4	59.0	51.5	41.5	--
Richland IFC	MK808CN	Conv	0.8	9/13	4.1	34.8	0.5	20.34	34.0	58.6	63.6	48.8	47.3
Richland IFC	MK1016	Conv	1.0	9/13	4.9	40.6	0.8	17.46	37.7	59.3	52.9	44.4	43.1
Richland IFC	MK9101	Conv	1.1	9/16	6.7	39.0	0.5	--	--	59.1	58.1	46.5	--
Richland IFC	MK41	Conv	1.1	9/7	3.7	36.8	0.5	16.94	39.4	57.6	59.2	47.9	48.9
Richland IFC	MK1023	Conv	1.0	9/18	5.3	32.7	0.3	18.63	34.5	60.0	47.0	--	--
Legacy Seeds	LS123-23 C	Conv	1.2	9/19	7.1	40.0	0.0	19.88	36.2	58.8	63.8	--	--
	RR Check 1			9/11	4.1	33.9	0.0	19.57	34.5	58.2	74.2	--	--
	RR Check 2			9/2	4.3	32.1	0.3	19.57	36.6	59.2	54.6	--	--
Mean				9/11	5.0	35.1	0.3	18.77	35.8	58.6	59.4	--	--
C.V. (%)				1.6	29.5	7.0	117.3	1.6	1.5	0.8	7.1	--	--
LSD (0.05)				2.6	2.2	3.5	0.6	0.43	0.8	0.7	6.1	--	--
LSD (0.10)				2.1	1.8	2.9	0.5	0.36	0.6	0.6	5.0	--	--

Planting Date = May 27; Harvest Date = October 4; Previous Crop = Spring Wheat

Soybean - Dryland, Roundup Ready Varieties **Barnes County - Dazey (Page 1 of 3)**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
NDSU	ND17009GT	GT	00.9	8/30	1.7	31.7	0.5	19.2	35.4	56.9	47.0	42.7	44.0
NDSU	ND21008GT20	GT	00.8	8/26	1.3	32.5	0.5	19.6	33.5	56.0	43.7	40.2	--
NDSU	ND2108GT73	GT	0.8	9/12	2.2	27.4	0.0	19.7	33.1	56.6	52.7	45.0	45.4
Dairyland Seed	DSR-0757E	E3	0.7	9/10	1.7	28.3	0.0	19.9	33.0	55.9	54.8	--	--
Dairyland Seed	DSR-0920E	E3	0.9	9/14	1.9	29.9	0.0	19.5	34.4	56.7	56.3	52.8	52.4
Dairyland Seed	DSR-1121E	E3	1.1	9/16	1.5	27.8	0.0	20.8	32.6	56.2	57.8	--	--
Dairyland Seed	DSR-1290E	E3	1.2	9/12	1.4	32.9	0.0	20.1	32.4	57.1	64.1	57.1	--
Dak-Sota	DE5309	E3	0.9	9/12	1.6	27.6	0.0	20.2	33.4	56.1	60.4	--	--
Dyna-Gro	S05EN82	E3	0.5	9/8	1.8	27.2	0.0	19.0	35.8	55.7	57.1	51.2	--
Dyna-Gro	S07XF23	RR2XF	0.7	9/9	2.2	30.3	0.0	19.0	33.9	56.8	59.0	--	--
Dyna-Gro	S09EN53	E3	0.9	9/17	1.6	27.2	0.0	19.5	33.7	57.4	58.3	--	--
Dyna-Gro	S09XF62	RR2XF	0.9	9/13	1.9	29.5	0.0	20.2	33.4	56.1	57.7	--	--
Legacy Seeds	LS072-21 E	E3	0.7	9/10	2.2	28.3	0.0	18.5	35.0	57.2	61.0	50.4	--
Legacy Seeds	LS074-22 XF	RR2XF	0.7	9/10	1.7	29.9	0.0	20.1	33.5	56.1	61.6	--	--
Legacy Seeds	LS084-22	RR2XF	0.8	9/11	1.4	32.3	0.0	19.8	33.0	56.4	61.0	--	--
Legacy Seeds	LS092-22E	E3	0.8	9/11	1.4	28.1	0.0	20.1	33.5	56.1	67.6	--	--
Legacy Seeds	LS094-20 XF	RR2XF	0.9	9/11	2.2	29.5	0.3	19.8	33.5	56.5	55.9	49.2	--
Legacy Seeds	LS102-22 E	E3	1	9/16	1.4	27.8	0.0	19.3	33.6	57.1	60.7	--	--
Legacy Seeds	LS122-21 E	E3	1.1	9/12	1.2	29.9	0.0	20.1	32.1	56.4	54.8	51.8	--
Mean				9/10	1.8	29.7	0.1	19.5	34.0	56.6	57.9	--	--
C.V. (%)				1.7	31.2	9.1	211.5	1.7	1.5	0.9	9.4	--	--
LSD (0.05)				2.6	2.0	3.8	0.4	0.5	0.7	0.7	7.6	--	--
LSD (0.10)				2.2	1.6	3.2	0.3	0.4	0.6	0.6	6.4	--	--

Planting Date = May 27; Harvest Date = October 5; Previous Crop = Spring Wheat

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
NK Seeds	NK03-V5E3	E3	0.3	9/4	1.3	28.0	0.0	18.9	35.2	56.1	57.1	--	--
NK Seeds	NK05-W3XF	RR2XF	0.5	9/8	1.8	36.2	0.5	19.0	35.1	57.6	57.6	49.4	--
NK Seeds	NK06-D9E3	E3	0.6	9/7	1.5	27.4	0.0	19.5	34.1	56.3	61.8	--	--
NK Seeds	NK06-P2XF	RR2XF	0.6	9/7	1.7	31.5	0.3	19.7	34.3	56.6	52.5	--	--
NK Seeds	NK08-M1XF	RR2XF	0.8	9/12	1.9	30.5	0.5	18.9	36.3	57.1	60.2	--	--
Paloma Seed	PL2E061	E3	0.6	9/8	1.9	27.0	0.0	19.6	33.5	56.4	55.9	--	--
Paloma Seed	PL2E101	E3	1	9/17	2.1	29.5	0.0	19.1	34.0	57.6	62.5	--	--
Proseed	EL30-53	E3	0.5	9/9	1.3	26.8	0.0	19.5	34.5	56.2	56.9	--	--
Proseed	XF30-52N	RR2XF	0.5	9/11	1.6	28.4	0.0	19.0	33.8	56.9	62.0	--	--
Proseed	XF30-62N	RR2XF	0.6	9/10	1.6	29.9	0.0	19.2	35.3	56.8	52.7	--	--
Proseed	XF30-72N	RR2XF	0.7	9/6	2.1	33.3	0.0	19.6	34.0	56.4	63.5	--	--
Proseed	XF30-82N	RR2XF	0.8	9/11	1.6	30.1	0.0	19.1	34.7	56.5	59.4	--	--
Proseed	XT90-50	RR2X	0.5	9/11	1.7	30.9	0.5	19.6	34.7	56.5	64.7	55.1	52.8
REA Hybrids	R0442XF	RR	0.4	9/8	1.6	28.7	0.0	19.9	34.8	56.0	56.1	--	--
REA Hybrids	R0632XF	RR	0.6	9/10	1.8	28.9	0.0	19.1	34.1	56.0	57.7	49.1	--
REA Hybrids	R0843XF	RR2XF	0.8	9/11	1.7	31.9	0.0	18.8	34.5	56.1	58.2	--	--
REA Hybrids	RX0721	RR	0.7	9/9	2.0	32.3	0.0	19.5	33.4	56.2	62.6	53.1	--
Stine Seed	03EB02	E3	0.3	9/3	1.7	26.6	0.0	19.5	33.9	55.8	64.5	--	--
Stine Seed	04EE06	E3	0.4	9/10	1.4	26.4	0.0	19.5	34.1	56.0	61.8	--	--
Mean				9/10	1.8	29.7	0.1	19.5	34.0	56.6	57.9	--	--
C.V. (%)				1.7	31.2	9.1	211.5	1.7	1.5	0.9	9.4	--	--
LSD (0.05)				2.6	2.0	3.8	0.4	0.5	0.7	0.7	7.6	--	--
LSD (0.10)				2.2	1.6	3.2	0.3	0.4	0.6	0.6	6.4	--	--

Planting Date = May 27; Harvest Date = October 5; Previous Crop = Spring Wheat

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
Stine Seed	05EB23	E3	0.5	9/4	1.3	27.4	0.0	20.3	33.0	55.8	46.9	--	--
Stine Seed	08EC32	E3	0.7	9/11	1.9	29.1	0.0	19.1	34.7	56.9	55.4	--	--
Thumder	TE7207	E3	0.7	9/12	1.9	31.9	0.5	19.5	33.0	57.4	54.5	49.4	--
Thumder	TE7309N	E3	0.9	9/14	1.9	30.1	0.0	19.9	33.9	57.6	61.1	--	--
Thumder	TX8307N	RR2XF	0.7	9/11	2.9	32.9	0.0	18.7	34.3	57.6	58.8	--	--
Thumder	TX8309N	RR2XF	0.9	9/14	2.0	32.9	1.0	18.6	34.7	57.2	58.9	--	--
Mean				9/10	1.8	29.7	0.1	19.5	34.0	56.6	57.9	--	--
C.V. (%)				1.7	31.2	9.1	211.5	1.7	1.5	0.9	9.4	--	--
LSD (0.05)				2.6	2.0	3.8	0.4	0.5	0.7	0.7	7.6	--	--
LSD (0.10)				2.2	1.6	3.2	0.3	0.4	0.6	0.6	6.4	--	--

Planting Date = May 27; Harvest Date = October 5; Previous Crop = Spring Wheat

Soybean - Dryland, Conventional Varieties **Wishek**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
NDSU	ND Stutsman	Conv	0.7	9/14	5.3	34.3	0.5	18.73	36.1	57.7	48.6	38.6	41.6
NDSU	ND Rolette	Conv	0.9	9/6	5.7	34.3	0.5	19.02	37.0	56.9	51.1	--	--
NDSU	ND Benson	Conv	0.4	9/12	4.9	32.9	0.5	18.01	39.2	57.9	45.3	35.2	37.0
NDSU	ND Dickey	Conv	0.7	9/17	5.5	30.1	1.0	17.40	37.7	58.3	46.8	36.1	40.2
Richland IFC	MK0603	Conv	0.6	9/16	6.9	35.0	1.0	15.71	38.8	58.3	37.3	--	--
Richland IFC	MK009	Conv	0.9	9/13	4.1	29.9	0.8	17.00	37.7	57.6	33.4	--	--
Richland IFC	MK808CN	Conv	0.8	9/15	6.5	33.7	0.5	19.16	35.9	58.6	48.4	--	--
Richland IFC	MK1016	Conv	1.0	9/17	5.1	35.0	1.0	17.07	38.1	58.6	36.2	--	--
Richland IFC	MK9101	Conv	1.1	9/19	6.5	34.0	0.5	--	--	57.0	36.9	--	--
Richland IFC	MK41	Conv	1.1	9/13	5.3	35.6	0.8	16.54	40.3	57.4	45.0	--	--
	RR check 1			9/8	5.9	35.2	0.5	18.96	38.1	58.0	42.8	--	--
	RR check 2			9/18	7.3	32.9	0.8	19.06	35.3	57.4	51.7	--	--
Mean				9/14	5.8	33.6	0.7	17.88	37.7	57.8	43.6	--	--
C.V. (%)				0.7	32.6	12.3	93.1	2.3	1.8	1.2	9.7	--	--
LSD (0.05)				2.6	2.7	5.9	0.9	0.58	1.0	1.0	6.1	--	--
LSD (0.10)				2.2	2.2	4.9	0.8	0.48	0.8	0.8	5.0	--	--

Planting Date = June 3; Harvest Date = October 6; Previous Crop = Spring Wheat

Soybean - Dryland, Roundup Ready Varieties **Wishek**

Brand	Variety	Trait	Maturity Group	Maturity Date	Pod Height	Plant Height	Lodging	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	0-9	%	%	lb/bu	bu/a	bu/a	bu/a
NDSU	ND2108GT73	GT	0.7	9/17	3.0	30.1	0.5	19.0	33.5	55.6	48.4	42.7	48.1
NDSU	ND17009GT	GT	00.9	9/7	4.3	31.5	0.0	18.9	35.2	54.5	46.2	39.1	--
Dyna-Gro	S09EN53	E3	0.9	9/23	5.3	31.3	0.8	18.8	33.9	56.4	62.4	--	--
Dyna-Gro	S09XF62	RR2XF	0.9	9/20	4.1	29.3	0.5	19.5	32.9	54.5	51.4	--	--
Dyna-Gro	S12EN72	E3	1.2	9/22	5.1	34.6	0.8	18.7	36.8	56.9	62.5	--	--
Dyna-Gro	S12XF92	RR2XF	1.2	9/22	4.5	30.5	0.5	18.5	34.8	56.1	56.2	--	--
Legacy Seeds	LS092-22E	E3	0.8	9/13	4.5	29.9	0.5	18.7	35.1	54.6	58.0	--	--
Legacy Seeds	LS094-20 XF	RR2XF	0.9	9/20	2.8	30.7	0.5	18.8	34.1	54.8	69.9	--	--
Legacy Seeds	LS102-22 E	E3	1.0	9/22	4.3	31.5	0.8	18.4	33.6	55.8	63.4	--	--
Legacy Seeds	LS122-21 E	E3	1.1	9/20	3.9	32.3	0.5	19.1	33.3	55.7	57.3	50.7	--
Legacy Seeds	LS084-22	RR2XF	0.8	9/18	4.3	35.2	0.8	18.4	33.5	54.8	64.1	--	--
LG Seeds	LGS0660XF	RR2XF	0.6	9/20	3.1	31.1	0.8	18.1	35.0	55.5	56.9	--	--
LG Seeds	LGS0701XF	RR2XF	0.7	9/18	4.3	30.1	0.5	17.5	35.2	54.9	50.6	45.3	--
NK Seeds	NK05-W3XF	RR2XF	0.5	9/16	4.7	33.1	0.3	17.7	35.5	55.1	62.9	52.0	--
NK Seeds	NK06-P2XF	RR2XF	0.6	9/15	4.9	30.9	0.8	18.3	35.1	55.1	58.5	--	--
NK Seeds	NK09-B5XF	RRSXF	0.9	9/18	5.3	29.7	0.5	17.9	35.2	55.4	52.8	--	--
NK Seeds	NK10-W8XF	RR2XF	1.0	9/17	5.7	32.5	0.5	17.9	34.5	56.1	48.5	48.5	--
Paloma Seed	PL2E061	E3	0.6	9/14	4.1	27.2	0.3	19.2	34.2	54.6	58.7	--	--
Paloma Seed	PL2E101	E3	1.0	9/15	4.9	28.1	0.8	18.9	34.7	55.2	58.6	--	--
REA Hybrids	R0442XF	RR2XF	0.4	9/16	4.9	29.5	0.3	19.1	33.8	53.8	53.4	--	--
REA Hybrids	R0632XF	RR2XF	0.6	9/18	4.3	30.5	0.0	17.9	34.2	54.7	63.1	49.7	--
REA Hybrids	RX0721	RR2X	0.7	9/18	4.3	31.7	0.8	18.5	33.8	54.7	63.9	52.7	59.1
REA Hybrids	R0843XF	RR2XF	0.8	9/18	5.7	31.9	0.8	18.4	34.9	55.7	66.9	--	--
REA Hybrids	R1042XF	RR2XF	1.0	9/21	7.7	34.6	0.5	18.1	35.2	55.3	53.3	--	--
Mean				9/17	4.5	30.9	0.5	18.5	34.5	55.2	57.0	--	--
C.V. (%)				0.9	38.2	11.9	99.5	3.8	2.9	1.5	18.5	--	--
LSD (0.05)				3.2	2.4	5.1	0.7	0.8	1.4	0.9	12.1	--	--
LSD (0.10)				2.7	2.0	4.3	0.6	0.7	1.2	0.8	10.2	--	--

Planting Date = June 3; Harvest Date = October 6; Previous Crop = Spring Wheat

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

Brand	Variety	Maturity Group[1]	Maturity Date	Pod Height	Plant Height	Lodging	Seeds/ Pound	Oil	Protein	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				inch	inch	0 to 9		%	%	lb/bu	bu/a	bu/a	bu/a
Brushvale Seeds	BS1252	1.2	9/10	3.3	38.5	0.5	2752	18.7	35.9	55.4	73.0	--	--
Legacy Seeds	LS123-23 C	1.2	9/13	4.3	40.3	0.5	2551	19.0	37.3	42.4	78.8	--	--
Sevita	Skyline	1.1	9/10	4.0	38.5	1.0	2551	19.0	37.9	55.6	68.0	75.4	65.9
Sevita	Finch	0.9	9/8	3.5	38.8	0.3	2415	18.4	38.6	56.0	69.0	--	--
Sevita	Odessa	1.1	9/13	3.8	35.3	0.5	2183	18.6	38.7	41.9	90.5	--	--
Sevita	Dunham	0.7	9/10	3.3	36.5	0.0	2162	17.4	41.1	56.2	73.0	--	--
Sevita	SVX21T0S15	0.7	9/8	3.0	35.8	0.3	2293	18.5	36.8	54.5	72.9	--	--
Mean			9/10	3.6	37.7	0.4	2398	18.5	38.0	51.7	75.0	--	--
C.V (%)			1.0	22.3	2.3	96.4	4.2	0.9	0.8	29.6	24.8	--	--
LSD 0.05			1.4	1.0	1.1	0.5	170.0	0.2	0.4	18.8	22.8	--	--
LSD 0.10			1.7	1.2	1.3	0.6	152.0	0.3	0.5	22.7	27.6	--	--

Planting Date = May 27; Harvest Date = September 30; Previous Crop = Corn

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

Brand	Variety	Maturity Group[1]	Maturity Date	Pod Height	Plant Height	Lodging	Seeds/ Pound	Oil	Protein	Test Weig	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				inch	inch	0 to 9		%	%	lb/bu	bu/a	bu/a	bu/a
Dairyland Seed	DSR-0920E	0.9	9/15	3.5	37.0	0.0	2594	18.2	36.8	56.5	75.9	78.6	74.1
Dairyland Seed	DSR-1121E	1.1	9/16	3.0	33.8	0.5	2929	20.0	33.6	56.4	76.4	--	--
Dairyland Seed	DSR-1290E	1.2	9/15	3.8	38.3	1.5	2785	19.7	33.5	57.5	77.0	80.5	--
Dyna-Gro	S09EN53	0.9	9/16	3.5	35.5	0.0	2785	18.5	35.4	56.9	78.5	--	--
Dyna-Gro	S09XF62	0.9	9/14	3.5	37.8	0.3	2929	19.4	34.3	56.6	72.8	81.4	--
Dyna-Gro	S12EN72	1.2	9/17	3.3	36.3	0.0	2624	18.5	36.5	57.0	76.5	80.2	--
Dyna-Gro	S12XF92	1.2	9/17	3.5	36.0	0.5	2752	18.5	35.6	56.4	80.5	85.2	--
Legacy Seeds	LS092-22E	0.8	9/15	3.5	35.5	0.3	2873	19.2	35.2	56.5	73.9	--	--
Legacy Seeds	LS094-20 XF	0.9	9/14	3.3	35.5	0.5	2785	18.8	35.5	56.7	75.5	--	--
Legacy Seeds	LS102-22 E	1.0	9/17	4.3	35.8	0.3	2702	18.5	35.2	56.8	81.6	--	--
Legacy Seeds	LS122-21 E	1.1	9/15	3.3	37.0	2.0	2873	19.6	33.5	57.6	78.5	89.2	--
Legacy Seeds	LS084-22	0.8	9/11	3.5	37.3	0.0	2752	19.4	34.2	56.3	75.6	--	--
LG Seeds	LGS0822E3	0.8	9/12	3.3	34.5	0.8	2415	18.4	36.5	57.0	75.4	79.9	--
LG Seeds	LGS0988XF	0.9	9/13	3.8	37.5	0.8	2594	18.1	35.8	57.6	75.9	--	--
LG Seeds	LGS1203E3	1.2	9/17	3.8	37.0	0.5	2551	18.5	36.6	56.8	74.0	81.1	--
LG Seeds	LGS1232XF	1.2	9/16	3.3	37.3	0.3	2838	18.3	36.0	56.8	74.2	81.4	--
LG Seeds	LGS1385XF	OL	9/17	3.8	40.8	0.8	2702	18.1	36.3	57.5	77.0	--	--
NDSU	ND2108GT73	0.7	9/15	3.5	35.8	1.0	2967	18.5	35.9	57.4	71.9	64.4	--
NDSU	ND17009GT	0.9	9/4	3.3	36.8	2.5	2594	18.5	37.9	58.5	53.4	--	--
Paloma Seed	PL2E061	0.6	9/15	3.5	33.8	0.5	2929	18.9	35.0	56.9	77.7	--	--
Paloma Seed	PL2E101	1.0	9/16	3.0	33.0	0.5	2929	18.7	35.1	57.2	75.4	--	--
REA Hybrids	RX0721	0.7	9/10	3.8	38.5	0.3	2752	18.9	35.0	56.3	76.5	73.7	--
REA Hybrids	R0843XF	0.8	9/12	3.3	36.3	0.0	3131	18.1	36.8	56.7	70.4	--	--
REA Hybrids	R1042XF	1.0	9/16	4.3	38.8	0.8	3068	18.5	36.9	56.9	73.1	73.7	--
REA Hybrids	R1133XF	1.1	9/16	3.3	38.0	1.0	2967	19.0	35.0	57.6	73.0	--	--
Mean			9/14	3.5	36.6	0.6	2783	18.7	35.5	57.0	74.8	--	--
C.V (%)			1.3	17.2	4.8	91.8	4	1.0	0.9	0.5	5.4	--	--
LSD 0.05			1.7	0.7	2.1	0.7	243	0.2	0.4	0.3	4.7	--	--
LSD 0.10			2.0	0.9	2.5	0.8	219	0.3	0.4	0.4	5.7	--	--

Planting Date = May 27; Harvest Date = October 2; Previous Crop = Corn

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

Dry Edible Bean - Dryland **Carrington**

Variety	Market Class	Days to Maturity	Growth Habit[1]	Direct Harvest[2]	Protein	100 Seed Weight	Test Weight	Yield 2022	Yield 3-yr. Avg.[3]
			1-9	%	%	gram	lb/bu	lb/a	lb/a
LaPaz	Pinto	90.8	7.5	92.5	19.6	34.6	61.9	2131	2481
Lariat	Pinto	91.0	5.5	89.5	20.3	38.2	60.4	2365	2444
Monterrey	Pinto	91.0	8.0	95.3	19.8	33.9	62.1	2528	2372
ND-Falcon	Pinto	92.5	8.3	96.0	20.5	34.7	58.7	2227	2391
ND-Palomino	Pinto	92.3	6.5	86.8	19.7	33.7	59.8	1943	2228
Stampede	Pinto	88.3	8.0	94.0	19.8	31.6	60.3	2009	2287
Torreon	Pinto	89.3	7.5	95.0	19.8	34.3	62.2	1874	2393
Vibrant	Pinto	86.8	6.5	88.8	20.3	30.1	62.0	1597	2211
Windbreaker	Pinto	84.3	7.5	93.3	19.8	36.4	59.3	1863	2290
Cowboy	Pinto	86.8	7.8	94.8	19.9	33.9	61.7	1981	2378
Blizzard	Navy	93.5	8.3	95.5	21.3	16.5	65.4	1817	2072
HMS Medalist	Navy	94.0	7.3	95.3	21.1	14.8	65.0	1816	2052
ND-Polar	Navy	96.3	7.5	96.5	20.8	17.6	65.8	2169	--
T9905	Navy	94.0	8.5	97.8	20.9	20.0	65.3	2112	2202
Armada	Navy	93.0	8.8	96.3	21.2	18.7	64.3	1946	--
Black Tails	Black	84.0	8.0	96.0	22.6	17.3	65.4	1614	2094
Eclipse	Black	91.3	8.5	97.0	21.2	19.9	64.2	2066	2095
Merlot	Small Red	91.0	6.8	93.3	20.4	31.1	61.9	2008	2124
ND-Pegasus	Great Northern	92.8	6.8	94.0	20.8	35.9	61.7	2634	2590
ND-Twilight	Black	91.3	8.8	94.8	20.3	20.8	65.5	2124	2218
Rosetta	Pink	92.8	7.5	89.3	19.3	33.7	61.9	1856	--
Viper	Small Red	91.3	7.8	96.5	20.3	24.5	62.4	2013	2297
Zorro	Black	91.8	8.0	94.0	21.1	18.3	64.9	1633	--
Ace	Black	90.3	8.8	97.0	21.1	20.1	63.9	2300	--
B3036381	Black	91.8	8.8	97.8	20.9	18.1	64.8	2084	--
B3033350	Black	88.0	8.0	94.5	22.2	16.4	65.1	1481	--
Mean		91.0	7.6	94.2	20.5	27.6	62.9	2075	--
C.V. (%)		2.0	13.3	3.7	2.1	4.4	0.4	11.7	--
LSD (0.05)		2.5	1.4	4.9	0.6	1.7	0.4	340	--
LSD (0.10)		2.1	1.2	4.1	0.5	1.4	0.3	284	--

Planting Date = June 2; Harvest Date = September 8; Previous Crop = Spring Wheat

[1]Growth habit is scored on a scale of 1-9; 1 = longer vine, low stature with low pods, 9 = very upright stature, pods held off the ground.

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

[3] Three-year average is for 2019, 2020 and 2022 as 2021 trial was lost due to drought.

Variety	Market Class	Days to Maturity	Growth Habit[1]	Direct Harvest[2]	Protein	100 Seed Weight	Test Weight	Yield 2022	Yield 3-yr. Avg.
			1-9	%	%	gram	lb/bu	lb/a	lb/a
LaPaz	Pinto	95.3	6.0	89.0	19.6	32.0	62.0	2772	2910
Lariat	Pinto	98.3	3.5	73.0	20.4	35.5	61.1	3470	3034
Monterrey	Pinto	95.8	6.0	89.3	19.9	31.5	62.3	2977	3088
ND-Falcon	Pinto	98.8	6.3	94.0	21.6	34.5	58.3	3064	2780
ND-Palomino	Pinto	99.3	4.5	79.5	19.9	34.7	59.6	2733	2748
Stampede	Pinto	92.3	6.3	92.8	20.2	33.0	59.7	2986	3055
Torreon	Pinto	93.8	6.8	93.5	19.9	35.8	61.9	2548	3005
Vibrant	Pinto	89.8	6.5	90.8	19.8	30.4	61.1	2199	2894
Windbreaker	Pinto	92.3	4.8	80.5	20.2	36.8	59.0	2659	2806
Cowboy	Pinto	91.8	6.8	89.3	19.6	33.7	61.2	2844	3056
Blizzard	Navy	95.5	8.0	94.8	22.0	16.3	64.3	2794	2961
HMS Medalist	Navy	96.3	8.0	97.3	21.7	15.3	64.4	3026	3005
ND-Polar	Navy	98.3	6.8	95.8	21.9	17.7	64.5	3322	2804
T9905	Navy	96.0	8.0	96.8	22.0	19.7	64.4	2915	2850
Armada	Navy	95.3	8.5	96.5	21.7	18.2	64.0	2793	--
Black Tails	Black	94.3	7.3	94.8	22.0	19.5	64.9	2999	2907
Eclipse	Black	93.8	6.5	88.8	21.3	19.7	64.3	2593	2571
Merlot	Small Red	98.3	4.0	75.0	20.3	33.6	61.4	2410	2618
ND-Pegasus	Great Northern	98.0	4.5	88.0	19.7	34.2	61.9	3654	3521
ND-Twilight	Black	95.8	7.3	95.3	20.3	20.7	65.3	2936	2756
Rosetta	Pink	96.8	6.0	85.8	19.7	32.3	61.9	2038	--
Viper	Small Red	96.8	6.5	95.3	20.3	23.9	62.4	3009	3075
Zorro	Black	95.5	6.8	93.5	21.1	18.4	64.3	2094	--
Ace	Black	94.3	7.8	96.8	22.0	19.5	64.4	3044	--
B3036381	Black	96.8	6.5	87.8	20.6	17.1	64.4	2565	--
B3033350	Black	90.8	8.0	93.0	22.1	17.0	64.6	2324	--
Mean		95.9	6.1	89.2	20.7	27.4	62.4	2968	--
C.V. (%)		1.2	15.4	7.6	2.6	2.9	0.7	11.1	--
LSD (0.05)		1.7	1.3	9.6	0.7	1.1	0.6	462	--
LSD (0.10)		1.4	1.1	8.0	0.6	0.9	0.5	387	--

Planting Date = June 2; Harvest Date = September 21; Previous Crop = Winter Rye

[1]Growth habit is scored on a scale of 1-9; 1 = longer vine, low stature with low pods, 9 = very upright stature, pods held off the

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

Dry Bean **Wishek**

Variety	Market Class	Days to Maturity	Growth Habit	Protein	Test Weight	Yield
			1-9	%	lb/bu	lb/a
ND Falcon	Pinto	97.0	3.0	20.4	54.5	1747
ND Palomino	Pinto	98.3	4.5	20.0	56.6	1651
Torreon	Pinto	96.0	4.0	19.9	57.6	1811
Vibrant	Pinto	96.8	4.5	20.2	58.3	1916
Blizzard	Navy	97.5	4.8	20.7	62.6	1788
ND Polar	Navy	99.0	3.5	22.5	62.5	1566
Eclipse	Black	97.0	4.3	21.2	60.7	1566
ND Twilight	Black	96.3	4.3	21.2	62.8	1821
Mean		97.2	4.1	20.8	59.4	1733
C.V. (%)		1.0	18.9	2.3	1.0	14.1
LSD (0.05)		1.5	1.1	0.7	0.9	359
LSD (0.10)		1.2	0.9	0.6	0.7	297

Planting Date = June 3; Harvest Date = September 28; Previous Crop = Spring Wheat

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

Variety	Market Class	Days to PM	Seeds/ Pound	100 Seed Weight	Test Weight	---------- Yield ---------- 2022	2-yr. Avg.	3-yr. Avg.
				gram	lb/bu	---------- lb/a ----------		
Black Tails	Black	87.0	2340	19.4	64.1	3419	3156	2488
Eclipse	Black	87.3	2257	20.1	63.6	3750	3478	2833
Merlot	Small Red	92.5	1302	34.9	60.4	3996	3588	2949
ND Pegasus	Great Northern	92.3	1207	37.6	61.7	5228	4288	3655
ND Twilight	Black	87.8	1988	22.8	65.2	4210	--	--
Rosetta	Pink	88.0	1267	35.8	60.6	4203	--	--
Viper	Small Red	89.8	1651	27.5	61.3	4222	3728	2988
Zorro	Black	87.8	2365	19.2	64.0	3409	--	--
Mean		89.1	1797.0	27.2	62.6	4054.4	--	--
C.V. (%)		0.8	2.7	2.8	0.7	5.9	--	--
LSD (0.10)		0.9	59	0.9	0.5	290	--	--
LSD (0.05)		1.0	71	1.1	0.6	351	--	--

Planting Date = June 4; Harvest Date = September 12 and 14; Previous Crop = Onions

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

Variety	Days to PM	Seeds/ Pound	100 Seed Weight	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
			gram		lb/a	lb/a	lb/a
Blizzard	89.5	2418	18.8	63.3	3993	3714	2915
HMS Medalist	90.0	2532	17.9	63.6	3813	3678	--
ND Polar	89.3	2432	18.7	62.8	4115	3504	2775
T9905	88.8	2133	21.3	63.6	3993	3678	3034
Armada	89.0	2273	20.0	62.5	3910	--	--
Mean	89.3	2357.2	19.3	63.2	3965	--	--
C.V. (%)	0.7	2.7	2.6	1.0	8.1	--	--
LSD (0.10)	0.8	81	0.6	0.8	403	--	--
LSD (0.05)	0.9	99	0.8	0.9	493	--	--

Planting Date = June 4; Harvest Date = September 12 & 14; Previous Crop = Onion

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

Variety	Days to PM	Seeds/ Pound	100 Seed Weight	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
			gram	lb/bu	lb/a	lb/a	lb/a
LaPaz	89.8	1301	34.9	61.3	4966	3928	3569
Lariat	90.0	1171	38.8	60.5	4012	3547	3309
Monterrey	89.5	1324	34.3	61.3	4803	4016	3628
ND Falcon	92.3	1236	36.7	58.1	3357	3112	2985
ND Palomino	88.8	1203	37.7	59.3	4795	4034	3377
Stampede	87.0	1259	36.0	58.8	4015	3285	2943
Torreon	89.0	1194	38.0	61.6	4421	3673	3161
Vibrant	87.0	1167	39.9	61.8	4307	3740	3278
Windbreaker	87.0	1124	40.4	59.2	4698	3943	3559
Cowboy	87.0	1190	38.2	61.1	4879	3993	--
Mean:	88.7	1217	37.5	60.3	4425	--	--
C.V.(%)	1.1	5.3	6.7	1.0	7.3	--	--
LSD (0.10)	1.2	77	3.0	0.7	394	--	--
LSD (0.05)	1.5	92	3.6	0.9	474	--	--

Planting Date = June 4; Harvest Date = September 12 and 14; Previous Crop = Onion

Variety	Vigor	Days to Flower	Plant Height	Lodging	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	1-10		inch	0-9	lb/bu	lb/a	lb/a	lb/a
Springfield	6.0	37.8	50.4	1.0	46.7	1930	1796	2053
Horizon	5.5	37.3	50.6	0.5	46.8	1957	1908	2090
Koma	5.3	39.0	43.4	0.0	49.6	1414	1507	1743
Koto	6.3	36.0	46.4	0.3	47.8	1642	1636	1880
Manor	8.8	35.0	51.1	1.0	47.1	1848	1892	1961
Devyatka	3.3	30.0	31.9	1.5	46.2	1098	936	1165
Green Testa	3.8	35.8	45.5	0.8	49.3	1487	1455	1622
Mean	6.1	35.6	46.0	0.8	47.7	1638	--	--
C.V. (%)	27.3	5.0	7.3	105.0	1.2	18.7	--	--
LSD (0.10)	2.0	2.1	4.1	1.0	0.8	373	--	--
LSD (0.05)	2.4	2.6	4.9	1.2	0.9	451	--	--

Planting Date = May 25; Harvest Date = September 9; Previous Crop = Soybean

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Organic buckwheat variety trial.

Buckwheat - Organic **Carrington**

Variety	Vigor	Days to Flower	Plant Height	Lodging	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	1-10		inch	0-9	lb/bu	lb/a	lb/a	lb/a
Springfield	6.0	36.5	45.6	0.0	48.8	906	730	1223
Horizon	6.0	36.5	48.1	0.0	48.7	1103	847	1328
Koma	3.8	37.8	44.9	0.0	50.9	834	737	1142
Koto	5.8	35.5	48.3	0.3	49.9	1179	963	1430
Manor	6.8	33.0	51.0	0.0	47.9	843	942	1264
Devyatka	3.8	28.8	30.0	0.0	46.8	600	612	894
Green Testa	4.8	37.0	47.0	0.0	50.9	862	711	1131
Mean	5.7	34.6	46.0	0.0	49.1	902	--	--
C.V. (%)	34.1	2.9	5.8	NA	1.1	21.1	--	--
LSD (0.10)	2.3	1.2	3.2	NS	0.7	232	--	--
LSD (0.05)	2.8	1.4	3.9	NS	0.8	280	--	--

Planting Date = May 25; Harvest Date = September 9; Previous Crop = Cover Crop (lentils, crimson clover, turnips)

Buckwheat - Organic **Carrington**

Variety	Vigor	Days to Flower	Plant Height	Lodging	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
	1-10		inch	0-9	lb/bu	lb/a	lb/a	lb/a
Springfield	5.0	37.5	44.5	0.0	48.9	947	750	1237
Horizon	6.0	37.0	42.0	0.0	48.5	939	765	1274
Koma	6.0	38.0	40.6	0.0	50.1	770	705	1121
Koto	5.8	35.3	42.9	0.0	50.3	959	854	1357
Manor	7.3	31.0	43.9	0.0	48.1	793	918	1247
Devyatka	3.3	28.3	31.4	0.0	45.6	524	574	869
Green Testa	3.3	36.3	38.8	0.0	49.7	780	670	1104
Mean	5.6	34.2	41.5	0.0	48.8	830	--	--
C.V. (%)	31.5	1.8	9.9	NA	1.3	19.8	--	--
LSD (0.10)	2.1	0.7	5.0	NS	0.8	200	--	--
LSD (0.05)	2.6	0.9	6.1	NS	0.9	242	--	--

Planting Date = May 25; Harvest Date = September 9; Previous Crop = Winter Rye

Variety	Brand	Days to Flower	Bloom Duration	Days to Maturity	Canopy Height at Harvest	Lodging at Maturity	Harvest Ease 2022	Harvest Ease 3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	Yield 2022	Yield 3-yr. Avg.
			days		inch	0-9	0 - 9		%	gram		lb/bu	bu/a	
Yellow Cotyledon Type														
DS Admiral	Pulse USA	49.3	8.5	77.0	22.3	3.0	3.5	3.5	24.7	225.8	2014	63.6	45.4	34.0
Agassiz	Meridian Seeds	46.8	11.8	78.3	18.3	5.5	6.3	5.4	23.9	255.3	1782	62.9	42.9	34.9
CDC Amarillo	Meridian Seeds	51.0	6.5	78.0	20.3	4.5	4.8	3.6	24.5	238.6	1904	62.8	41.8	36.3
ND Dawn	NDSU	48.5	8.0	76.8	18.5	5.5	6.0	4.7	23.1	239.2	1901	62.6	38.8	30.9
EP_2311B1	Equinom	46.0	12.5	78.8	17.3	6.3	6.5	--	26.5	222.5	2058	63.2	34.4	--
EP_6301S3	Equinom	50.0	8.5	80.5	19.1	3.8	4.8	--	27.9	192.4	2364	61.8	29.5	--
EP_1401S42	Equinom	50.8	6.8	79.8	17.6	7.3	8.0	--	25.7	201.2	2259	62.9	34.0	--
EP_8971	Equinom	47.8	9.8	80.8	16.8	5.8	6.5	--	27.7	245.4	1851	62.3	25.7	--
CP5222Y	WinField United	45.0	11.5	78.3	16.5	6.5	6.5	--	26.1	278.5	1639	62.5	36.7	--
CP5244Y	WinField United	44.8	13.8	79.3	17.8	6.5	6.0	--	25.5	247.4	1840	62.8	35.5	--
AAC Profit	Premier Genetics	50.0	6.8	78.3	14.8	6.5	7.3	5.0	24.0	259.3	1752	63.6	45.2	37.9
AAC Asher	Premier Genetics	48.3	9.0	78.5	15.9	5.5	6.0	4.3	23.1	281.1	1617	63.8	47.8	39.5
CDC Inca	Meridian Seeds	49.8	7.8	75.5	21.9	2.8	3.8	3.2	24.1	226.2	2011	63.8	43.7	37.6
CDC Spectrum	Meridian Seeds	50.3	7.5	79.3	18.4	3.8	4.0	3.0	24.9	238.7	1906	62.7	38.6	35.2
MS GrowPro	Meridian Seeds	48.5	10.5	79.8	20.9	5.0	5.3	4.4	26.7	305.9	1485	62.5	42.5	35.0
MS-22YP6	Meridian Seeds	49.3	9.0	76.5	16.7	6.8	7.5	--	23.7	212.7	2142	62.8	48.4	--
MS-20Y1	Meridian Seeds	48.5	8.5	76.5	21.2	6.5	7.5	--	24.4	261.5	1740	62.0	41.0	--
MS-20Y3	Meridian Seeds	49.3	8.0	79.8	19.4	5.8	5.8	--	25.4	268.3	1699	62.1	37.9	--
PG 2601	Pulse Genetics	48.8	8.8	76.5	17.5	5.3	6.5	--	23.8	227.0	2000	63.8	40.9	--
Mean		48.2	9.2	78.1	18.2	5.3	5.9	--	24.6	240.4	1922	63.0	39.3	--
C.V. (%)		1.4	11.8	2.1	12.9	16.4	16.9	--	3.7	4.9	5.2	0.7	10.9	--
LSD (0.05)		0.9	1.5	2.3	3.3	1.2	1.4	--	1.3	16.8	139	0.7	6.0	--
LSD (0.10)		0.8	1.3	1.9	2.8	1.0	1.2	--	1.1	14.0	116	0.6	5.1	--

Planting Date = May 16; Harvest Date = August 11; Previous Crop = Flax

Variety	Brand	Days to Flower	Bloom Duration	Days to Maturity	Canopy Height at Harvest	Lodging at Maturity	- Harvest Ease - 2022	- Harvest Ease - 3-yr. Avg.	Protein	1000 KWT	Seeds/ Pound	Test Weight	------ Yield ------ 2022	------ Yield ------ 3-yr. Avg.
			days		inch	0-9	------- 0 - 9 -------		%	gram		lb/bu	------- bu/a -------	
Yellow Cotyledon Type														
PG 3308	Pulse Genetics	48.0	8.5	77.0	16.9	5.0	6.0	--	22.8	226.7	2006	62.5	46.4	--
PG 4529	Pulse Genetics	45.8	9.8	73.5	20.0	3.0	4.0	--	23.4	217.3	2092	64.0	39.4	--
DL Apollo	PulseUSA	46.8	10.3	78.0	18.8	4.3	5.3	4.4	24.4	224.5	2032	63.1	39.0	29.5
LG Stunner	PulseUSA	45.8	11.8	79.8	17.8	5.0	5.5	--	27.4	210.8	2159	62.7	30.2	--
Durwood	PulseUSA	48.3	8.3	77.3	19.5	4.3	4.3	3.7	24.7	247.0	1842	63.1	37.3	30.6
Korando	PulseUSA	44.0	13.3	78.8	18.5	6.3	6.8	4.9	25.8	277.0	1641	62.7	37.3	28.1
AAC Chrome	Valesco Genetics	49.5	8.0	79.0	15.0	6.0	7.8	5.2	21.2	251.1	1809	63.4	47.7	37.6
AAC Julius	Valesco Genetics	49.0	8.5	74.5	19.0	3.5	4.5	--	23.5	218.2	2085	63.6	43.1	--
DLP-22Y1	Pulse USA	49.0	8.8	78.8	17.1	5.8	6.3	--	24.7	267.7	1699	63.1	46.2	--
DLP-22Y2	Pulse USA	49.5	8.8	79.5	18.9	5.0	5.8	--	24.4	257.7	1765	63.1	37.9	--
DLP-22Y3	Pulse USA	46.8	11.3	79.5	17.9	5.0	5.8	--	24.9	278.4	1632	63.0	41.8	--
DLP-22Y4	Pulse USA	47.5	9.8	76.3	18.8	3.5	3.8	--	24.1	189.8	2393	63.6	40.2	--
DLP-22Y5	Pulse USA	48.5	8.8	78.3	19.7	5.3	5.8	--	22.1	280.7	1619	63.4	37.3	--
Orchestra	Premier Genetics	46.8	10.3	80.5	17.9	5.8	5.8	4.8	27.4	274.5	1656	62.0	32.9	25.9
Green Cotyledon Type														
CDC Striker	Pulse USA	49.3	6.0	77.3	18.0	5.0	6.0	5.3	23.9	223.7	2030	63.6	37.0	28.8
Aragorn	Pulse USA	45.8	12.0	76.5	17.1	7.5	8.0	6.4	24.3	226.4	2009	61.5	35.0	25.9
Arcadia	Pulse USA	48.0	8.8	77.0	15.9	6.0	7.0	6.1	23.6	216.6	2099	63.4	41.4	33.0
ND Victory	NDSU	51.8	7.8	81.8	17.5	5.3	6.3	--	24.3	169.5	2690	63.7	32.9	--
Shamrock	Valesco Genetics	50.8	5.8	78.5	14.6	7.0	7.8	5.6	23.3	249.7	1819	63.3	39.5	32.2
Mean		48.2	9.2	78.1	18.2	5.3	5.9	--	24.6	240.4	1922	63.0	39.3	--
C.V. (%)		1.4	11.8	2.1	12.9	16.4	16.9	--	3.7	4.9	5.2	0.7	10.9	--
LSD (0.05)		0.9	1.5	2.3	3.3	1.2	1.4	--	1.3	16.8	139	0.7	6.0	--
LSD (0.10)		0.8	1.3	1.9	2.8	1.0	1.2	--	1.1	14.0	116	0.6	5.1	--

Planting Date = May 16; Harvest Date = August 11; Previous Crop = Flax

Lodging Score: 0 = no lodging; 9 = plants lying flat.

Variety	Days to Flower	Days to Maturity	Canopy Height	Harvest Ease	Protein	Test Weight	1000 Seed Weight	Yield 2022	Yield 2-yr. Avg.[1]	Yield 3-yr. Avg.[2]
			inch	0-9	%	lb/bu	gram	lb/a	lb/a	lb/a
ND Eagle	55.0	85.3	13.8	4.7	25.4	61.3	35.3	2372	2086	1980
CDC Kermit	56.3	87.0	14.6	2.0	26.2	61.9	34.7	2239	2131	--
CDC Richlea	54.0	92.7	14.3	3.0	24.6	60.3	51.6	2011	2075	1940
Avondale	54.0	91.3	13.5	3.3	24.8	61.1	50.5	2561	2360	2076
CDC Grandora	57.3	105.0	16.4	3.0	25.0	60.8	56.1	971	--	--
CDC Greenland	57.7	103.7	15.4	2.3	24.9	60.3	65.7	1435	--	--
CDC Imvincible	55.7	88.3	14.2	3.0	27.2	62.8	36.5	2257	2228	--
Mean	55.0	92.8	14.4	3.5	25.3	61.3	48.6	1967.5	--	--
C.V. (%)	0.9	2.2	6.7	25.7	2.0	1.1	8.1	14.8	--	--
LSD (0.05)	0.9	3.4	1.6	1.5	0.9	1.2	6.7	499	--	--
LSD (0.10)	0.8	2.8	1.4	1.3	0.7	1.0	5.6	412	--	--

Planting Date = May 6; Harvest Date = September 8; Previous Crop = Flax

[1] Two-year average is for 2020 and 2022 as 2021 trial was lost due to drought.

[2] Three-year average is for 2019, 2020 and 2022 as 2021 trial was lost due to drought.

Lupin variety trial.

Lupin **Carrington**

Variety	Days to Flower	Bloom Duration	Days to Maturity	Plant Height	Protein	1000 Seed Weight	Seeds/ Pound	Test Weight	Yield	Yield
		days		inch	%	g/1000		lb/bu	lb/a	bu/a
LND0127	44.3	19.7	98.0	24.5	28.15	396.9	1143	56.6	2252	37.5
LND0212	46.0	18.7	97.7	25.5	28.11	386.8	1182	56.8	2112	35.2
LND0228	47.0	19.3	99.0	24.7	28.05	342.7	1325	57.5	2146	35.8
LND0229	46.7	19.3	99.0	24.8	28.06	347.2	1311	57.2	2171	36.2
LND0431	45.7	20.3	99.7	25.1	28.51	368.7	1233	56.9	2075	34.6
LND0603	46.3	18.7	99.3	24.0	28.41	355.6	1277	56.7	2214	36.9
LND0605	45.7	18.3	98.0	23.9	28.22	356.0	1274	57.1	2162	36.0
LND0614	46.0	18.0	98.3	23.0	28.52	365.5	1242	56.5	2233	37.2
LND0617	46.0	19.3	99.3	23.9	28.17	368.0	1234	56.5	2630	43.8
LND0619	46.0	18.7	98.0	25.2	28.21	356.5	1272	57.0	2344	39.1
LND0621	45.7	19.0	99.0	25.3	28.09	363.5	1250	57.0	2348	39.1
LND0705	46.0	19.0	98.3	26.2	28.52	349.9	1301	56.8	2118	35.3
LND0727	47.0	18.7	98.7	26.5	28.44	354.9	1285	56.6	2142	35.7
LNDa210	45.0	20.0	97.7	25.8	28.31	359.6	1271	56.0	2195	36.6
Lupro 2085	45.3	20.3	99.0	20.9	28.54	355.9	1275	56.7	2025	33.8
NR55-Baer	44.3	22.0	100.3	21.4	27.94	382.0	1187	55.4	2226	37.1
Mean	49.3	21.9	98.7	23.6	28.5	375.2	1219	56.3	1950	32.5
C.V. (%)	2.3	5.1	1.2	17.2	1.4	5.3	5.4	1.2	13.6	
LSD (0.05)	1.9	1.8	1.9	6.7	0.7	32.9	109	1.2	502	
LSD (0.10)	1.6	1.5	1.6	5.6	0.6	27.4	91	0.9	418	

Planting Date = May 24; Harvest Date = September 22; Previous Crop = Corn

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	%	%	%	lb/bu	bu/a	bu/a	bu/a
REA Hybrids	83B33	83	VT2Pro	69.3	36.6	89.3	11.6	9.0	65.8	55.8	141.2	--	--
REA Hybrids	2B851	85	VT2Pro	69.8	35.6	85.0	11.4	8.3	67.8	56.2	161.8	108.0	109.5
REA Hybrids	2B863	86	VT2Pro	72.3	37.2	79.3	12.3	8.4	66.7	55.2	151.5	101.8	--
REA Hybrids	86A94	86	SmartStax	70.8	33.0	80.8	11.5	8.2	67.0	56.2	148.0	--	--
Dairyland Seed	DS-2531AM	85	AM	72.0	37.9	83.9	11.9	8.0	67.2	56.0	149.6	--	--
Dairyland Seed	DS-2919AM	89	AM	74.0	38.3	82.3	12.2	8.1	68.1	57.3	174.3	--	--
Dairyland Seed	DS-3203AM	92	AM	75.8	33.5	80.0	13.3	8.7	69.6	54.1	173.1	--	--
Dyna-Gro	D21VC81	81	VT2P	69.8	34.4	81.1	11.4	8.7	66.4	56.1	147.3	101.5	98.1
Dyna-Gro	D23VC83	83	VT2P	69.5	33.7	80.4	11.5	7.8	67.8	56.0	158.3	108.5	--
Dyna-Gro	D26VC72	86	VT2P	70.5	31.3	81.4	11.3	8.1	66.9	55.6	151.4	101.9	101.7
Dyna-Gro	D27VC87	87	VT2P	71.3	38.3	79.8	11.3	8.6	66.3	56.3	135.1	96.8	101.1
Dyna-Gro	D31VC23	91	VT2P	73.3	37.4	83.3	12.0	8.5	67.4	57.4	165.3	--	--
Integra	3282	82	VT2P RIB	71.0	34.0	82.7	11.1	8.1	65.0	57.0	128.2	90.9	87.3
Integra	3431	84	VT2P RIB	71.0	35.0	76.1	11.7	7.8	67.3	56.9	161.3	116.3	114.8
Integra	3537	85	VT2P RIB	70.8	35.8	86.3	11.5	8.2	67.1	56.4	153.6	111.6	109.6
Integra	3718	87	VT2P RIB	71.5	36.5	84.8	12.4	8.2	67.0	56.6	173.6	120.5	117.4
Proseed	1984	84	VT2PRIB	71.0	35.2	80.2	11.3	8.3	66.4	56.4	154.8	106.8	109.7
Proseed	1787	87	VT2PRIB	70.8	35.7	81.1	11.9	8.2	67.0	56.7	150.5	110.0	109.9
Legacy Seeds	LC354-20	85	3110.0	80.0	31.7	64.6	17.9	9.0	71.1	52.7	227.0	--	--
Mean				71.6	35.7	82.2	12.0	8.4	67.3	56.3	156.5	--	--
C.V. (%)				1.4	13.3	8.2	4.9	3.8	1.2	1.6	12.1	--	--
LSD (0.05)				1.4	6.6	9.5	0.8	0.4	1.2	1.2	26.6	--	--
LSD (0.10)				1.2	5.6	7.9	0.7	0.4	1.0	1.0	22.3	--	--

Planting Date = May 16; Harvest Date = November 1; Previous Crop = Spring Wheat

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

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	%	%	%	lb/bu	bu/a	bu/a	bu/a
Legacy Seeds	LC353-22	85	3120.0	73.8	35.6	84.6	12.7	9.0	69.0	57.7	154.5	--	--
Legacy Seeds	LC-2817	86	VT2P	71.0	35.8	85.1	11.7	8.4	66.7	56.5	143.0	101.9	106.6
Legacy Seeds	LC-3017	90	VT2P	71.8	33.8	80.0	12.4	8.7	66.4	56.0	166.4	--	--
Legacy Seeds	LC414-21	90	VT2P	73.8	34.3	82.1	12.6	8.8	67.2	57.1	167.2	--	--
Legacy Seeds	LC403-22	90	3120.0	73.5	36.5	77.7	12.5	8.3	68.8	54.9	162.4	--	--
Thunder	T6983 VT2P	83	VT2P	70.5	35.4	83.5	11.2	8.4	66.5	56.5	133.2	--	--
Thunder	T6185 VT2P	85	VT2P	69.0	37.9	84.1	11.6	8.8	66.7	56.0	144.4	106.1	104.9
Thunder	T6987 VT2P	87	VT2P	70.5	35.1	85.9	11.2	8.7	65.9	56.0	150.7	110.1	105.9
Thunder	T6389 VT2P	89	VT2P	71.3	38.7	85.7	11.1	7.9	68.9	55.6	162.0	--	--
Latham Hi-Tech Seeds	LH 3325 VT2PRO	83	VT2 PRO	71.3	38.3	83.2	11.1	8.1	67.3	56.8	148.5	--	--
Latham Hi-Tech Seeds	LH 3695 VT2PRO	86	VT2 PRO	71.3	37.7	83.1	11.5	8.6	66.4	56.7	144.5	--	--
Latham Hi-Tech Seeds	LH 3867 VT2PRO	88	VT2 PRO	70.8	36.4	83.1	12.4	8.1	68.5	56.4	157.1	--	--
Latham Hi-Tech Seeds	LH 3937 VT2PRO	89	VT2 PRO	72.5	33.7	85.0	13.3	8.4	67.0	55.9	172.3	--	--
Stine Seed	9140-G	83	Agrisure GT	70.5	32.3	81.7	11.7	8.6	67.7	56.4	137.9	97.6	--
Stine Seed	9202-11	85	Agrisure GT	69.8	37.9	82.7	12.4	8.7	67.6	57.6	155.1	109.0	--
Stine Seed	9212-10	88	Agrisure 3010	73.5	36.4	81.1	12.7	8.9	68.6	56.5	163.8	--	--
Champion Seed	33A20	83	VT2PRORIB	71.0	35.1	81.8	11.7	8.1	67.5	57.7	156.2	105.4	--
Champion Seed	36A22	86	VT2PRORIB	70.8	35.5	84.4	12.6	8.5	67.6	55.9	163.9	111.3	--
Champion Seed	40A21	90	VT2PRORIB	70.0	37.8	87.2	11.5	8.0	67.0	56.8	156.3	111.2	--
Mean				71.6	35.7	82.2	12.0	8.4	67.3	56.3	156.5	--	--
C.V. (%)				1.4	13.3	8.2	4.9	3.8	1.2	1.6	12.1	--	--
LSD (0.05)				1.4	6.6	9.5	0.8	0.4	1.2	1.2	26.6	--	--
LSD (0.10)				1.2	5.6	7.9	0.7	0.4	1.0	1.0	22.3	--	--

Planting Date = May 16; Harvest Date = November 1; Previous Crop = Spring Wheat

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

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	%	%	%	lb/bu	bu/a	bu/a	bu/a
REA Hybrids	83B33	83	VT2Pro	69.8	37.6	83.2	13	7.9	68.2	56.1	166.0	--	--
REA Hybrids	2B851	85	VT2Pro	70.3	38.1	88.7	13	7.3	69.5	55.6	191.8	192.9	178.6
REA Hybrids	2B863	86	VT2Pro	72.0	32.3	86.7	14	7.7	69.0	55.6	170.1	188.8	--
REA Hybrids	86A94	86	SmartStax	72.8	38.9	82.0	14	7.3	69.3	56.6	173.2	--	--
REA Hybrids	3B903	90	VT2Pro	73.5	37.2	84.4	15	7.5	70.8	55.5	195.7	207.1	187.0
RENK	RK297VT2P	89	VT2P	74.5	39.3	88.2	14	7.3	70.8	55.4	204.7	216.1	--
RENK	RK300RR	90	RR2	74.8	42.4	87.2	16	7.8	70.4	56.1	179.0	212.3	--
RENK	RK400VT2P	91	VT2P	75.8	39.7	85.8	15	7.8	69.2	56.3	199.5	--	--
Dairyland Seed	DS-2919AM	89	AM	73.3	35.7	83.3	15	7.4	69.8	56.8	189.4	--	--
Dairyland Seed	DS-3022AM	90	AM	71.5	41.7	89.6	14	7.3	69.8	56.4	186.5	192.7	--
Dairyland Seed	DS-3203AM	92	AM	75.3	39.9	90.7	16	8.0	71.9	56.4	184.2	--	--
Dyna-Gro	D23VC83	83	VT2P	70.0	36.3	84.8	14	7.4	70.7	56.0	164.9	188.1	--
Dyna-Gro	D26VC72	86	VT2P	71.8	41.2	89.2	13	7.3	69.4	55.5	158.6	180.7	162.1
Dyna-Gro	D27VC87	87	VT2P	72.5	41.0	90.2	14	7.7	68.9	56.8	188.0	210.1	186.7
Dyna-Gro	D28VC33	88	VT2P	73.0	42.5	89.0	15	7.7	69.7	53.0	170.4	--	--
Integra	3282	82	VT2P RIB	72.0	43.1	89.5	13	7.4	67.7	56.6	154.7	--	--
Integra	3431	84	VT2P RIB	71.3	39.8	85.4	14	7.3	69.5	56.2	174.7	--	--
Integra	3537	85	VT2P RIB	72.0	40.8	85.9	14	7.5	69.0	56.9	171.1	--	--
Proseed	1984	84	VT2PRIB	70.8	38.8	88.1	13	7.5	69.3	56.3	184.9	197.5	181.0
Mean				73.0	39.4	87.8	14.7	7.7	70.0	55.8	180.0	--	--
C.V. (%)				1.8	11.7	5.8	2.2	3.1	1.0	2.5	12.3	--	--
LSD (0.05)				1.9	6.4	7.1	0.5	0.3	1.0	2.0	31.0	--	--
LSD (0.10)				1.6	5.4	5.9	0.4	0.3	0.8	1.7	25.9	--	--

Planting Date = May 16; Harvest Date = October 31; Previous Crop = Winter Rye

Brand	Hybrid	RM	Traits	Days to Silk	Ear Height	Plant Height	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
					inch	inch	%	%	%	lb/bu	bu/a	bu/a	bu/a
Proseed	1787	87	VT2PRIB	71.3	39.4	93.0	14	7.6	68.2	57.3	158.2	191.2	172.2
Legacy Seeds	LC354-20	85	3110.0	80.5	39.5	91.9	22	8.8	75.3	48.5	210.1	--	--
Legacy Seeds	LC353-22	85	3120.0	74.8	42.3	88.8	16	8.2	71.7	57.6	169.0	--	--
Legacy Seeds	LC-2817	86	VT2P	73.3	40.6	84.3	14	7.4	68.9	56.8	182.6	200.3	180.6
Legacy Seeds	LC-3017	90	VT2P	74.0	39.2	90.7	16	8.0	69.4	55.6	173.1	--	--
Legacy Seeds	LC414-21	90	VT2P	75.5	40.4	86.9	15	7.8	70.4	55.9	193.9	--	--
Legacy Seeds	LC403-22	90	3120.0	74.0	45.3	89.4	17	7.8	72.3	54.3	187.4	--	--
Latham Hi-Tech Seeds	LH 3325 VT2PRO	83	VT2 PRO	72.0	35.4	85.5	13	7.3	69.9	56.7	164.6	--	--
Latham Hi-Tech Seeds	LH 3695 VT2PRO	86	VT2 PRO	71.8	39.5	89.0	14	7.6	69.1	56.6	170.5	--	--
Latham Hi-Tech Seeds	LH 3867 VT2PRO	88	VT2 PRO	74.3	36.3	85.4	15	7.8	69.7	54.8	189.4	--	--
Latham Hi-Tech Seeds	LH 3937 VT2PRO	89	VT2 PRO	74.5	39.4	91.8	16	8.1	69.2	55.2	197.7	--	--
Stine Seed	9140-G	83	Agrisure GT	72.3	36.9	89.6	14	7.7	70.5	56.7	177.2	185.2	--
Stine Seed	9202-11	85	Agrisure GT	72.0	37.1	84.1	15	7.7	70.3	57.2	180.0	195.3	--
Stine Seed	9212-10	88	Agrisure 3010	73.0	41.7	95.7	15	8.2	70.4	55.8	179.8	--	--
Mean				73.0	39.4	87.8	14.7	7.7	70.0	55.8	180.0	--	--
C.V. (%)				1.8	11.7	5.8	2.2	3.1	1.0	2.5	12.3	--	--
LSD (0.05)				1.9	6.4	7.1	0.5	0.3	1.0	2.0	31.0	--	--
LSD (0.10)				1.6	5.4	5.9	0.4	0.3	0.8	1.7	25.9	--	--

Planting Date = May 16; Harvest Date = October 31; Previous Crop = Winter Rye

Hybrid	Days to Silk	Ear Height	Plant Height	Starch	Oil	Protein	Harvest Moisture	Test Weight	Yield
		inch	inch	%	%	%	%	lb/bu	bu/a
DB41-75-OR	67.3	30.2	84.4	66.7	3.9	6.8	24.2	53.9	99.3
DB41-77-OR	73.3	33.3	87.4	64.5	3.6	6.2	25.0	52.0	95.6
DB41-80-OR	71.3	31.0	87.0	65.1	3.6	6.6	26.1	52.5	101.6
DB41-83-OR	70.8	29.8	85.4	65.6	3.4	6.2	22.8	55.4	91.8
DB41-87-OR-T	75.3	38.4	97.4	68.8	3.6	6.4	30.0	51.1	113.4
DB41-87-OR-UT	75.5	37.3	99.8	67.7	3.6	6.6	32.2	50.5	109.5
DB41-91-OR	76.0	42.8	101.2	64.5	3.6	6.8	35.7	48.6	120.8
DB42-93-OR	78.3	41.6	94.3	67.8	4.2	6.5	33.7	50.3	92.8
Mean	74.4	35.6	92.1	66.4	3.7	6.5	28.9	51.7	103.4
C.V. (%)	1.4	7.5	4.1	1.1	3.8	5.6	3.9	1.7	17.5
LSD 0.10	1.2	3.2	4.6	0.9	0.1	0.4	1.4	1.1	22.1
LSD 0.05	1.5	3.9	5.6	1.1	0.2	0.5	1.7	1.3	26.7

Planting Date = May 18; Harvest Date = October 10; Previous Crop = Cover Crop (red lentil, crimson clover, turnip)

Corn hybrid performance test.

Corn - Dryland **Fingal (Page 1 of 2)**

Brand	Hybrid	RM	Traits	Green Snap	Cob Drop	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				%	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
REA Hybrids	3B903	90	VT2Pro	0	0	15.5	8.9	71.1	54.6	178.1	190.3	176.0
REA Hybrids	92B10	92	VT2Pro	0	0	16.0	8.1	71.1	54.6	185.7	--	--
REA Hybrids	4B944	94	VT2Pro	0	0	16.4	8.2	71.6	54.2	174.7	--	--
REA Hybrids	95A36	95	SmartStax	0	0	15.9	8.9	70.9	53.8	169.6	--	--
REA Hybrids	4B958	95	VT2Pro	0	0	16.8	8.8	70.8	54.1	186.2	195.3	--
RENK	RK400VT2P	91	VT2P	0	0	15.6	9.2	69.0	53.9	156.4	--	--
RENK	RK444VT2P	93	VT2P	0	1	16.6	8.6	71.5	53.8	174.8	--	--
RENK	RK429-3220A	93	AGRISURE 3220A	1	3	16.9	8.8	71.6	56.0	180.8	195.8	--
RENK	RK485DGVT2P	94	DG, VT2P	0	4	18.2	8.8	72.0	53.6	165.1	187.5	--
RENK	RK502SSTX	95	SmartStax	0	1	16.4	8.7	71.2	52.9	171.4	--	--
RENK	RK561DGVT2P	96	DG, VT2P	1	1	16.0	9.0	69.6	53.6	197.3	214.0	--
Dairyland Seed	DS-2919AM	89	AM	0	6	15.1	8.4	70.0	55.5	149.1	--	--
Dairyland Seed	DS-3203AM	92	AM	0	1	16.1	9.1	71.6	54.6	182.5	--	--
Dairyland Seed	DS-3477AM	94	AM	0	1	15.9	8.8	71.1	54.2	167.6	--	--
Dairyland Seed	DS-3601AM	96	AM	10	0	16.8	9.1	72.4	54.3	177.6	--	--
Dairyland Seed	DS-3727AM	97	AM	20	1	16.0	8.7	70.8	54.2	116.3	178.9	--
Dyna-Gro	D27VC87	87	VT2P	0	1	14.3	8.6	68.3	55.7	152.4	166.0	154.8
Dyna-Gro	D28VC33	88	VT2P	1	0	15.5	8.7	69.7	55.2	166.1	--	--
Dyna-Gro	D31VC23	91	VT2P	0	0	15.5	9.4	68.8	54.5	159.9	--	--
Dyna-Gro	D34VC93	94	VT2P	0	0	17.4	8.9	72.2	53.7	175.8	--	--
Proseed	2392	92	VT2PRIB	0	1	15.2	9.3	68.2	54.6	148.9	--	--
Mean				1.2	0.9	16.1	8.8	70.4	54.4	167.9	--	--
C.V. (%)				602.2	291.8	3.9	3.3	1.3	1.7	8.9	--	--
LSD (0.05)				NS	NS	0.9	0.4	1.2	1.3	13.9	--	--
LSD (0.10)				NS	NS	0.7	0.3	1.0	1.1	11.7	--	--

Planting Date = June 8; Harvest Date = November 8; Previous Crop = Soybean

Corn - Dryland **Fingal (Page 2 of 2)**

Brand	Hybrid	RM	Traits	Green Snap	Cob Drop	Harvest Moisture	Protein	Starch	Test Weight	Yield 2022	Yield 2-yr. Avg.	Yield 3-yr. Avg.
				%	%	%	%	%	lb/bu	bu/a	bu/a	bu/a
Proseed	1794	94	VT2PRIB	0	0	16.7	8.8	70.9	53.9	154.5	183.7	175.1
Legacy Seeds	LC-3017	90	VT2P	0	1	15.8	9.2	70.0	54.4	155.0	--	--
Legacy Seeds	LC414-21	90	VT2P	0	1	15.7	9.6	69.0	54.1	154.8	--	--
Legacy Seeds	LC403-22	90	3120.0	0	3	16.8	8.6	71.5	53.8	162.1	--	--
Legacy Seeds	LC-3517	95	VT2P	0	0	17.6	9.4	71.3	54.1	192.5	--	--
Legacy Seeds	LC461-21	96	DGVT2P	8	0	16.9	8.5	71.0	54.6	157.4	201.2	--
Legacy Seeds	LC464-21	96	3120.0	5	1	19.0	8.7	73.3	54.4	166.2	--	--
Thunder	T6389 VT2P	89	VT2P	0	0	15.5	8.0	71.2	55.1	144.3	--	--
Thunder	T6791 VT2P	91	VT2P	0	0	15.3	8.6	69.1	54.9	178.5	195.8	--
Thunder	T6992 VT2P	92	VT2P	0	0	15.8	8.9	70.2	54.7	192.5	190.6	--
Thunder	T6294 VT2P	94	DGVT2P	0	4	17.2	8.4	71.1	53.9	178.1	191.2	--
Latham Hi-Tech Seeds	LH 3695 VT2PRO	86	VT2 PRO	0	3	14.3	8.2	68.9	56.1	152.3	--	--
Latham Hi-Tech Seeds	LH 3867 VT2PRO	88	VT2 PRO	0	0	15.1	8.7	68.5	55.8	163.6	--	--
Latham Hi-Tech Seeds	LH 3937 VT2PRO	89	VT2 PRO	0	3	15.4	9.1	68.9	55.2	187.7	--	--
Latham Hi-Tech Seeds	LH 4375 VT2PRO	93	VT2 PRO	0	0	15.4	8.8	69.5	55.1	167.7	--	--
Latham Hi-Tech Seeds	LH 4527 VT2PRO	95	VT2 PRO	0	0	15.6	9.4	68.8	53.6	177.0	--	--
Champion Seed	36A22	86	VT2PRORIB	0	0	16.1	8.5	70.1	54.8	167.4	--	--
Champion Seed	37A21	87	VT2PRORIB	0	0	15.1	8.8	69.4	55.4	156.4	--	--
Champion Seed	41A20	91	VT2PRORIB	0	0	15.7	8.8	69.1	54.3	171.5	--	--
Champion Seed	47A22	97	VT2PRORIB	1	1	17.9	9.2	71.4	52.4	167.3	--	--
Mean				1.2	0.9	16.1	8.8	70.4	54.4	167.9	--	--
C.V. (%)				602.2	291.8	3.9	3.3	1.3	1.7	8.9	--	--
LSD (0.05)				NS	NS	0.9	0.4	1.2	1.3	13.9	--	--
LSD (0.10)				NS	NS	0.7	0.3	1.0	1.1	11.7	--	--

Planting Date = June 8; Harvest Date = November 8; Previous Crop = Soybean

Major wind storm on November 5-6.

Corn - Dryland **Dickey County - Oakes (Page 1 of 2)**

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Protein	Starch	Oil	Harvest Moisture	Test Weight	Yield 2022	Yield 2 yr. Avg.
					inch	inch	%	%	%	%	lb/bu	bu/a	bu/a
REA Hybrids	92B10	92	VT2Pro	49.5	39.5	85.7	8.0	73.1	3.5	18.2	52.3	192.5	--
REA Hybrids	4B944	94	VT2Pro	49.3	34.2	81.1	8.0	73.1	3.5	18.1	52.4	171.1	--
REA Hybrids	95A36	95	SmartStax	52.5	39.3	87.1	8.4	73.0	3.3	18.4	51.6	190.7	--
REA Hybrids	4B958	95	VT2Pro	50.5	39.5	87.0	8.6	73.2	3.2	19.4	51.2	187.7	173.4
REA Hybrids	4B976	97	VT2Pro	48.5	38.9	88.2	8.0	73.7	3.2	19.8	50.3	183.7	--
RENK	RK400VT2P	91	VT2P	50.3	39.3	84.7	8.8	72.1	3.9	18.2	53.2	192.8	--
RENK	RK444VT2P	93	VT2P	50.8	43.2	86.6	8.3	73.0	3.6	18.8	51.1	201.1	--
RENK	RK429-3220A	93	AGRISURE 3220A	50.5	39.8	84.8	8.3	73.0	3.4	18.2	53.7	182.9	168.6
RENK	RK485DGVT2P	94	DG, VT2P	50.3	39.2	85.7	8.4	73.5	3.4	19.6	51.2	177.7	
RENK	RK502SSTX	95	SmartStax	51.5	37.8	92.2	8.9	72.7	3.4	19.6	50.0	182.7	--
RENK	RK561DGVT2P	96	DG, VT2P	50.8	34.8	85.0	8.6	72.4	3.7	18.7	50.9	182.5	167.1
Dairyland Seed	DS-3203AM	92	AM	50.0	41.1	87.1	8.7	73.2	3.1	19.0	53.0	184.3	--
Dairyland Seed	DS-3477AM	94	AM	50.0	34.5	82.3	8.2	73.6	2.8	18.5	52.3	184.7	--
Dairyland Seed	DS-3601AM	96	AM	48.5	40.2	90.0	8.5	73.1	3.3	19.5	51.8	197.9	--
Dairyland Seed	DS-3727AM	97	AM	49.8	38.1	81.5	8.0	73.3	3.4	18.7	53.1	165.8	155.6
Dyna-Gro	D33QZ83	93	3220	50.3	40.1	86.1	8.4	72.9	3.5	18.3	53.4	186.2	--
Dyna-Gro	D34VC93	94	VT2P	50.5	42.3	87.0	8.4	73.2	3.3	19.5	50.8	198.4	--
Dyna-Gro	D38VC80	98	VT2P	50.5	40.5	90.0	8.8	72.9	3.5	19.9	50.5	203.8	--
MEAN				50.8	39.7	87.5	8.5	73.1	3.4	19.2	51.3	185.6	--
C.V. (%)				1.5	6.1	3.0	3.2	0.5	4.8	4.9	1.5	8.6	--
LSD (0.05)				1.1	3.4	4	0.4	0.5	0.2	1.3	1.1	22.5	--
LSD (0.10)				0.9	2.8	3.0	0.3	0.4	0.2	1.1	0.9	18.8	--

Planting Date = June 10; Harvest Date = October 25; Previous Crop = Corn

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Grain Protein	Starch	Oil	Harvest Moisture	Test Weight	Yield 2022	Yield 2 yr. Avg.
					inch	inch	%	%	%	%	lb/bu	bu/a	bu/a
Proseed	2196	96	VT2PRIB	50.3	38.3	88.4	8.7	72.9	3.4	19.7	50.3	197.1	--
Proseed	2398	98	TRE	54.5	43.5	95.3	8.4	72.6	3.6	19.0	49.7	182.9	--
Legacy Seeds	LC-3517	95	VT2P	50.8	40.6	86.0	8.7	72.7	3.5	18.3	52.5	172.2	152.5
Legacy Seeds	LC461-21	96	DGVT2P	50.8	40.3	86.6	8.3	73.5	3.4	19.3	51.3	183.1	161.4
Legacy Seeds	LC464-21	96	3120	51.8	40.0	93.2	8.0	73.9	3.1	19.1	52.5	174.1	--
Legacy Seeds	LC503-21	100	5222EZ	52.3	40.7	89.5	9.8	73.0	3.3	22.7	48.0	162.0	--
Legacy Seeds	LC-3718	97	DGVT2P	51.3	40.8	89.2	8.6	73.3	3.4	20.3	49.6	191.9	174.9
Thunder	T6396 VT2P	96	VT2P	50.5	43.3	89.9	8.5	72.9	3.5	19.7	51.0	206.6	--
Thunder	T6298 VT2P	98	VT2P	51.5	40.8	85.5	8.0	73.5	3.3	19.0	49.7	176.6	170.0
Thunder	T6398 TRE	98	TRE	54.5	42.0	94.3	8.7	72.7	3.5	19.7	49.6	184.1	--
MEAN				50.8	39.7	87.5	8.5	73.1	3.4	19.2	51.3	185.6	--
C.V. (%)				1.5	6.1	3.0	3.2	0.5	4.8	4.9	1.5	8.6	--
LSD (0.05)				1.1	3.4	4	0.4	0.5	0.2	1.3	1.1	22.5	--
LSD (0.10)				0.9	2.8	3.0	0.3	0.4	0.2	1.1	0.9	18.8	--

Planting Date = June 10; Harvest Date = October 25; Previous Crop = Corn

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

Corn - Irrigated **Dickey County - Oakes (Page 1 of 2)**

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Protein	Starch	Oil	Moisture	Test Weight	Yield 2022	Yield 2 yr. Avg.
					inch	inch	%	%	%	%	lb/bu	bu/a	bu/a
REA Hybrids	92B10	92	VT2Pro	51.5	44.1	91.4	8.0	72.3	3.9	14.7	57.8	235.7	--
REA Hybrids	4B944	94	VT2Pro	51.5	36.7	86.9	8.4	71.8	3.9	15.1	56.8	247.6	258.3
REA Hybrids	95A36	95	SmartStax	53.8	49.8	96.7	8.2	72.6	3.5	15.4	58.2	237.1	--
REA Hybrids	96B49	96	VT2Pro	51.8	42.8	91.0	8.4	72.3	3.7	15.9	57.4	236.2	--
REA Hybrids	4B976	97	VT2Pro	51.5	45.1	93.3	7.7	72.6	3.8	15.9	56.8	243.0	268.1
RENK	RK400VT2P	91	VT2P	52.0	47.3	90.7	8.9	71.2	4.1	14.4	59.4	198.7	--
RENK	RK444VT2P	93	VT2P	53.0	47.9	95.6	7.7	72.7	3.8	15.6	57.2	225.4	--
RENK	RK429-3220A	93	AGRISURE 3220A	52.0	46.2	91.8	8.6	72.0	3.7	15.2	58.4	236.4	267.5
RENK	RK485DGVT2P	94	DG, VT2P	53.0	46.5	95.2	8.3	72.7	3.6	15.7	58.5	236.3	260.7
RENK	RK502SSTX	95	SmartStax	52.3	42.4	98.0	8.4	72.4	3.6	15.5	57.4	232.6	--
RENK	RK561DGVT2P	96	DG, VT2P	53.5	44.6	92.4	8.6	71.6	4.1	15.8	57.2	244.8	274.8
Dairyland Seed	DS-3203AM	92	AM	51.8	45.0	94.0	8.8	72.0	3.4	14.9	58.2	228.8	--
Dairyland Seed	DS-3477AM	94	AM	51.0	40.2	91.8	8.3	72.4	3.5	15.5	57.1	240.8	--
Dairyland Seed	DS-3601AM	96	AM	50.8	45.0	97.5	8.4	71.9	3.7	15.0	56.9	251.0	--
Dairyland Seed	DS-3727AM	97	AM	51.0	46.2	92.3	7.8	72.6	3.8	15.8	57.5	265.8	282.4
Dyna-Gro	D21VC81	81	VT2P	47.0	42.3	91.3	9.4	71.1	4.0	14.7	57.4	176.4	--
Dyna-Gro	D33QZ83	93	3220	52.5	44.6	92.7	8.5	72.2	3.6	15.4	57.8	220.8	--
Dyna-Gro	D34VC93	94	VT2P	52.3	47.9	95.7	7.7	72.7	3.7	15.4	57.1	228.4	--
MEAN				52.5	45.5	94.4	8.3	72.2	3.8	15.5	57.5	235.3	--
C.V. (%)				1.2	4.3	2.1	5.4	0.6	5.2	4.0	1.1	7.5	--
LSD (0.05)				0.9	2.8	2.8	0.6	0.6	0.3	0.9	0.9	24.6	--
LSD (0.10)				0.7	2.3	2.3	0.5	0.5	0.2	0.7	0.7	20.6	--

Planting Date = May 23; Harvest Date = October 26; Previous Crop = Soybean

Brand	Hybrid	RM	Hybrid Traits[1]	Days to Silk	Ear Height	Plant Height	Protein	Starch	Oil	Moisture	Test Weight	Yield 2022	Yield 2 yr. Avg.
					inch	inch	%	%	%	%	lb/bu	bu/a	bu/a
Dyna-Gro	D37VC64	97	VT2P	53.0	46.8	93.8	9.0	72.1	3.3	15.1	57.6	225.2	--
Proseed	2196	96	VT2PRIB	52.5	45.9	94.5	8.4	71.9	4.0	15.6	57.2	235.3	274.3
Proseed	2398	98	TRE	56.5	45.7	99.4	8.2	72.0	3.9	15.8	56.4	238.7	--
Legacy Seeds	LC-3517	95	VT2P	53.3	47.3	94.0	8.6	71.7	4.1	15.8	57.9	240.9	261.5
Legacy Seeds	LC461-21	96	DGVT2P	53.3	49.3	95.7	8.4	72.4	3.7	15.5	58.7	222.5	253.0
Legacy Seeds	LC464-21	96	3120	52.8	45.6	96.3	7.9	72.9	3.7	16.4	57.6	248.8	--
Legacy Seeds	LC503-21	100	5222EZ	54.3	49.8	96.3	8.6	71.7	4.0	16.5	56.5	247.3	--
Legacy Seeds	LC-3718	97	DGVT2P	52.5	46.9	97.5	7.9	72.4	3.8	15.8	57.2	249.7	272.8
Thunder	T6397 AA	97	AA	53.0	45.3	98.9	8.1	72.7	3.7	15.8	57.6	259.6	--
Thunder	T6298 VT2P	98	VT2P	53.3	48.0	94.4	7.7	72.7	3.8	15.5	57.0	231.1	--
Thunder	T6398 TRE	98	TRE	56.0	45.5	100.0	8.4	71.8	4.1	15.8	57.0	238.6	--
MEAN				52.5	45.5	94.4	8.3	72.2	3.8	15.5	57.5	235.3	--
C.V. (%)				1.2	4.3	2.1	5.4	0.6	5.2	4.0	1.1	7.5	--
LSD (0.05)				0.9	2.8	2.8	0.6	0.6	0.3	0.9	0.9	24.6	--
LSD (0.10)				0.7	2.3	2.3	0.5	0.5	0.2	0.7	0.7	20.6	--

Planting Date = May 23; Harvest Date = October 26; Previous Crop = Soybean

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

Corn Silage - Dryland **Carrington**

Brand	Hybrid	RM	Hybrid Traits	Days to Silk	Plant Height	Lodging	Harvest Moisture	DM	Yield 2022	Yield 2-yr. Avg.
					inh	0-9	%	%	ton/a (65% moisture)	
Integra	STP4810	98	RR	80.7	105.0	1.3	64.7	35.3	20.5	14.1
Integra	STP5191	101	RR2	84.7	108.9	0.7	69.5	30.5	21.6	15.0
Integra	STP5209	102	GSS,Smartstax RIB	81.0	101.6	0.3	69.8	30.2	19.9	--
Proseed	Lfy 101	101	RR	85.0	111.8	1.0	67.4	32.6	22.1	14.6
Proseed	STS 106	106	GT/CB/LL	83.3	107.1	0.3	70.8	29.2	19.6	--
Stine	9202-G	86	Agrisure GT	74.3	84.3	0.0	57.7	42.3	16.7	--
Stine	9212-10	89	Agrisure 3010	73.7	91.3	0.3	62.0	38.0	16.4	--
Stine	9319-10	93	Agrisure 3010	77.7	89.8	0.0	63.5	36.5	17.3	--
Stine	9543-G	103	Agrisure GT	76.0	79.5	0.7	65.8	34.2	17.2	--
Croplan	3200S	93	RR2	81.3	112.1	0.3	66.8	33.2	22.5	--
Croplan	4100S	101	VT2P/RIB	82.3	98.2	0.0	69.5	30.5	18.4	--
Petersons Farm Seeds	2LF01	101	RR2	85.0	108.7	1.7	70.8	29.2	21.8	15.1
REA Hybrids	94A16	94	SmartStax	77.3	90.3	0.0	65.8	34.2	18.2	--
REA Hybrids	95A36	95	SmartStax	77.3	88.7	0.0	63.8	36.2	20.1	--
REA Hybrids	4B958	95	VT2Pro	74.0	86.1	0.0	61.7	38.3	19.5	13.3
REA Hybrids	5A984	98	SmartStax	76.7	85.3	0.0	64.8	35.2	17.7	--
Mean				79.4	96.8	0.4	65.9	34.1	19.4	--
C.V. (%)				2.6	4.6	114.2	4.3	8.3	7.4	--
LSD (0.05)				3.4	7.4	0.8	4.7	4.7	2.4	--
LSD (0.10)				2.8	6.1	0.7	3.9	3.9	2.0	--

Planting Date = May 16; Harvest Date = September 14; Previous Crop = Spring Wheat

Lodging Score: 0 = no lodging; 9 = plans lying flat.

Corn Silage - Irrigated **Carrington**

Brand	Hybrid	RM	Hybrid Traits	Days to Silk	Plant Height	Lodging	Harvest Moisture	DM	Yield 2022	Yield 2-yr. Avg.
					inch	0-9	%	%	ton/a (65% moisture)	
Proseed	Lfy 101	101	RR	87.3	104.2	1.3	66.1	33.9	28.5	27.0
Proseed	STS 106	106	GT/CB/LL	83.3	102.1	0.0	67.6	32.4	27.5	--
Legacy Seeds	LC-4545	99	RR2	82.0	93.7	0.0	63.0	37.0	24.8	25.6
Legacy Seeds	LC-555-21	100	GT/CB/LL	78.0	110.0	0.7	62.0	38.0	25.9	26.3
Legacy Seeds	LC-416-22	101	RR2	82.3	106.8	1.0	60.6	39.4	25.3	--
Stine	9202-G	86	Agrisure GT	72.3	92.5	0.3	54.6	45.4	22.8	--
Stine	9212-10	89	Agrisure 3010	74.7	92.1	0.3	60.6	39.4	23.0	--
Stine	9319-10	93	Agrisure 3010	77.7	92.9	0.3	63.7	36.3	22.4	--
Stine	9543-G	103	Agrisure GT	77.7	90.9	0.7	65.2	34.8	21.2	--
Innvictis Seed Solutions	B8548-3120ez	85	Agrisure 3120 ez	74.7	96.5	0.0	56.1	43.9	25.2	--
Innvictis Seed Solutions	A9436VT2PRIB	94	VT Double Pro	76.7	100.4	0.0	61.2	38.8	28.0	--
Innvictis Seed Solutions	A9938VT2PRIB	99	VT Double Pro	77.3	93.2	0.3	63.6	36.4	31.1	--
AgVenture	AV4104Q	104	Qrome	78.7	89.0	1.0	65.8	34.2	26.2	--
Croplan	4100S	101	VT2P/RIB	81.0	106.8	0.0	62.5	37.5	26.2	--
Croplan	3899	98	VT2P/RIB	80.3	102.6	0.7	63.4	36.6	30.6	--
Petersons Farm Seeds	2LF01	101	RR2	85.3	104.1	1.7	66.9	33.1	29.2	27.3
REA Hybrids	94A16	94	SmartStax	77.7	107.9	0.3	62.4	37.6	27.2	--
REA Hybrids	95A36	95	SmartStax	78.3	95.7	0.0	62.9	37.1	26.5	--
REA Hybrids	4B958	95.0	VT2Pro	76.7	100.3	0.0	59.9	40.1	26.2	25.9
REA Hybrids	5A984	98.0	SmartStax	80.7	97.4	0.0	63.0	37.0	24.9	--
Dairyland Seed	HiDF-3855QQ	98.0	Q	77.3	99.5	0.3	61.3	38.7	27.6	--
Dairyland Seed	HiDF-3802	102.0	Q	81.0	100.5	0.3	66.2	33.8	27.4	--
Mean				79.1	99.0	0.4	62.7	37.3	26.3	--
C.V. (%)				1.5	8.2	109.5	3.0	5.0	8.4	--
LSD (0.05)				2.0	13.5	0.8	3.1	3.1	3.6	--
LSD (0.10)				1.7	11.2	0.6	2.6	2.6	3.0	--

Planting Date = May 16; Havest Date = September 26; Previous Crop = Winter Rye

2021 Corn Silage - Dryland **Carrington**

					60 days after ensiling					
Brand	Hybrid	Maturity	Yield[1]	pH	Crude Protein[2]	ADF[2]	aNDF[2]	Starch[2]	TDN[2]	NEg[2]
			ton/a		%	%	%	%	%	%
Peterson Farms Seed	2LF95	95	7.90	3.83	8.21	29.2	45.9	7.6	67.4	44.1
Peterson Farms Seed	2LF01	101	8.31	3.82	8.26	28.9	46.1	5.3	67.6	44.1
Peterson Farms Seed	19L95	95	7.86	3.64	8.15	24.6	40.9	19.9	70.7	45.8
Integra	STP4810	98	7.69	3.68	8.09	27.9	44.5	12.2	68.3	44.6
Integra	STP5191	101	8.32	3.92	8.27	29.9	47.0	5.7	67.0	43.8
REA Hybrids	4A301-RHDS	94	6.08	3.68	8.60	26.8	43.7	10.8	69.1	45.0
REA Hybrids	4B958	95	7.01	3.75	7.91	25.3	41.5	20.3	70.1	45.6
REA Hybrids	5A982	98	6.69	3.82	8.13	27.9	43.1	16.7	68.3	45.1
Proseed	STS102	102	7.86	3.69	8.34	27.8	44.9	8.5	68.4	44.5
Proseed	LFY 101	101	7.10	3.62	8.89	28.4	45.2	6.5	67.9	44.6
Pioneer	PO157	101	8.26	3.75	8.04	25.4	42.6	19.4	70.1	45.2
Mean			7.55	3.75	8.3	27.4	44.1	12.1	68.6	44.8
C.V. (%)			14.3	5.1	5.1	9.0	6.3	35.0	2.5	2.2
LSD (0.05)			1.84	0.30	0.71	4.2	4.7	7.2	2.9	1.7
LSD (0.10)			1.52	0.26	0.59	3.5	3.9	6.0	2.4	1.4

Planting Date = April 29; Harvest Date = September 16; Previous Crop = Spring Wheat

2021 Corn Silage - Irrigated **Carrington**

					----------60 days after ensiling----------					
Brand	Hybrid	Maturity	Yield[1]	pH	Crude Protein[2]	ADF[2]	aNDF[2]	Starch[2]	TDN[2]	NEg[2]
			ton/a		%	%	%	%	%	%
Peterson Farms Seed	2LF95	95	27.52	3.99	7.85	34.6	55.3	9.6	63.6	40.7
Peterson Farms Seed	2LF01	101	25.46	3.80	8.14	29.5	47.8	18.1	67.2	43.4
Peterson Farms Seed	19L95	95	23.44	3.91	7.00	26.0	43.6	28.2	69.6	44.6
Dairyland	DS-4329AM	105	27.61	3.78	7.25	24.7	42.1	27.2	70.5	41.9
Dairyland	HiDF-3522Q	95	24.06	3.84	7.28	26.2	42.9	26.7	69.5	47.3
REA Hybrids	4A301-RHDS	94	21.88	3.65	8.33	28.0	45.3	18.8	68.3	44.4
REA Hybrids	4B958	95	25.63	3.85	7.06	28.9	46.9	23.3	68.7	43.4
REA Hybrids	5A982	98	27.43	3.87	6.89	24.6	41.1	29.6	70.7	45.4
Proseed	STS102	102	25.31	3.72	7.52	26.1	43.6	25.8	69.5	44.7
Proseed	LFY 101	101	25.45	3.71	8.04	28.1	45.8	17.7	68.2	44.1
Legacy	LC-4545	100	26.47	3.86	7.48	32.1	50.9	15.8	65.4	42.2
Legacy	LC-3567	95	24.54	3.85	7.96	28.4	46.7	19.7	68.0	43.8
Legacy	LC555-21	100	26.66	3.90	7.94	30.2	49.5	18.1	66.7	42.8
Pioneer	PO157	101	25.62	3.87	7.84	28.1	46.3	21.5	68.2	43.9
Mean			25.51	3.83	7.61	28.2	46.3	21.4	68.2	43.8
C.V. (%)			5.7	2.1	7.0	12.8	10.6	28.0	3.7	5.6
LSD (0.05)			2.43	0.14	0.90	6.1	8.2	10.1	4.2	4.1
LSD (0.10)			2.01	0.74	5.1	6.8	8.4	3.5	3.4	

Planting Date = April 29; Harvest Date = September 16; Previous Crop = Field Peas

[1]Corrected to 65% moisture

[2]all numbers in this column are reported as % of dry matter

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Cows fall grazing winter rye regrowth.

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